IEEE ICMA 2017

2017 IEEE International Conference on Mechatronics and Automation

AUGUST 6-9, 2017
TAKAMATSU, JAPAN

Conference Proceedings

Conference Digest

Co-sponsored by

IEEE Robotics and Automation Society
Kagawa University
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Key Laboratory of Convergence Medical Engineering System and Healthcare Technology, the Ministry of Industry and Information Technology, School of Life Science and Technology, BIT

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Foreword

On behalf of the IEEE ICMA 2017 Conference Organizing Committee, it is our great pleasure, an honor, and a privilege to welcome you to Takamatsu for the 2017 IEEE International Conference on Mechatronics and Automation. This conference reflects the growing interests in the broad research areas of mechatronics, robotics, sensors and automation.

IEEE ICMA 2017 marks the 14th edition of the IEEE ICMA annual conference series. We are proud to announce that a high number of **558** papers were submitted from 31 countries and regions, including **540** contributed papers, **18** papers for organized sessions, and **358** papers were accepted for oral presentation at the conference after a rigorous full-paper review process, achieving an acceptance rate of less than **65%**. Presentations at IEEE ICMA 2017 are organized in 6 parallel tracks, for a total of **55** sessions, taking place during the three conference days. We are fortunate to be able to invite five distinguished speakers to deliver plenary talks and keynote speeches.

We are very glad that you are joining us at IEEE ICMA 2017 in Takamatsu to live this unique experience. The main objective of IEEE ICMA 2017 is to provide a forum for researchers, educators, engineers, and government officials involved in the general areas of mechatronics, robotics, sensors and automation to disseminate their latest research results and exchange views on the future research directions of the related fields. IEEE ICMA 2017 promises to be a great experience for participants from all over the world, with an excellent technical program as well as social activities.

We would like to express our most sincere appreciation and thanks to all of our sponsoring societies and organizations and to all the individuals who have contributed to the organization of this conference. Our special thanks are extended to our colleagues in the Program Committee for their thorough review of all the submitted papers, which is vital to the success of this conference. We must also extend our thanks to our Organizing Committee and our volunteers who have dedicated their time toward ensuring the success of this conference. Last but not least, we thank all the contributors for their support and participation in making this conference a great success. Finally, we wish you a great conference and enjoyable stay in Takamatsu, Japan.

Shuxiang Guo
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Organizing Committee Chair
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Welcome Remarks

Welcome to the 2017 IEEE International Conference on Mechatronics and Automation (IEEE ICMA 2017). As one of the Advisory Council Chairs, it is my great pleasure and honor to welcome you to what promises to be its most successful conference to date.

Kagawa University delighted to be one of the hosts of the Conference which marked as the 14th edition of the IEEE ICMA among the annual conference series. The Conference reflects the growing interests in the broad research areas of mechatronics, robotics sensors and automation.

IEEE ICMA 2017 is dedicated to provide a forum for researchers, educators, engineers and government officials involved in these areas to disseminate the latest research results and exchange ideas on the future research directions.

As the founding university of the IEEE ICMA conference, Kagawa University is a research oriented university, with science, engineering and research as its core. We have established our own unique programs related to the field of mechatronics and automation that are well known in Japan.

Kagawa University appreciates all of the sponsoring societies, organizations and all the individuals contributed to the organization of the conference, as well as all the authors, sessions organizers, plenary speakers, exhibitors for their interests and contribution to make IEEE ICMA 2017 a successful and fruitful event.

Wish IEEE ICMA 2017 conference a complete success!

Seigo Nagao, *Medical Doctor*
President of Kagawa University, Japan

IEEE ICMA 2017 Conference Digest

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Zhang, Songyuan
Zhang, Xianmin
Zhang, Xiaolong
Zhang, Xiaoyu
Zhang, Xinming
Zhang, Xuping
Zhang, Yanhua
Zhang, Yi
Zhang, Yimin
Zhang, Yong
Zhang, Yongde
Zhang, Yonggang
Zhang, Youmin
Zhang, Yunong
Zhang, Zhaohui
Zhang, Zhe
Zhao, Cangwen
Zhao, Chunhui
Zhao, Lin
Zhao, Qing
Zhao, Xin
Zhao, Xinhua
Zhao, Yuxin
Zhao, Zhijun
Zheng, Fei
Zheng, Guibin
Zheng, Jinyang
Zheng, Yuanfang
Zhong, Ning
Zhou, Xunyu
Zhu, Chi
Zhu, Chunbo
Zhu, George
Zhu, Jianguo
Zhu, Qidan
Zhu, Xiangyang
Zhu, Xiaorui
Zhu, Xilin
Zhu, Yu
Zu, Jean
Zyada, Zakarya

IEEE ICMA 2017 Conference

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The Japan Society of Mechanical Engineers

University of Electro-Communications

University of Electronic Science and Technology of China

Harbin Institute of Technology

Changchun University of Science and Technology

Key Laboratory of Convergence Medical Engineering System and Healthcare Technology, the Ministry of Industry and Information Technology, School of Life Science and Technology, BIT

General Information

Takamatsu

Takamatsu City is located facing the calm, island-dotted Seto Inland Sea. The lives of the Takamatsu people have always been strongly tied economically and culturally to the sea. Takamatsu is both the capital of the prefecture and the central management city for Shikoku. The temperature is relatively stable year-round, and there is very little rainfall.

Takamatsu was founded in the Kamakura period (1185-1333), and in 1588, Toyotomi Hideyoshi's retainer, Ikoma Chikamasa built a castle on the Tamamo Coast and named it Takamatsu Castle. This is how Takamatsu got its name. The Ikoma family ruled the town for four generations (54 years) and the Matsudaira family did so for eleven generations (220 years). During the Meiji Restoration, the feudal system was abolished, and Takamatsu was made the capital of Kagawa prefecture. Takamatsu was incorporated as a municipality on February 15, 1890, becoming the 40th incorporated city in Japan.

Since the 1910s, there have been eight municipal mergers, and now Takamatsu City stretches from the Seto Inland Sea in the north, to the Tokushima prefectural border in the south. It has become a wide municipal area blessed with the ocean, mountains, and rivers, a lively city center, and slow-paced rural districts. The city has become a place where urban functionality and natural resources are in balance, providing a good life for its citizens.

Thanks to geographical and other natural factors, Takamatsu has always been the central management city for Shikoku, but in particular because of the Seto Ohashi Bridge which was built in 1988, the New Takamatsu Airport which was built in 1989, and the Takamatsu Expressway which reached Takamatsu in 1992, in April of 1999, the city was designated a core city.

Now, Takamatsu is working at becoming an even more convenient and green city, making use of the unique qualities that each region of the city has to offer, creating a compact and sustainable city.

Hotel Information

● JR Hotel Clement Takamatsu as the IEEE ICMA 2017 official hotel

JR Hotel Clement Takamatsu is a 20-storey luxury hotel located in Sunport Takamatsu. The hotel offers guest rooms commanding a view over the Seto Inland Sea and the city of Takamatsu, and boasts a range of facilities including multi-purpose banquet halls, making it the ideal choice for business, sightseeing or international conferences. JR Hotel Clement Takamatsu has a range of restaurants including Chinese, Western and Japanese to cater to every taste.

For the special issue, some other accommodations are recommended for its convenience and cheapness. You can find the detailed information at the following links.

Reference rate and detailed information of accommodations:

①JR Hotel Clement Takamatsu (JP￥10,000 room only/night; JP￥11,650 with breakfast/night)

②Takamatsu Teriminal Hotel (JP￥6,000 room only/night)

③Takamatsu Tokyu Inn (JP￥7,000 room only/night;JP￥8,000 with breakfast/night)

④Hotel Kawaroku Her-Stage (JP￥5,880 with breakfast/night)

⑤Daiwa Roynet Takamatsu (JP￥8,300 room only/night; JP￥9,300 with breakfast/night)

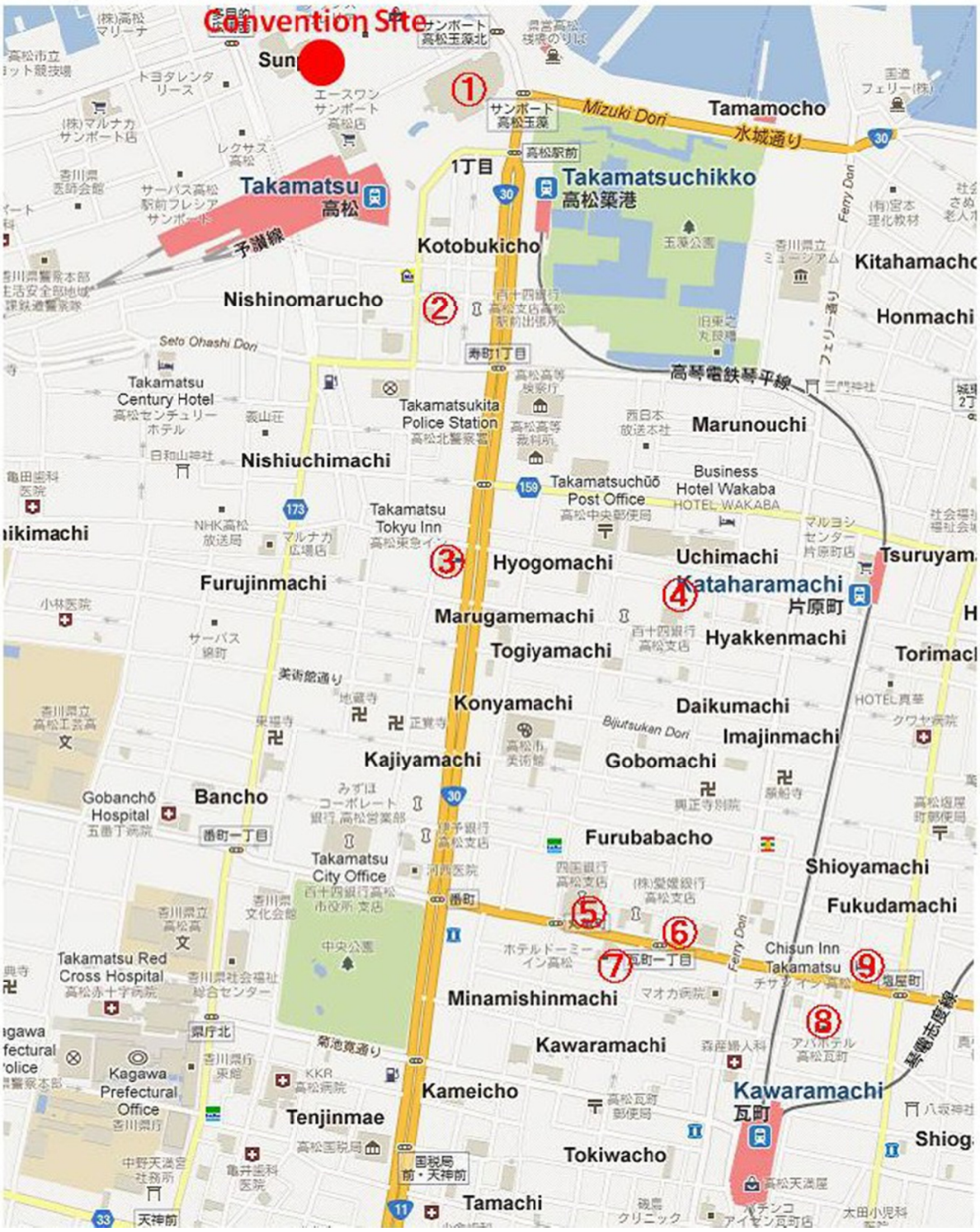
⑥ Takamatsu Washington Hotel Plaza (JP ￥ 5,610 room only/night; JP ￥ 6,610 with breakfast/night)

⑦Dormy Inn Takamatsu (JP￥7,600 room only/night)

⑧Apa Hotel Takamatsu Kawaramachi (JP￥5,000 with breakfast/night)

⑨Chisan Inn Takamatsu (JP￥7,020 room only/night)

- **Map of Accommodations**



➢ **It takes 15-20 mins on foot from IEEE ICMA 2017 Conference site to accommodation ⑨**

Attractions

● Ritsurin Garden

Among the gardens in Japan designated as National Special Scenic Beauty, Ritusrin Garden is the largest. Construction started around 1625 by Takatoshi Ikoma, the feudal lord of Takamatsu, and took about 100 years with successive feudal lords to complete in 1745. The garden has six ponds and thirteen mounds strategically placed to use Mt Shiun as a background. Different flowers bloom all year round, changing the scenery as you walk. “One step, one scenery.”

The garden also has an excellent reputation overseas. It was given three stars as the highest-rated, worth-visiting place for sightseeing in the Michelin Green Guide Japan in 2009.

● Tamamo Park (Ruins of Takamatsu Castle)

There is a song about Takamatsu Castle that goes, “You can see the Takamatsu Castle above the sea in Sanuki.” The castle is also called Tamamo Castle because Kakinomoto Hitomaro used the word “Tamamo yoshi” as a pillow word of Sanuki in Manyoshu. Takamatsu Castle was built by Chikamasa Ikoma, the first feudal lord of Takamatsu. Taking several years to build, the castle has outer, middle and inner moats. It is one of only three castles surrounded by water moats in Japan. At that time, Takamatsu Castle had a magnificent view of the surrounding area with a unique Western-style, three-story, five-layered, castle tower. However, it was removed as it became old. The Ushitora tower, Moon-watch tower as well as Mizutegomon gate still exists which reflects ancient times. A recreational area with old pine trees and other beautiful trees attracts many residents and tourists.

- ***Hiunkaku with romantic Taisho atmosphere***

Hiunkaku was built as a second house for Yorinaga Matsudaira, the 12th feudal lord of the Matsudaira family. Construction started in the second year of the Taisho period and took about three years to complete. There is a room called the "big study room" (142 tatami mats) and there are seven rooms named after the view each room has. For example: the "cycadophyte room," the "pine tree room" and the "wave room". Nowadays, tea ceremonies and concerts are held with a romantic Taisho atmosphere - a fusion of Japanese tradition and Western skills.

- ***Beautiful cherry blossom of Sakura no baba (turf of cherry blossom)***

"Sakura no baba" is located in the southern part of the castle tower ruins. As its names shows, this was the place used to train horses in ancient times, but now has become one of the best places to see cherry blossoms with as many as 90 cherry trees blooming in spring.

● A Well-known Genpei Battlesite: Yashima

The peak of Yashima is flat and resembles a roof, which is the origin of the name "Yashima," which means "roof island." There are three viewpoints located along a walking path atop the mountain, named Dankorei, Shishi no Reigan, and Yu-kakutei. From there, the entire Seto Inland Sea National Park can be seen, as well as the island-dotted Seto Inland Sea, and the cityscape of Takamatsu City. A battle site from the Genpei War can also be seen on the mountain. In addition, the 84th temple in the Shikoku 88 Temple Pilgrimage, Yashima-ji, is located atop the mountain, as well as the Shin-Yashima Aquarium, which is said to be located highest above sea level of all the aquariums in Japan.

● Konpira Shrine (Kotohira-cho)

Long long passage leading to the shrine is lined up a variety of shops. Hard to step up but fan to see on the way to famous shrine.

Kanemaru-za on the way is the oldest theater in Japan and an important cultural asset.

Weather

Takamatsu has a humid subtropical climate with hot summers and cool winters. Some rain falls throughout the year, but the months from May to September have the heaviest rain.

Month	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
° F	48.7	49.3	55.2	66.2	74.5	80.1	87.3	89.1	81.7	72	62.2	53.4
° C	9.3	9.6	12.9	19.0	23.6	26.7	30.7	31.7	27.6	22.2	16.8	11.9

Transportation

All the registrants should make their own local transportation in the city. In Takamatsu, it is necessary to book a taxi excepting some dedicated places, such as the JR Shikoku Takamatsu Station and the Takamatsu Airport. The taxi price contains the base price JPY620 below 1.5km and extra JPY80 for per 314m.

It takes about 30 minutes by taxi from the Takamatsu Airport to the Takamatsu Symbol Tower , the taxi fare is about JPY5000 (approx. US $ 51). Whenever you arrive at the airport, there are always many taxis waiting at the airport to pick up passengers. The other method is by bus. It also takes about 30 minutes from the Takamatsu Airport to the JR Shikoku Takamatsu Station which is very near to the Takamatsu Symbol Tower. You can find the bus at the **No.2 bus stand,** the bus fare is JPY740 (approx. US $ 7). Please ask for a receipt with the taxi or the bus.

Useful Information

- **Language:** Official language is Japanese. English can be understood by many young people and is used in hotels and big restaurants. In all tourist hotels, staff can speak in Japanese, English and other languages. They can also write down addresses or instructions in Japanese for taxi drivers or others.
- **Currency:** The Japanese yen is the official currency of Japan. It is the third most traded currency in the foreign exchange market after the United States dollar and the euro. It is also widely used as a reserve currency after the U.S. dollar, the euro and the pound sterling.

  Money exchanges by cash or traveler's cheques can be made at the branches of Bank of Japan at Takamatsu Airport, hotels and tourist stores. Please remember to keep the receipt to exchange back to foreign currency when leaving Japan.

- **Credit Cards:** Visa, Master Card and American Express are the most commonly used in Japan. Cards can be used in most middle to top-range hotels, Friendship and department stores, but they cannot be used to finance your transportation costs.

- **Time:** GMT + 9 hours (the whole of Japan is set to Tokyo time)

- **Electricity:** Electricity is 100 Volts, which is different from North America (120V), Central Europe (220V) and most other regions of the world. Japanese electrical plugs have two, non-polarized pins.

- **Water:** Bottled mineral water can easily be bought in all stores and automatic vending machine for JPY150. And sometimes hotels provide it free of charge. Furthermore, potable water is only available in a few 4 to 5 star hotels, while water in thermos flasks in rooms is usually non-potable tap water.

- **Measurement:** Japan uses centimeters and meters, kilogram, liter, km/h as SI units. But measurement tools and measure tapes sold in Japan often include inch as well.

- **Tipping:** On the rare occasion that you actually need to give a tip in Japan, do so by putting the money inside of a tasteful, decorative envelope and seat it. Hand it to the recipient with a slight bow; do not expect them to open your "gift" right away.
  Pulling cash out of your pocket in full view of the recipient is the worst way to give a tip in Japan.

- **Attention:** Smoking is prohibited in public places in Takamatsu, such as hospital, office building, theatres, cinemas, museums, planes, and electric railcar.

- **Emergency telephone number:** 110 - Police 119 – Fire and Ambulance

Conference Information

Conference Venue

IEEE ICMA 2017 will be held in the city of Takamatsu Symbol Tower, Kagawa International Conference Hall, which serves as the official conference venue for the technical program.

JR Hotel Clement Takamatsu which serves as the official conference hotel is a 20-storey luxury hotel located in Sunport Takamatsu. The hotel offers guest rooms commanding a view over the Seto Inland Sea and the city of Takamatsu, and boasts a range of facilities including multi-purpose banquet halls, making it the ideal choice for business, sightseeing or international conferences. JR Hotel Clement Takamatsu has a range of restaurants including Chinese, Western and Japanese to cater to every taste.

The map of the Conference Venue and Awards Banquet Venue

Japanese Address Cards

JR Hotel Clement Takamatsu

JR ホテルクレメント高松

住所：香川県高松市浜ノ町 1-1 760-0011

Tel: (81-87) 811-1111

Fax: (81-87) 811-1100

Conference Registration

A conference registration desk will be set up and opened at the Pre-Function Area of 6th Floor of Symbol Tower from August 6 (13:30) to August 9 (18:00) as followings.

August 6, 2017: 13:30 ~ 18:30 (Pre-Function Area of 6th Floor)
August 7, 2017: 07:30 ~ 13:00 (Kagawa International Conference Hall)
August 7, 2017: 13:00 ~ 18:00 (Pre-Function Area of 6th Floor)
August 8, 2017: 08:00 ~ 17:00 (Pre-Function Area of 6th Floor)
August 9, 2017: 08:00 ~ 11:00 (Pre-Function Area of 6th Floor)

Internet Access

Free internet access will be provided during the conference period, to the IEEE ICMA 2017 participants at the Conference Room on 6th floor of Symbol Tower, Takamastu. Broadband internet access services are also provided at the conference hotel for a fee. For the fee information, please contact the hotel you are staying directly.

Social Events

The social events organized by the IEEE ICMA 2017 include the conference reception, the awards banquet, the conference registration, the farewell party, etc.

Conference Reception

The Conference Reception will be held from 18:30 to 19:30 on August 6, 2017 in Conference Room 54, 5F of Takamatsu Symbol Tower (高松シンボルタワー 5 階 54 会議室). All the Conference participants are welcomed to join this event.

Awards Banquet

The Awards Banquet will be held from 18:00 to 20:30 on August 6, 2017 in Ballroom HITEN, 3F, **JR Hotel Clement Takamatsu (JR ホテルクレメント高松、3 階大宴会場飛天).** All the conference participants are welcomed to join this event.

Farewell Party

The Farewell Party will be held from 12:00 to 13:00 on August 7, 2017 in Communication Plaza on 1F of Takamatsu Symbol Tower. All the conference participants are welcomed to join this event.

IEEE ICMA 2017 Conference

Plenary Talk 1

Intelligent Robotics and Automation in a Cloud-Connected World

James Kuffner, Ph.D.

Chief Technology Officer

Toyota Research Institute

james.kuffner@tri.global

http://www.tri.global/james-kuffner

Abstract:

Robotics is currently undergoing a dramatic transformation. High-performance networking and cloud computing has radically transformed how individuals and businesses manage data, and is poised to disrupt the state-of-the-art in the development of intelligent machines. This talk explores the long-term prospects for the future evolution of robot intelligence based on search, distributed computing, and big data. Ongoing research on autonomous cars and humanoid robots will be discussed in the context of how cloud-connectivity will enable future robotic systems to be more capable and useful.

Dr. Kuffner is the Chief Technology Officer at the Toyota Research Institute (TRI). Dr. Kuffner received a Ph.D. from the Stanford University Dept. of Computer Science Robotics Laboratory in 1999, and was a Japan Society for the Promotion of Science (JSPS) Postdoctoral Research Fellow at the University of Tokyo working on software and planning algorithms for humanoid robots. He joined the faculty at Carnegie Mellon University's Robotics Institute in 2002. Dr. Kuffner is perhaps best known as co-inventor of the Rapidly-exploring Random Tree (RRT) algorithm, which has become a key standard benchmark for robot motion planning. He has published over 125 technical papers, holds more than 40 patents, and received the Okawa Foundation Award for Young Researchers in 2007. Before joining TRI, Dr. Kuffner was a Research Scientist and Engineering Director at Google from 2009 to 2016. Dr. Kuffner was part of the initial engineering team that built Google's self-driving car. In 2010, he introduced the term "Cloud Robotics" to describe how network-connected robots could take advantage of distributed computation and data stored in the cloud. Dr. Kuffner was appointed head of Google's Robotics division in 2014, which he co-founded along with Andy Rubin. Dr. Kuffner continues to serve as an Adjunct Associate Professor at the Robotics Institute, Carnegie Mellon University.

Additional information: https://en.wikipedia.org/wiki/James_J._Kuffner_Jr.

IEEE ICMA 2017 Conference

Plenary Talk 2

Micro-nano Mechatronics for Multiscale Interactions in the Physical World

Fumihito Arai

Professor and Director

Dept. of Micro-Nano Mechanical Science & Engineering

Institute of Innovation for Future Society

Director of Center for Micro-nano Mechatronics

Nagoya University

E-mail: arai@mech.nagoya-u.ac.jp

http://www.biorobotics.mech.nagoya-u.ac.jp/index_e.html

Abstract:

Interactions in the physical world occur in several cases, such as mechanical interactions in the caregiving tasks, in the biosignal sensing of human, in the mechanical sensing of biological small objects, as well as chemical interactions between cells in culturing, and so on. Measurement of interaction with the environment is quite important for the progress of science and technology. However, the scale of interaction extends over the multi-scale. For example, to measure the force acting on the human motion, we should consider the maximum force over 500 N. On the other hand, reaction force by the blood pressure is less than 1 N. Furthermore, for the investigation of mechanical property of cells, reaction force of the single cell is less than 1 uN. Since the size of the object is small, fine space resolution is needed as well as fine force resolution. It is quite challenging to measure several interactions over the multi-scale. To meet a variety of demands in measuring several interactions in the physical world, Micro-nano Mechatronics is quite important. In this talk, several sensing technologies will be addressed based on the micro-nano fabrication technology. Especially, force sensing in the multiscale range will be addressed, such as a wide range force sensor using Quartz Crystal Resonator(QCR), QCR force sensor probe, and vision based fine force sensing using moiré fringe. Moreover, recent progress on in-process environmental measurement using fluorescent dye will be shown with application examples in tissue engineering.

Fumihito Arai is a Professor in the Dept. of Micro-Nano Mechanical Science & Engineering at Nagoya University. He received Master of Eng. degree from Tokyo Univ. of Science in 1988. He received Dr. of Eng. from Nagoya University in 1993. Since 1994, he was an Assistant Professor of Nagoya University. Since 2005, he was a Professor of Tohoku University. Since 2010, he has been a Professor of Nagoya University. Since 2013, he has been a Director of Center for Micro-nano Mechatronics, Nagoya University. Since 2014, he has been a Professor of Institute of Innovation for Future Society, Nagoya University. He was Invited Visiting Professor of Seoul National University, Korea from 2009 to 2012. He was Visiting Professor of University of Tokyo, Japan from 2011 to 2014. He is mainly engaging in the research fields of micro- and nano-robotics and its application to the micro- and nano-assembly, cell manipulation, and sensing & analysis, MEMS, Bio-Robotics, and intelligent robotic systems. He is the author of 345 journal papers exclusive of conference papers. He received 77 awards on his research activities, for example, Early Academic Career Award in Robotics and Automation from IEEE Robotics and Automation Society in 2000 and Best Conference Paper Award at IEEE ICRA2012. Currently, he is the Vice President for Technical Activities, IEEE Robotics and Automation Society since 2014 (until 2017).
Additional information: http://www.biorobotics.mech.nagoya-u.ac.jp/index_e.html

IEEE ICMA 2017 Conference
Plenary Talk 3

Micro Medical Robotics: Painless and Scarless

Max Q.-H. Meng, PhD, FIEEE

Professor and Chairman

Department of Electronic Engineering

The Chinese University of Hong Kong

Shatin, Hong Kong

E-mail: max.meng@cuhk.edu.hk

Abstract:

Research on micro medical robotics is attracting more and more public attention and research efforts laterly. Recent revolutionary development and drastic progress in robotic technology in terms of both hardware capability and software power have made it possible for researchers to redefine what micro medical robotics is capable of achieving to facilitate complicated medical procedures with much less pain and surgical procedures without even external scars. In this talk, we will start with an introduction to how research on micro medical robotics started and what the milestone achievements are, and then move onto our own research efforts on micro medical robotics with several case study examples. Personal thoughts and ourlook on future research efforts and potentials in micro medical robotics will be outlined to conclude the talk.

Max Q.-H. Meng received his Ph.D. degree in Electrical and Computer Engineering from the University of Victoria, Canada, in 1992, following his Master's degree from Beijing Institute of Technology in 1988. He joined the Chinese University of Hong Kong in 2001 and is currently Professor and Chairman of Department of Electronic Engineering at CUHK. He was a professor in the Department of Electrical and Computer Engineering at the University of Alberta in Canada, serving as the Director of the ART (Advanced Robotics and Teleoperation) Lab and holding the positions of Assistant Professor (1994), Associate Professor (1998), and Professor (2000), respectively. He was jointly appointed as an Overseas Outstanding Scholar Chair Professor of the Chinese Academy of Sciences and the Dean of the School of Control Science and Engineering at Shandong University in China. He is currently jointly appointed as a Distinguished Chair Professor at Harbin Institute of Technology supported via the 1000 Talents Recruitment Program of Global Experts, a Distinguished Provincial Chair Professor of Henan University of Science and Technology, and the Honorary Dean of the School of Control Science and Engineering at Shandong University, in China. His research interests include robotics, perception and sensing, human-robot interaction, active medical devices, bio-sensors and sensor networks, and adaptive and intelligent systems. He has published more than 500 journal and conference papers and book chapters and led more than 40 funded research projects to completion as Principal Investigator. He has served as an editor of the IEEE/ASME Transactions on Mechatronics and an associate editor of the IEEE Transactions on Fuzzy Systems, and is currently a technical editor of a number of journals in robotics. He has served as the General Chair of several conferences, including IROS 2005, AIM 2008, WCICA 2010, and Robio 2013 conferences. He is the founder of the IEEE ICIA conference series and co-founder of the IEEE Robio conference series. He served as an Associate VP for Conferences of the IEEE Robotics and Automation Society (2004-2007), an AdCom member of the IEEE Neural Network Council/Society (2003-2006), the Co-Chair of the Fellow Evaluation Committee of the IEEE Robotics and Automation Society. He is currently serving as an elected member of the Administrative Committee (AdCom) of the IEEE Robotics and Automation Society. He is a recipient of the IEEE Third Millennium Medal award and he is a Fellow of IEEE.

IEEE ICMA 2017 Conference

Keynote Speech 1

Human Interactive Service Robots

Toshio Fukuda, Ph.D.

Professor

Department of Micro-Nano Systems Engineering

Nagoya University

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http://www.mein.nagoya-u.ac.jp/

Abstract:

Recent robot technology (RT) has made remarkable progress in both manufacturing and service sectors. Because of this RT advanced technology, there are growing demands to make robots work more friendly and flexible coordinated with human for service. There are many research and developing works undergoing for robot and human interaction, such as assistance and supports of human by robots in manufacturing, inspection and maintenance, entertainment, education, bio-medical applications, rehabilitation and techno-care of aged people. Robot is required to have the more flexibility and adaptation control to human behavior, more friendly robot and human interface, and estimation capability of human intention some way to make more proactive motion. There are a lot of problems to solve them with robotic sensor, actuator, control, communication and interface with human. Thus human will be able to work interactively with robots together in future and will receive assistance and support from robot, in terms of physical, skill and intelligence levels. Some examples of the on-going projects will be shown in this presentation.

Toshio Fukuda (M'83-SM'93-F'95) received the B.A. degree from Waseda University, Japan, in1971, and the M.S and Dr. Eng. from the University of Tokyo, Japan, in 1973 and 1977,respectively. In 1977, he joined the National Mechanical Engineering Laboratory. In 1982, hejoined the Science University of Tokyo, Japan, and then joined Nagoya University, Nagoya, Japan, in 1989. Currently, he is Professor of Department of Micro-Nano System Engineering at Nagoya University, and Director of Center for Micro and Nano Mechatronics, where he is mainly involved in the research fields of intelligent robotic and mechatronic system, cellular robotic system, and micro- and nano-robotic system.

Dr. Fukuda was President of IEEE Robotics and Automation Society (1998-1999), Director of the IEEE Division X, Systems and Control (2001-2002), and Editor-in-Chief of IEEE / ASME Transactions on Mechatronics (2000-2002). He was Founding President of IEEE Nanotechnology Council (2002-2005) and President of SOFT (Japan Society for Fuzzy Theory and Intelligent Informatics) (2003-2005). He is a member of Japan Council of Science (2008-).

He received the IEEE Eugene Mittelmann Award (1997), IEEE Millennium Medal (2000), Humboldt Research Prize (2003), the IEEE Robotics and Automation Pioneer Award (2004), IEEE Robotics and Automation Society Distinguished Service Award (2005), Award from Ministry of Education and Science in Japan (2005). IEEE Nanotechnology Council Distinguished service award (2007). George Saridis Leadership Award (2009), IEEE Robotics and Automation Technical Field Award (2010), Best Googol Application paper awards from IEEE Trans. Automation Science and Engineering (2007). Best papers awards from RSJ(2004) and SICE(2007), Special Funai Award from JSME(2008), IEEE Fellow (1995), SICE Fellow (1995), JSME Fellow (2001), RSJ Fellow (2004).

IEEE ICMA 2017 Conference

Keynote Speech 2

Invented the World's First Smart Desktop Robotic Arm

Liu Peichao

Chief Executive Officer of Dobot

jerryliu@dobot.cc

Abstract:

In the present market, robot arm is mainly applied in conventional manufacturing industry, such as mechanical manufacturing, automobile Industry, warship manufacturing and electric appliance manufacturing industry, etc. However, some repetitive and tedious work has to be done by labor, which is costly and poor precision. In the age of Industry 4.0, labor should be emancipated and be taken place by robot.

This talk refers to product creation process, corporate growth and futuristic visions of Yuejiang Tech and explores the long-term prospect for the future evolution of robot intelligence based on scientific research, computer programming and big data. Further research the application of desktop robot arm applied in K12 and STEAM education in China.

Liu Peichao is the Chief Executive Officer of Shenzhen Yuejiang Technology Co., Ltd (Yuejiang Tech). He received a Master Degree in Engineering from School of Mechanical Engineering Shandong University in 2014. He initially studied large conventional industrial machinery in Suzhou Institute of Biomedical Engineering and Technology Chinese Academy of Science. When he learned about some repetitive and tedious work had to be done by labor, which was costly and poor precision. He came up with an idea to create a desktop smart robot arm save, which can save labor and enhance productivity.

Up to now, Yuejiang has developed out four generations of Dobot series robot arm: Dobot V1.0, Dobot Magician, Dobot M1 and Dobot Rigit. The intelligence of Dobot robot arm embodies in usability and visual identity. With implanted opening API and 13 extensible interfaces, it can be further developed without any limitation.

What's more, combined with brain wave and myoelectricity, Dobot robot arm can conduct work as human's thought without any body movement. That's a further step in artificial intelligence, and can promote the development of Industry 4.0.

Shenzhen Yuejiang Technology Co., Ltd is a leading company in the field of smart desktop robotic arm, which is one of the first companies in the world brings the concept of smart desktop robotic arm. More than 70% of Yuejiang's staff are educated engineers from MIT and Harvard. It owns 100% core technologies and over 40 international patents. Yuejiang's long-term prospect is a high-tech provider and a right-hand assistant in everyone's daily life.

IEEE ICMA 2017 Conference Workshop

Tutorial Workshops on Systems Science of Bio-navigation

Sunday, August 6, 2017
14:00 - 17:00
Conference Room 61, 6F
Sunport Takamatsu Symbol Tower, Takamatsu, Japan

Organizers:

Kotaro Kimura, Ph.D.
Associate Professor
Department of Biological Sciences
Osaka University
Toyonaka, Osaka
kokimura@bio.sci.osaka-u.ac.jp
http://www.bio.sci.osaka-u.ac.jp/~kokimura/e/Top.html

Koichi Hashimoto, Ph.D.
Professor
Graduate School of Information Sciences
Tohoku University
Sendai, Miyagi
koichi@tohoku.ac.jp
http://www.ic.is.tohoku.ac.jp/

About the workshop:

The purpose of this workshop is to introduce systems science of bio-navigation. We are trying to develop the foundation of research scheme that integrates robotics, data science, ecology, and neuroscience, with the theme of navigation. In navigation, animals as well as humans properly and promptly perform the following: the acquisition of dynamically-changing information from external and internal environment, the choice of route and destination based on the information, and the behavioral regulation to reach the destination, all of which can be modified by their memory, emotions etc. Thus, through the study of navigation, we can also analyze a variety of brain functions. In this workshop, we will introduce the incredible abilities of animals during navigation, and ongoing research projects understanding and applying them.

Dr. Kotaro Kimura

Dr. Kimura received his B.S., M.S. and Ph.D. from The University of Tokyo (Tokyo) in 1990, 1992 and 1995, respectively. He then worked as a postdoc with Prof. Gary Ruvkun at Harvard Medical School / Massachusetts General Hospital at Boston, USA, where he started working on the nematode C. elegans as a simple model animal. He came back to Japan and worked at Nagoya University, National Institute of Genetics, and joined Osaka University, where he is currently an Associate Professor in the Department of Biological Sciences. Dr. Kimura's interests include basic principles of brain functions, such as memory, emotion, and decision-making, as well as the genetic mechanism of ageing. He has published 3 papers in Science, one of which has been cited more than 1,400 times (Kimura et al., Science 1997).

Dr. Koichi Hashimoto

Dr. Hashimoto received his B.S., M.S. and Ph.D. from Osaka University in 1985, 1987 and 1990, respectively. He became an assistant professor at Osaka University and joined Okayama University as an associate professor in 1994. He moved to The University of Tokyo in 1990. He is now a professor at Tohoku University since 1994. He is interested in robotics and computer vision, which are very important technologies in bio-navigation. Drs. Kimura and Hashimoto jointly developed a robotic microscope system with projection mapping to reveal the mechanics of sensor-motor coordination of small animals.

List of Speakers and Schedule

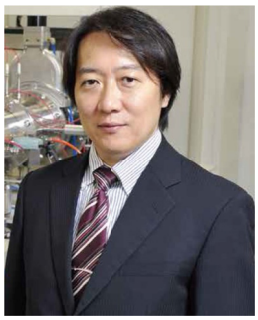
Time	Topics	Speaker List
14:00-14:10	Welcome speech	
14:10-14:30	Robotic microscope for measuring and manipulating neural activity during navigation	Prof. Koichi Hashimoto Tohoku University, Japan
14:30-14:50	Robot technology enhancing bio-logging science	Prof. Yuichi Tsumaki Yamagata University, Japan
14:50-15:10	Knowledge discovery from animal locomotion data	Prof. Takuya Maekawa Osaka University, Japan
15:10-15:30	Coffee break	
15:30-15:50	Tuning of a Fuzzy Controller for Collision Free Navigation of a Mobile Robot in Constraint Environment	Prof. Gancho Vachkov Baku Higher Oil School (BHOS) Azerbaijan
15:50-16:10	Measuring the "attention" during 3D navigation of bats	Prof. Shizuko Hiryu Doshisha University, Japan
16:10-16:30	Memory of places in rats	Prof. Susumu Takahashi Doshisha University, Japan
16:30-16:50	Differential equations for decision-making in worms' navigation	Prof. Kotaro Kimura Osaka University, Japan
16:50-17:00	Panel Discussion	Moderators: All speakers

IEEE ICMA 2017 Conference

Invited Workshop on MEMS-based Intelligent Devices

Monday, August 7, 2017
13:30 - 15:00
Conference Room 61, 6F
Sunport Takamatsu Symbol Tower, Takamatsu, Japan

Organizer: Prof. Hidekuni Takao, Kagawa University, Japan



Prof. Takao received his B.S., M.S. and Ph.D. degrees from Toyohashi University of Technology in 1993, 1995 and 1998, respectively. Since 2014, he has been a full professor of Kagawa University, and also holding the director position of Nano-Micro Structure Device Integrated Research Center in Kagawa University. His research interests are high performance silicon MEMS sensors and actuators and their applications to tactile sensing technology. Since 2015, he has been the representative of a JST-CREST project.

List of Speakers and Schedule

Time	Topics	Speaker List
13:30-14:00	MEMS Vibrational Energy Harvesters Using High Density Solid-Ion Electret	Prof. Hiroshi ToshiyoshiThe University of Tokyo, Japan
14:00-14:30	3D Fabrication of Microneedle for Blood Collection Biomimicking Mosquito	Prof. Seiji Aoyagi Kansai University, Japan
14:30-15:00	MEMS-based Tactile Display	Prof. Norihisa Miki Keio University, Japan

IEEE ICMA 2017 Conference

Invited Workshop on MEMS-based Intelligent Devices

Talk 1

MEMS Vibrational Energy Harvesters Using High Density Solid-Ion Electret

Hiroshi Toshiyoshi

Professor

Institute of Industrial Science,

The University of Tokyo, Tokyo, Japan

E-mail: hiro@iis.u-tokyo.ac.jp

http://toshi.iis.u-tokyo.ac.jp/toshilab/

In association with

Gen Hashiguchi, Shizuoka University

Shimpei Ono, Central Research Institute of Electric Power Industry

Hiroyuki Mitsuya, Saginomiya Seisakusho, Inc.

Abstract:

IoT or Internet-of-Things is also a buzzword in the field of microelectromechanical systems (MEMS), and one might associate it to small sensors integrated in things. It is absolutely true that MEMS takes a very important portion in the IoT technology, as it has already diffused into mobile electronics, by taking various forms of such as microphone, accelerometer, gyroscope, barometer, and else. On the extension of it, we would have no difficulty in visualizing a grain-size gadget equipped with sensors, processors, and wireless communication interface. In our opinion, nonetheless, the true implication of the MEMS technology in the emerging IoT is in the power sources. Provided that electronics have been made to be small enough to fit in a tiny chip, how are we going to supply power to it? Cables are already larger in size than such a MEMS-based IoT device. Small batteries will do the job but for only a limited duration of time, and therefore perpetual power sources are definitely needed to keep them running for long. For this reason, recent MEMS studies focus onto the development of energy harvesters to gain electrical power from the environments such as light, heat, electromagnetic waves, and mechanical vibrations.

In our research group, we perform development of MEMS vibrational energy harvesters based on the electrical induction current caused by the permanent electrical charge so called the electrets. Our target is a 1mW-class power generation from the environmental vibrations of 0.1 G or less, in the frequency range lower than 100 Hz. A high-density electret of a few mC/m^2 is formed on the silicon micromechanical structures, which is mechanically shaken by the vibration to produce electrical currents by induction. In this talk, we look into the mechanism of power generation using electret and discuss the methodology to improve the energy conversion efficiency in terms of the electrical and mechanical designs.

This talk includes the products of research supported by JST-CREST Grant Number JPMJCR15Q4 and by NEDO, Japan.

Dr. H. Toshiyoshi is a Professor in the Institute of Industrial Science (IIS) of the University of Tokyo, Tokyo, Japan, and also with the Research Center for Advanced Science and Technology (RCAST) of the University of Tokyo. Dr. Toshiyoshi received the M.E. and Ph.D. degrees in electrical engineering from the University of Tokyo, Tokyo, Japan, in 1993 and 1996, respectively. He joined the IIS in 1996 as a Lecturer. From 1999 to 2001, he was a Visiting Assistant Professor at the University of California, Los Angeles, CA, US. In 2002, he became an Associate Professor with the IIS, and since 2009 he has been a Professor with the IIS and RCAST at the University of Tokyo.

From 2005 to 2008, he was the Project Leader of the Optomechatronics Project at Kanagawa Academy of Science and Technology (KAST), Kawasaki, Japan, where he led a team on MEMS for optical applications such as image display and fiber-endoscope. From 2011 to 2014, he was the Principal Investigator of a NEXT program (Funding Program for Next Generation World-Leading Researchers) of the Japan Society for the Promotion of Sciences (JSPS) initiated by the Council for Science and Technology Policy (CSTP) of Japan, where he developed the integrated MEMS technology for multi-functional low power electronics.

IEEE ICMA 2017 Conference

Invited Workshop on MEMS-based Intelligent Devices

Talk 2

3D Fabrication of Microneedle for Blood Collection Biomimicking Mosquito

Seiji Aoyagi, Ph.D.

Professor

Robot &Micro System Laboratory

Dept. of Mechanical Engineering

Faculty of Engineering Science

Kansai University, Japan

E-mail: aoyagi@kansai-.ac.jp

http://www2.ipcku.kansai-u.ac.jp/~t100051/

Abstract:

The mosquito's proboscis should be a good model for painless needle. We have observed the cooperative inserting motion of three-piece mosquito's proboscises (one labrum and two maxillae), in which the central and the outer needles are advanced alternatively at several Hz, where jagged edges effectively work as anchors. We have also observed the motion of sucking blood, where human whole blood was embedded in an artificial skin made of glucomannan. Unlike other researches on microneedles, we have been investigating a painless needle for collecting blood by mimicking the mosquito. However, achieving sharp tip and jagged side edges was incomplete, since degrees of freedom based on conventional MEMS technologies is basically limited to two-and-half dimensions.

In this article, microneedles mimicking mosquito were fabricated by employing a three-dimensional laser lithography. An ultra-precision three-dimensional laser lithography system "Nanoscribe GT" is employed. Based on two-photon absorption phenomenon, an extremely small space of less than 200 nm in photocurable polymer material is cross-linked, where a laser beam is focused on. The total cross-linked space finally emerges after development process.

A practical needle of comprising two parts was proposed and fabricated. The functions of three-piece mosquito's proboscises (one labrum and two maxillae) are integrated to two parts. Each half-needle has semicircular channel and jagged edges. By combining the two-halves, one hollow microneedle is realized. Alternative motion like mosquito maxillae is possible. Fluid is introduced into the channel through small holes in the wall, and is drawn up by capillary force.

It was experimentally confirmed that the fabricated needle successfully penetrates PDMS skin. The effectiveness of alternative motion of two parts with 90 deg phase to each other was also investigated. Human whole blood was successfully collected by the fabricated needle from a droplet.

Seiji Aoyagi received his BE, ME, and PhD degrees in precision machinery engineering from the University of Tokyo, Tokyo, Japan, in 1986, 1988, and 1994, respectively. From 1988 to 1995, he was with the Mechanical System Engineering Department at Kanazawa University, Kanazawa, Japan as a research associate and an associate professor. He is currently a full professor in the Mechanical Engineering Department at Kansai University, Osaka, Japan. His current research interests are biomimetics, 3D micro/nano fabrication featuring 3D laser lithography, femtosecond laser machining, etc., MEMS with an emphasis on sensors and actuators for micro robotics, and mechatronics.

More information can be obtained bellow (select language button menu as English on the pages):

http://www2.ipcku.kansai-u.ac.jp/~t100051/resume_aoyagi_j.html

http://www2.ipcku.kansai-u.ac.jp/~t100051/publication_aoyagi_j.html

IEEE ICMA 2017 Conference

Invited Workshop on MEMS-based Intelligent Devices

Talk 3

MEMS-Based Tactile Display

Norihisa Miki, Ph.D.

Professor

Department of Mechanical Engineering

Keio University

E-mail: miki@mech.keio.ac.jp

http://www.miki.mech.keio.ac.jp

Abstract:

Tactile displays can present tactile sensation via physical or electrical stimulation of tactile receptors. Given the current ICT where vision and hearing are almost saturated, tactile displays are promising media for next generation ICT. High resolution tactile displays are preferable where MEMS technologies can contribute. In this presentation, we introduce a mechano-tactile display composed of MEMS-enabling large displacement micro-actuators array and an electro-tactile display consisting of an array of micro-needle electrodes. Both displays exploit the virtues of MEMS and can present a wider variety of tactile sensations than conventional tactile displays. On the other hand, we encountered a new challenge, which is characterization of the presented tactile sensation. The tactile sensation is heavily dependent on the subjects and contains large discrepancies among individuals. I introduce a concept of sample comparison method as one of the quantification methods for tactile sensations.

Dr. Miki is a Professor in the Department of Mechanical Engineering at Keio University. He received Ph.D. in mechano-informatics from University of Tokyo in 2001. Then, he worked at MIT microengine project as a posdoc, later as a research engineer. He joined the Department of Mechanical Engineering at Keio University in 2004 as an assistant professor and became a full professor in 2017. His current research fields range from Biomedical devices to MEMS-based human interface devices. He closely works with medical doctors to develop an implantable artificial kidney. The EEG electrodes that his group developed are ready to be applied in the field of psychology and media arts. He was a researcher of JST PRESTO (Information Environment and Humans) from 2010 to 2016 and Kanagawa Institute of Industrial Science and Technology (formerly, Kanagawa Academy of Science and Technology) from 2010 to present. He is a general chair of the 8 th and 9 th Symposium on Micro-Nano Science and Technology in 2017 and 2018 sponsored by JSME. He co-founded a healthcare startup in 2017.

More information can be obtained in http://www.miki.mech.keio.ac.jp

IEEE ICMA 2017 Program at a Glance

Sunport Takamatsu Symbol Tower, Takamatsu, Kagawa, Japan August 6-9, 2017

Sunday, August 6, 2017	
13:30 - 18:30	Registration Desk Open on 6th floor
14:00 - 17:00	Workshop at Conference Room 61
17:00 - 18:00	Keynote Speech #1 (Prof. Toshio Fukuda) at Conference Room 61
18:30 - 19:30	Reception at Conference Room 54 on 5th floor
Monday, August 7, 2017	
8:20 - 8:30	Opening Ceremony (Kagawa International Conference Hall)
8:30 - 9:30	Plenary Talk #1 (Dr. James Kuffner) (Kagawa International Conference Hall)
9:30 - 10:30	Plenary Talk #2 (Prof. Fumihito Arai) (Kagawa International Conference Hall)
10:30 - 11:00	Morning Break
11:00 - 12:00	Technical Sessions MA1 (Kagawa International Conference Hall)
12:00 - 13:00	Lunch Hour Keynote Speech #2 (Mr. Peichao Liu) (Kagawa International Conference Hall)
13:30 - 15:00	Technical Sessions MP1 (Conference Room on 6th floor)
15:00 - 15:20	Afternoon Break
15:20 - 16:50	Technical Sessions MP2 (Conference Room on 6th floor)
17:00 - 18:00	Technical Sessions MP3 (Conference Room on 6th floor)
Tuesday, August 8, 2017	
8:30 - 9:20	Plenary Talk #3 (Prof. Max Q.-H. Meng) (Kagawa International Conference Hall)
9:30 - 10:30	Technical Sessions TA1 (Conference Room on 6th floor)
10:30 - 10:40	Morning Break
10:40 - 12:10	Technical Sessions TA2 (Conference Room on 6th floor)
12:10 - 13:30	Lunch Break
13:30 - 15:00	Technical Sessions TP1 (Conference Room on 6th floor)
15:00 - 15:20	Afternoon Break
15:20 - 16:50	Technical Sessions TP2 (Conference Room on 6th floor)
18:00 - 20:30	Award Banquet, Hiten Hall, 3F in JR Hotel Clement Takamatsu
Wednesday, August 9, 2017	
8:30 - 10:00	Technical Sessions WA1 (Conference Room on 6th floor)
10:00- 10:20	Morning Break
10:20 - 11:50	Technical Sessions WA2 (Conference Room on 6th floor)
12:00 - 13:00	Farewell Party at Communication Plaza on 1st floor

* 15 minutes (Speech: 12 minutes, Q&A:3 minutes) are scheduled for oral presentation including discussions for each paper.

*30 minutes (core time) are scheduled for poster presentation

IEEE ICMA 2017 Technical Program, Sunday, August 6, 2017

Room / Time	1 Conf. Room 61	2 Conf. Room 62	3 Conf. Room 63	4 Conf. Room 64	5 Conf. Room 65	6 Conf. Room 66
13:30 - 18:30	**Registration Desk Open**				Location: Registration Area on 6th floor	
14:00 - 17:00	**Tutorial Workshops on Systems Science of Bio-navigation**				Location: Coference Room 61 on 6th floor	
17:00 - 18:00	**Keynote Speech #1**		Human Interactive Service Robots **Prof. Toshio Fukuda, Nagoya University, Japan** Location: Coference Room 61 on 6th floor			
18:30 - 19:30	**Reception**				Location: Coference Room 54 on 5th floor	

IEEE ICMA 2017 Technical Program, Monday, August 7, 2017

7:30 - 13:00	**Registration Desk Open**				Location: Kagawa International Conference Hall	
13:00 - 18:00	**Registration Desk Open**				Location: Registration Area on 6th floor	
8:20 - 8:30	**Opening Ceremony**				Location: Kagawa International Conference Hall	
8:30 - 9:30	**Plenary Talk #1**		Intelligent Robotics and Automation in a Cloud-Connected World **Dr. James Kuffner, Toyota Research Institute** Location: Kagawa International Conference Hall			
9:30 - 10:30	**Plenary Talk #2**		Micro-nano Mechatronics for Multiscale Interactions in the Physical World **Dr. Fumihito Arai, Nagoya University, Japan** Location: Kagawa International Conference Hall			
10:30 - 11:00	Morning Break					
11:00 - 12:00	Technical Sessions MA1 (Poster session: Intelligent Mechatronics and Automation)				Location: Kagawa International Conference Hall	
12:00 - 13:00	Lunch Hour Keynote Speech					
	Keynote Speech #2		Invented the World's First Smart Desktop Robotic Arm **Mr. Peichao Liu, Chief Executive Officer of Dobot** Location: Kagawa International Conference Hall			
13:30 - 15:00	**MP1-1** Invited Workshop on MEMS-based Intelligent Devices	**MP1-2** Medical Robots for Minimal Invasive Surgery (I)	**MP1-3** Biomimetic Measurment and Control in Robotics	**MP1-4** Biomimetic Underwater Robots	**MP1-5** Industrial, Manufacturing Process and Automation	**MP1-6** Manipulator Control and Manipulation (I)
15:00 - 15:20	Afternoon Break					
15:20 - 16:50	**MP2-1** OS: Navigation Mechanism Analysis (I)	**MP2-2** Medical Robots for Minimal Invasive Surgery (II)	**MP2-3** Medical, Biomedical and Rehabilitation Systems (I)	**MP2-4** Biomimetic Systems (I)	**MP2-5** Elements, Structures, and Mechanisms	**MP2-6** Manipulator Control and Manipulation (II)
17:00 - 18:00	**MP3-1** OS: Navigation Mechanism Analysis (II)	**MP3-2** Medical Robots for Minimal Invasive Surgery (III)	**MP3-3** Medical, Biomedical and Rehabilitation Systems (II)	**MP3-4** Biomimetic Systems (II)	**MP3-5** Dynamics Vibration Analysis and Vibration Control	**MP3-6** Manipulator Control and Manipulation (III)

IEEE ICMA 2017 Technical Program, Tuesday, August 8, 2017

Time \ Room	1 Conf. Room 61	2 Conf. Room 62	3 Conf. Room 63	4 Conf. Room 64	5 Conf. Room 65	6 Conf. Room 66
8:00 - 17:00	**Registration Desk Open**				Location: Registration Area on 6th floor	
8:30 - 9:20	**Plenary Talk #3**		Micro Medical Robotics: Painless and Scarless **Prof. Max Q.-H. Meng, The Chinese University of Hong Kong Shatin, Hong Kong, China** Location: Kagawa International Conference Hall			
9:30 - 10:30	**TA1-1** Intelligent Mechatronics and Application (I)	**TA1-2** Signal and Image Processing (I)	**TA1-3** Control Theory and Application(I)	**TA1-4** Modeling, Simulation Techniques and Methodologies (I)	**TA1-5** Robot Navigation and Control Algorithm (I)	**TA1-6** Human-System Interaction and Interface (I)
10:30 - 10:40	Morning Break					
10:40 - 12:10	**TA2-1** Intelligent Mechatronics and Application (II)	**TA2-2** Signal and Image Processing (II)	**TA2-3** Control Theory and Application(II)	**TA2-4** Modeling, Simulation Techniques and Methodologies (II)	**TA2-5** Robot Navigation and Control Algorithm (II)	**TA2-6** Human-System Interaction and Interface (II)
12:10 - 13:30	Lunch Break					
13:30 - 15:00	**TP1-1** Intelligent Mechatronics and Application (III)	**TP1-2** Signal and Image Processing (III)	**TP1-3** Control Theory and Application(III)	**TP1-4** Modeling, Simulation Techniques and Methodologies (III)	**TP1-5** Mobile Robot System (I)	**TP1-6** Humanoid Robot System
15:00 - 15:20	Afternoon Break					
15:20 - 16:50	**TP2-1** Intelligent Mechatronics and Application (IV)	**TP2-2** Signal and Image Processing (IV)	**TP2-3** Control Theory and Application (IV)	**TP2-4** Modeling, Simulation Techniques and Methodologies (IV)	**TP2-5** Mobile Robot System (II)	**TP2-6** Intelligent Biomedical Instrument Technology
18:00 - 20:30	**Award Banquet**				Location: Hiten Hall, 3F in JR Hotel Clement	

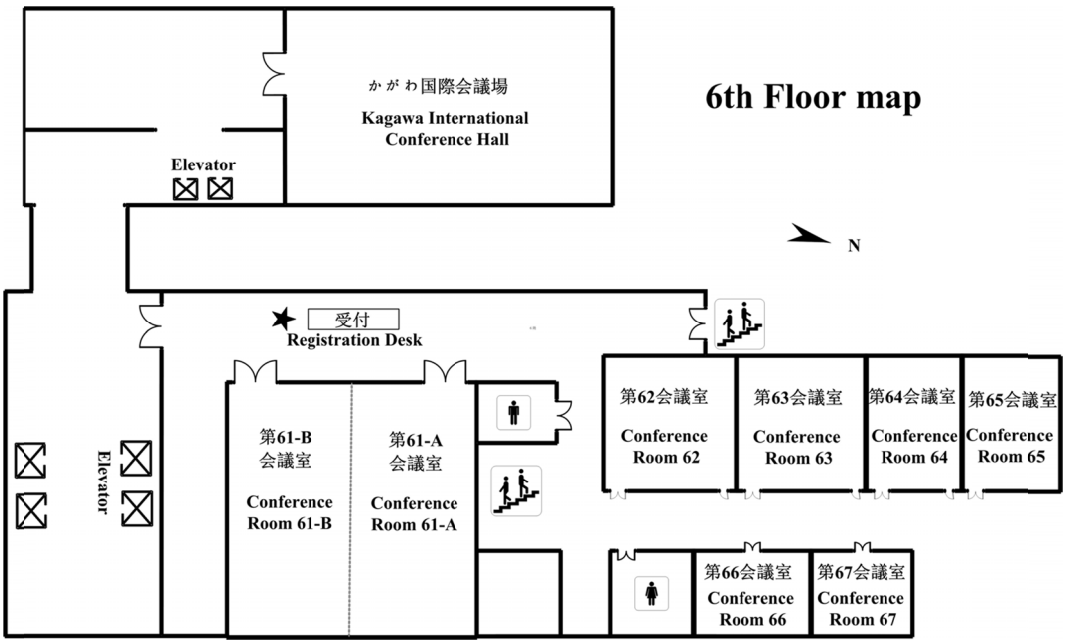
IEEE ICMA 2017 Technical Program, Wednesday, August 9, 2017

Time \ Room	1 Conf. Room 61	2 Conf. Room 62	3 Conf. Room 63	4 Conf. Room 64	5 Conf. Room 65	6 Conf. Room 66
8:00 - 11:00	**Registration Desk Open**				Location: Registration Area on 6th floor	
8:30 - 10:00	**WA1-1** OS: Signal measurement and Process in Automatic Control (I)	**WA1-2** Signal and Image Processing (V)	**WA1-3** Fuzzy Control	**WA1-4** Modeling, Simulation Techniques and Methodologies (V)	**WA1-5** Mobile Robot System (III)	**WA1-6** Micro and Nano Systems
10:00 - 10:20	Morning Break					
10:20 - 11:50	**WA2-1** OS: Signal measurement and Process in Automatic Control (II)	**WA2-2** Robotic Vision	**WA2-3** Intelligent Control	**WA2-4** Actuator Design, and Novel Actuator Systems	**WA2-5** Rescue Robots and Field Robot Systems	**WA2-6** CAD/CAM/CAE and Manufacturing Systems
12:00 - 13:00	**Farewell Party**				Location: Communication Plaza on 1st floor	

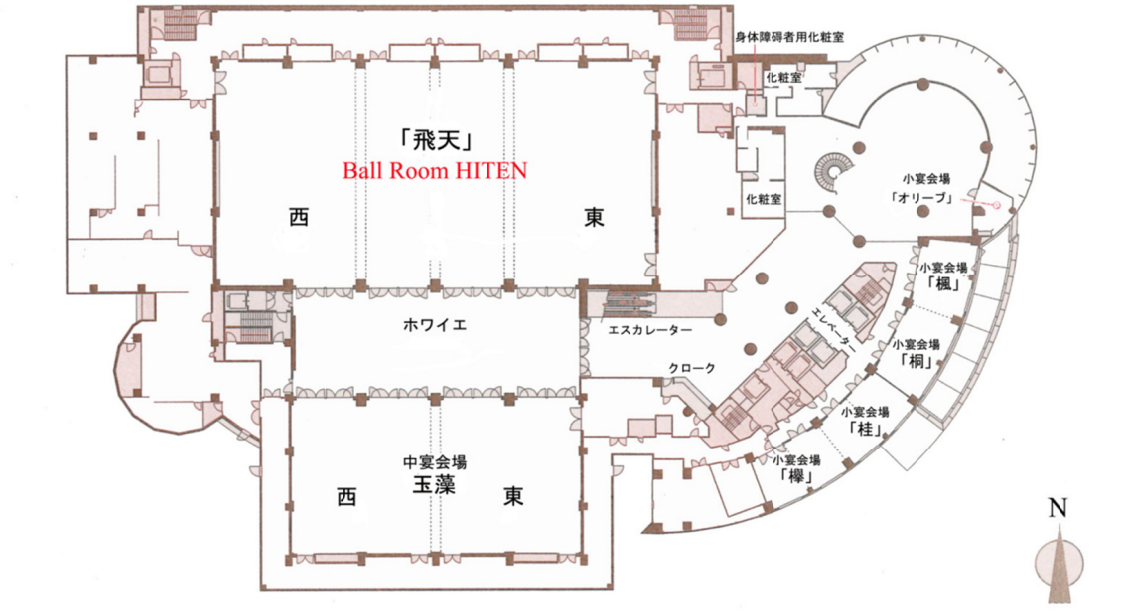
IEEE ICMA 2017
Floor Map of Conference Rooms

6F, Symbol Tower, Takamatsu

Conference Room 61-66



6th Floor Map of Conference Room



3rd Floor Map of JR Hotel Clement Takamatsu

Overall Map of Sunport in Takamatsu

Monday
August 7, 2017

Morning Sessions

MA1-P Poster Session (Intelligent Mechatronics and Automation)

Monday
August 7, 2017

Afternoon Sessions

MP1-1	Invited Workshop on MEMS-based Intelligent Devices
MP1-2	Medical Robots for Minimal Invasive Surgery (I)
MP1-3	Biomimetic Measurement and Control in Robotics
MP1-4	Biomimetic Underwater Robots
MP1-5	Industrial, Manufacturing Process and Automation
MP1-6	Manipulator Control and Manipulation (I)
MP2-1	OS: Navigation Mechanism Analysis (I)
MP2-2	Medical Robots for Minimal Invasive Surgery (II)
MP2-3	Medical, Biomedical and Rehabilitation Systems (I)
MP2-4	Biomimetic Systems (I)
MP2-5	Elements, Structures, and Mechanisms
MP2-6	Manipulator Control and Manipulation (II)
MP3-1	OS: Navigation Mechanism Analysis (II)
MP3-2	Medical Robots for Minimal Invasive Surgery (III)
MP3-3	Medical, Biomedical and Rehabilitation Systems (II)
MP3-4	Biomimetic Systems (II)
MP3-5	Rotor Dynamics Vibration Analysis and Vibration Control
MP3-6	Manipulator Control and Manipulation (III)

MA1-P: Poster Session (Intelligent Mechatronics and Automation)

Session Chairs: Hideyuki Hirata, Kagawa University
Yu Song, Kagawa University

Kagawa International Conference Hall, 11:00-12:00, Monday, 7 August 2017

MA1-P(1) 11:00-12:00

The Research on System of Frequency Conversion and Speed Regulation of Exchange Asynchronous Motor

Xuesong Zhou, Tianxiang Huang, Youjie Ma and Zhiqiang Gao
Key Research Laboratory for Control Theory & Applications in Complicated Systems,Tianjin University of Technology
Tianjin,China

- The background and significance
- Development status at home and abroad
- The principle
- The key technology
- The prospect

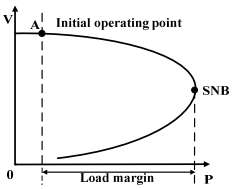
AC Variable Frequency Speed Regulation Asynchronous Motor

MA1-P(2) 11:00-12:00

Review Analysis of Voltage Stability in Power System

Youjie Ma, Shaofeng Lv, Xuesong Zhou and Zhiqiang Gao
Key Research Laboratory for Control Theory & Applications in Complicated Systems
Tianjin University of Technology, Tianjin, China

- Introduction
- The definition of voltage stability
- Mechanism of voltage instability
- Research methods of voltage stability
- Conclusions and prospects



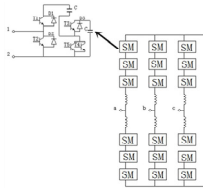
P-V curv

MA1-P(3) 11:00-12:00

A Study on Modular Multilevel Converter Topology to Inhibit DC Voltage Drop

Youjun Yue*1,Li Yang*1,Hui Zhao*1*2 ,Hongjun Wang*1
*1Tianjin Key laboratory for Control Theory and Applications in Complicated System, Tianjin University of Technology,Tianjin, China;*2Tianjin Agricultural University,Tianjin, China

- A new topology based on modular multilevel converter and its sub-modules working status
- MMC-HVDC pre-charge process
  - *A*. Uncontrolled rectification phase
  - *B*. Progressive unlocking phase
  - *C*. High frequency rectification phase



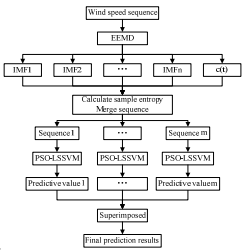
MMC and sub-module structure

MA1-P(4) 11:00-12:00

Short-term Wind Speed Combined Prediction for Wind Farms

Youjun Yue, Yan Zhao, Hui Zhao, and Hongjun Wang
Tianjin Key laboratory for Control Theory and Applications in Complicated System, Tianjin University of Technology, Tianjin, China

- Use the EEMD to decompose the wind speed time series.
- The SE of each sub-sequence is calculated, and the sequences with similar complexity are merged.
- PSO is used to optimize the two parameters σ and γ of LSSVM.
- Use the optimized LSSVM to predict all the components and the prediction results are superimposed to obtain the final prediction result.



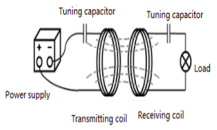
The flow chart of short-term wind speed prediction

MA1-P(5) 11:00-12:00

Design of Wireless Power Transmission System Based on Magnetic Coupling Resonant for the Capsule Endoscopy

Shuxiang Guo[1], Peng Zhang[1], Jian Guo[1,2*], Lili Wang[3] and Gang Sun[4]
1 Tianjin Key Laboratory for Control Theory & Application in Complicated Systems and Biomedical Robot LaboratoryTianjin University of Technology, Binshui Xidao 391,Tianjin, China
2 Intelligent Mechanical Systems Engineering Department, Kagawa University, Takamatsu, Kagawa, Japan
3 Internal Medicine-Oncology, Tianjin Hospital of ITCWM Naikai Hospital,Three latitude Road 122, Tianjin, China
4 Gastrointestinal Surgery, Tianjin Hospital of ITCWM Naikai Hospital,Three latitude Road 122, Tianjin, China
*Corresponding Author: jianguo@tjut.edu.cn;guoshuxiang@hotmail.com; lpy19920505@gmail.com;nkyywlili@163.com

- This paper proposed a miniaturized, low-power energy transmission mode based on magnetic coupling resonant WPT(Wireless Power Transmission).
- We finished the experiment contrast of the magnetic coupling resonant and magnetic induction coupling transmission in power and efficiency.
- Through this design, we solved the questions of wireless capsule endoscope battery power restrictions, improve the work efficiency.



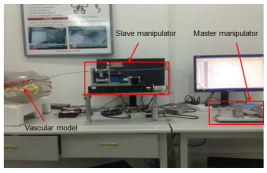
The basic structure of magnetic coupling resonant wireless energy transmission system

MA1-P(6) 11:00-12:00

Study on the Tracking Performance of the Vascular Interventional Surgical Robotic System Based on the Fuzzy-PID Controller

Jian Guo*1 ,Xiaoliang Jin*1,Shuxiang Guo*1*2 and Wenxuan Du*1
*1 Tianjin Key Laboratory for Control Theory & Application in Complicated Systems and Biomedical Robot Laboratory, Tianjin University of Technology, Binshui Xidao 391, Tianjin, China
*2 Intelligent Mechanical Systems Engineering Department, Faculty of Engineering Kagawa University, Takamatsu, Kagawa, Japan

- This paper proposed a fuzzy-PID controller for the VIS to solve the problem of tracking error from the slave to the master manipulator.
- Experimental results showed that the fuzzy-PID controller can improve the tracking performance of the master-slave system and reduce the error.



The master-slave vascular interventional surgical robotic system

MA1-P: Poster Session (Intelligent Mechatronics and Automation)

Session Chairs: Hideyuki Hirata, Kagawa University
Yu Song, Kagawa University

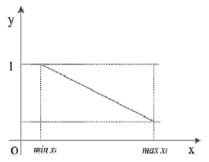
Kagawa International Conference Hall, 11:00-12:00, Monday, 7 August 2017

MA1-P(7) 11:00-12:00

A Method for evaluating The Rescue Priority Level of Power Line Post-disaster based on AHP

Yu Hong1,Ma Yi2,WangLongfei3,Du Zhijie4, Zhai Yongsai5
Electrical Research Institute of YunnanElectric Power Research Institute (Group) Co,Ltd.Kunming 650051,China
Tianjin Key Laboratory of Intelligent RemoteSending Date Processing TechnologyTianjin 300301,China

• This method improves the traditional analytic hierarchy process (AHP), and based on this, by application of cask theory, constructing a hierarchical structure model for rescue priority evaluation, constructing the judgment matrix, calculation of the evaluation index weigh,consistency check, dimensionless of evaluation index, calculation of rescue priority value, determination of rescue priority and a series of work, complete the evaluation of rescue priority level of power line post-disaster.



Reverse Geometry Index Threshold Method

MA1-P(8) 11:00-12:00

A Landslide Intelligent Detection Method based on CNN and RSG_R

Yu Hong1,Ma Yi2,WangLongfei3,Wang Xiaoqian4,Zhai Yongsai5
Electrical Research Institute of YunnanElectric Power Research Institute (Group) Co,Ltd.Kunming 650051,China
Tianjin Zhongwei Aerospace DataSystem Technology CO.Ltd.Tianjin 300301,China

- Convolutional neural network (CNN) region growing algorithm (RSG_R) method for detection of landslide intelligence.
- The first visible light transmission line inspection image establish landslide detection image data set;
- Then the CNN of the image data sets were detected, and get the image existence landslide set;
- Finally use rsg_r algorithm to extract the discriminant information of the image elements of disaster disaster .

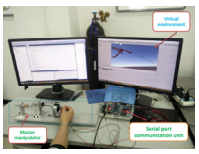
Disaster Extraction Results

MA1-P(9) 11:00-12:00

A Novel Path Planning Algorithm for the Vascular Interventional Surgical Robotic Doctor Training System

Jian Guo*1 , Yuhang Cheng*1 ,Shuxiang Guo*1*2 and Wenxuan Du*1
*1 Tianjin Key Laboratory for Control Theory & Application in Complicated Systems and Biomedical Robot Laboratory, Tianjin University of Technology, Binshui Xidao 391, Tianjin, China
*2 Intelligent Mechanical Systems Engineering Department,
Kagawa University, 2217-20, Hayashi-cho, Takamatsu 761-0396, Japan

- This paper proposed a novel path planning algorithm for the vascular interventional surgical robotic doctor training system.
- The algorithm could implement the catheter that moves forward, backward and rotates in the blood vessels, and then finally pass the specified blood vessel.
- Experimental results shown that the maximum error between the real path and the path planning is 1mm and the average error is 0.3mm.



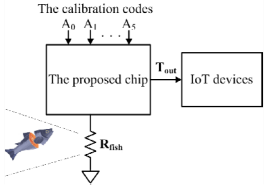
The whole structure of the training system

MA1-P(10) 11:00-12:00

A CMOS Fish Resistance to Period Converter with Calibration Circuits for Fish Spoilage Detecting Applications

Cheng-Ta Chiang, Yen-Kuei Lu, and Lian-Teng Lin
Department of Electrical Engineering, National Chia Yi University
Chia Yi, Taiwan

- The proposed chip is simple and low-cost, furthermore, it can monitor the fish spoilage without influencing by real environmental influence.
- Reduce the non-linear effect by the proposed calibration technique.
- Being a fish spoilage detector, it can measure the freshness of fish easily in real time.



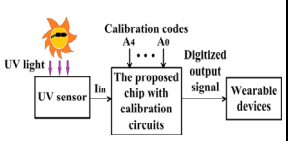
Block diagram of the proposed chip

MA1-P(11) 11:00-12:00

A CMOS Ultraviolet (UV) Light Intensity to Duty Cycle Converter with Calibration Circuits for Monitoring Environmental UV Light Applications

Cheng-Ta Chiang, Chia-Ming Chang, and Chih-Chieh Chang
Department of Electrical Engineering, National Chia Yi University
Chia Yi, Taiwan

- With the calibration technology, the proposed chip successfully overcomes the nonlinear problems. After calibration, the maximum linear error is reduced to 0.33%.
- Being a general-purpose UV light intensity sensor transducer, it can be combined with various UV sensors.



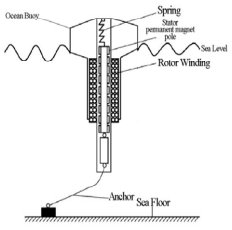
Block diagram of the proposed chip

MA1-P(12) 11:00-12:00

Key Technologies of Wave Energy Power Generation System

Chunjie Wang, Zhaohui Zhang
Tianjin University of Technology
Tianjin, China

- Design of conversion system
- Design of permanent magnet linear generator se.
- Design of the storage battery charging and discharging circuit
- Simulation of Closed-loop Control of Buck-Boost Converter Circuit.
- Simulation and Analysis of wave energy generation system.



The Power System Structure Diagram

MA1-P: Poster Session (Intelligent Mechatronics and Automation)

Session Chairs: Hideyuki Hirata, Kagawa University
Yu Song, Kagawa University

Kagawa International Conference Hall, 11:00-12:00, Monday, 7 August 2017

MA1-P(13) 11:00-12:00

Multi-Scene Smart Home System Based on Embedded Chips

Liqi Yan, and Jin Yu, Yuqing Ye, Huiai Bai, Jinshuo Zhang, and Jie Huang
Beijing University of Posts and Telecommunications
Beijing, China

- Multi-Scene Smart Home system is based on different demand patterns (such as work, sleep, nostalgia, etc.).
- It designs to achieve the simulations of different environments (such as forests, oceans, etc.) at home.
- The controller is programmed based on the embedded Linux technology.
- Users could easily choose the scene they want using the APP on the mobile terminal.

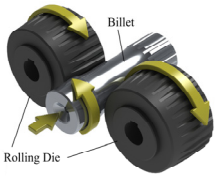
Multi-Scene Smart Home

MA1-P(14) 11:00-12:00

Study and Improvements on the Rolling Loads of Axial Incremental Rolling Process for Spline Shaft Based on Finite Element Method

Dazhou Liu, Shengdun Zhao, Minchao Cui, Shuaipeng Li and Jiaming Gao
of Mechanical Engineering, Xi'an Jiaotong University
Xi'an, China

- The axial incremental rolling process has a promising performance for the production of spline shafts
- The lubricating condition is an important factor for the rolling loads.
- The tooth divided flow method (TDFM) is an effective way to improve the friction condition.



Axial Incremental Rolling Process

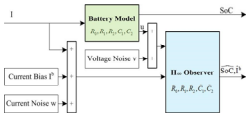
MA1-P(15) 11:00-12:00

Offset-free ECM based SOC estimation using H-infinity observer

Daiwei Feng, Dagui Huang
School of Mechatronics Engineering,
University of Electronic Science and
Technology of China,
Chengdu, Sichuan, China

Jiangtao He
Department of Mechanical Engineering,
McMaster University,
Hamilton, Ontario, Canada

- Augment current bias as one battery state.
- SOC estimation accuracy can be improved.
- Observer parameters' adaption and robustness can be enhanced.



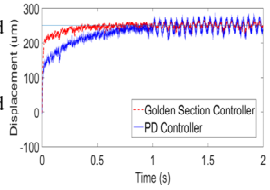
Offset-free H-infinity observer

MA1-P(16) 11:00-12:00

Nonlinear Adaptive Control For Hybrid Foil-magnetic Bearing

Zhongliang Tian Zhengyuan Wei Yanhua Sun
State Key Laboratory of Strength and Vibration for Mechanical Structure
Xi'an Jiaotong University Xi'an, Shaanxi Province, China

- This paper presents an adaptive control method for the HFMB to simplify the controller design and improve the performance of the rotor-HFMB system.
- The simulation results show good performance of the presented controller compared with a conventional PD controller.
- All-coefficient adaptive control method based on characteristic model



MA1-P(17) 11:00-12:00

Design of adaptive regulator for Lower Extremity Rehabilitation Robot

Feng Li , Wei Hou , Xiaofei Qin , Shaobin Wang , Xiao Zhang and Jie Liu
School of Optical Electrical and Computer Engineering, University of Shanghai for Science and Technology, Shanghai China,200093

- A Youla-Kucera parameterized adaptive regulation approach.
- A daptive approach is further proposed to tune the parameter online in order to track the patient's unknown gait trajectory.
- It can be used in LERR system to deal with the unknown factors and thus smoothly cooperate the patient's move intention during the rehabilitation training process.

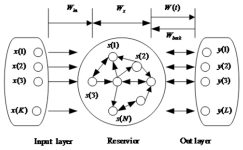
Lower Extremity Rehabilitation Robot with six degrees of freedom

MA1-P(18) 11:00-12:00

Echo State Network Ship Motion Modeling Prediction Based on Kalman Filter

Xiuyan,Peng and Huiyuan,Dong and Biao Zhang
College of Automation, Harbin Engineering University
Harbin, Heilongjiang, China

- Abract
- Introduction
- Echo State Network based on Kalman filter
- Simulation example
- Conclusion



ESN structure schematic

MA1-P: Poster Session (Intelligent Mechatronics and Automation)

Session Chairs: Hideyuki Hirata, Kagawa University
Yu Song, Kagawa University

Kagawa International Conference Hall, 11:00-12:00, Monday, 7 August 2017

MA1-P(19) 11:00-12:00

Intelligent Monitoring System of Light Intensity and CO_2 Concentration in Strawberries Greenhouse

Baofeng zhang[1] , Lei Yang[1] ,Junchao Zhu[1],Yan Zhao[1] and Na Liu[2]
[1] Tianjin Key Laboratory for Control Theory & Application in Complicated Systems ,Tianjin University of Technology, Binshui Xidao 391, Tianjin, China
[2] Tianjin Binhai tea grape science and Technology Development Co., Ltd., Tianjin, China

- In this article, we propose an intelligent monitoring system of strawberry greenhouse based on STM32 single chip to achieve the intelligent monitoring of light intensity and CO_2 concentration in the strawberry greenhouse.
- In this system, the intelligent monitoring system consists of three parts: the data acquisition module, the control module of the actuator and the display module of the environmental factors.
- Until now, the system has been tested in a strawberry greenhouse for one year and the system is stable and the feedback of the staff is that the system is convenient to use. The maximum error of the light intensity of this system is 940Lux, and the maximum error of the CO_2 concentration is 40ppm ,which can meet the needs of the strawberry growth.

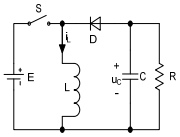
System application picture

MA1-P(20) 11:00-12:00

Study on the Output controllability of Buck-Boost Converter

Xiaojing Li[1], Zhaolong Zhang[2]
1 School of Electrical and Electronic Engineering,Tianjin University of Technology
2 Tianjin Long-Dream Science&Technology Co.LTD
Tianjin, China

- Output Controllability is an important feature for control systems. In this paper, hybrid systems (HS) was introduced and the model of BUCK-BOOST Converter was built based on switched linear systems (SLS), which belong to HS. Then the output controllability of BUCK-BOOST converter was studied and its sufficient and necessary criterion was given by the researching achievements of SLS. Lastly, the simulation analysis and verification were provided. The results of study indicated that the output could be stabilized at the enactment value when the sufficient and necessary criterion of output controllability was satisfied, on the contrary, the output could not be controlled stably.

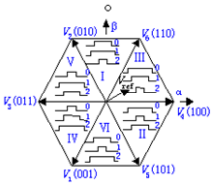


MA1-P(21) 11:00-12:00

SVPWM Control of Frequency-variable Speed-adjustable System

Xiaojing Li[1], Zhaolong Zhang[2]
1 School of Electrical and Electronic Engineering,Tianjin University of Technology
2 Tianjin Long-Dream Science&Technology Co.LTD
Tianjin, China

- **Vector control was the first choice of high-performance frequency-variable speed-adjustable system for AC asynchrony motors in many occasions. And Space Vector Pulse Width Modulation (SVPWM) had been applied widely for its more excellent performances compared with Space Pulse Width Modulation (SPWM). Firstly, the fundamental principium of SVPWM was described in this paper. Secondly, a method to realize SVPWM was put forth using DSP of TI Co. Then the full digital control of frequency-variable speed-adjustable system was achieved. The results of experiment for actual motor indicated that this method was feasible and it had extensive prospect in motor control. In this case, the control system had excellent dynamic, static performance and better control effect.**

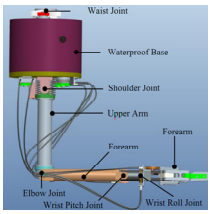


MA1-P(22) 11:00-12:00

Design and Analysis of a Novel Lightweight Underwater Manipulator

Chong Tang, Yu Wang, Shuo Wang, Rui Wang, and Min Tan
Institute of Automation, Chinese Academy of Sciences
University of Chinese Academy of Sciences
Beijing, China

- This paper addresses the mechanism design of a novel lightweight underwater manipulator with 5 degree of freedom.
- This manipulator has the advantages of light weight, small size and uniform mass distribution.
- Implement of every joint and the gripper is elaborated, and the kinematics and dynamics models are established.



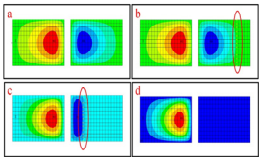
Underwater Manipulator

MA1-P(23) 11:00-12:00

Numerical method for analyzing the static characteristics of sliding bearing based on Ansys

Hao Li, Haipeng Geng, Sixun Tang, Hao Lin, Hao Lv and Lie Yu
Mechatronics State Key Laboratory for Strength and Vibration of Mechanical Structures
Xi'an Jiaotong University
Xi'an, Shaanxi Province, China

- Present and verify a new method for analyzing the sliding bearing.
- Use a intuitive way to build up Reynolds boundary condition.
- Put forward an index to measure the mesh sensitivity between two different integration method.



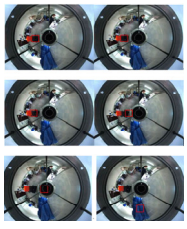
The analyzing process

MA1-P(24) 11:00-12:00

Robot Target Recognition and Tracking Based on Panoramic Vision

Liang Yan-hua[1], Cai Cheng-tao[2]
1.College of Electrical and Control Engineering, Heilongjiang University of Science and Technology, Harbin, China, 150022
2.College of Automation, Harbin Engineering University, Harbin,China,150001

- Scale Space Generation in Panoramic Vision system.
- Extreme Point Detection and Accurate Determination of Extreme Point Information.
- Distribution of Key Points Direction and Generation of Feature Descriptors.
- Target Recognition Algorithm based on Color Guide SIFT Feature Matching.



Tracking extraction frame using Meanshift tracking algorithm

MA1-P: Poster Session (Intelligent Mechatronics and Automation)

Session Chairs: Hideyuki Hirata, Kagawa University
Yu Song, Kagawa University

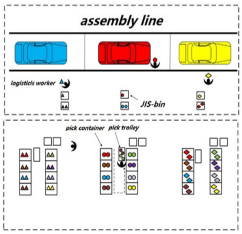
Kagawa International Conference Hall, 11:00-12:00, Monday, 7 August 2017

MA1-P(25) 11:00-12:00

Optimization of part supply of assembly lines with line-integrated supermarket

Xu HAO and Binghai ZHOU
School of Mechanical Engineering ,Tongji University
shanghai, China

- Line-integrated supermarkets
- Minimize the total cost of logistic workers and part supply
- Dynamic programming embedded with heuristics was adopted to obtain the optimum for small scale problems.
- For medium and large-scale problems, a modified immune clone selection algorithm was presented to generate satisfactory solutions

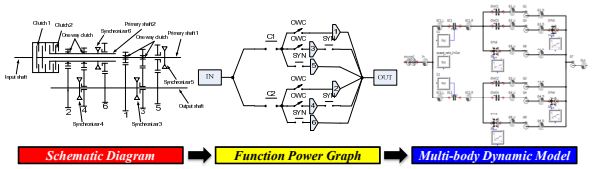


Line-integrated supermarket

MA1-P(26) 11:00-12:00

Design and Modeling of a Novel 6-Speed Dual Clutch Transmission (DCT) System

Yu-Hsuan Huang[1], Heng-Chuan Hsu[1], Yu-Fan Chen[1], Cheng-Ping Yang[2], and Tyng Liu[1]
1 Department of Mechanical Engineering, National Taiwan University, Taipei, Taiwan
2 Mechanical and Mechatronic Systems Laboratories, Industry Technology and Research Institute, Hsinchu, Taiwan



Advantages of the new DCT system (compared to the conventional DCT system)

☺ From the viewpoint of ***actuation timing***, the new DCT system is no need to concern about when the clutches should be actuated because the one-way clutches will guide the power flow automatically.

☺ From the viewpoint of ***output torque***, the gear shifting of the new DCT system is faster, earlier and more sensitive due to synchronizers and one-way clutches that make the gearshifts more effective.

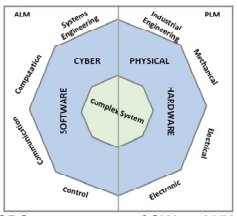
☺ From the viewpoint of ***operating time***, although the new DCT system has more elements, however, the actuation duration of controllable units for the new DCT system is shorter

MA1-P(27) 11:00-12:00

Design and implementation of complex systems using Mechatronics and Cyber-Physical Systems approaches

Luis Escobar, Nicolás Carvajal, Jonathan Naranjo, César Villacís, Margarita Zambrano and Fernando Galárraga
Mechatronics Lab., Universidad de las Fuerzas Armadas ESPE
Quito, Ecuador

- The standard methodology VDI 2206 is very powerful and can be used to design complex systems using a mechatronics approach.
- Cyber-Physical Systems are a natural evolution of the mechatronic systems.
- Many tools developed for mechatronics can shape the future



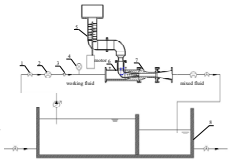
CPS as a synergy of SW and HW

MA1-P(28) 11:00-12:00

The analysis and research of new fracturing fluid dynamic mixer

Long Feng, Zengliang Li, Zhaocheng Sun, Qi Zhang, Chunyong Fan
Department of mechanical and electrical engineering
China University of Petroleum(East China)
Qingdao, China

- The main advantages of new fracturing fluid dynamic mixer are large powder intake, uniform mixing and high inhalation efficiency.
- The new mixer can solve the problems of insufficient amount of rubber guanidine powder inhalation and a lot of powder package.
- The principle of annular jet and the discrete action of powder are applied in the design process.



fracturing fluid dynamic mixer testing system

MA1-P(29) 11:00-12:00

Measurement of Ice Thickness based on Binocular Vision Camera

Yi Ma1, Hong Yu2, Jinyu Liu3, and Yongsai Zhai4
Electrical Research Institute of Yunnan Electric Power Research Institute (Group) Co., Ltd.Kunming, China

- Results of binocular vision measurement for ice thickness.
- The difference of the ice thickness on the different iced conductor position.
- The thickness value of the middle of the tower conductor is smaller, due to the UAV wing rotation caused by snow falling.

Serial number	Field measurement of ice thickness (mm)	Binocular measurement of ice thickness (mm)	Error rate
1	84	89	6.0%
2	84	87.6	4.3%
3	84	78	7.1%
4	84	98.9	17.7%
5	95	104.4	9.9%
6	95	108.6	14.3%

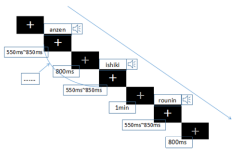
Results of binocular vision measurement

MA1-P(30) 11:00-12:00

Influencing Factors of Phonological Cognition in Chinese and Japanese

Qianqian Chen, Yangying Fan, Kun Wang, Sa Lu, Jinglong Wu
Department of Foreign Language,Ningbo University of Technology
Ningbo, China

- This study is to explore the speech processing of second language.
- With the number of bilinguals increasing, the great importance is given to Second Language Learning. For the Second Language Learners without authentic language environment, speech is the difficult point. This thesis is to explore the factors that affect speech recognition and how it affects second language speech learning in turn. The experiment result verifies that language environment interferes speech recognition.



Experimental method

MA1-P: Poster Session (Intelligent Mechatronics and Automation)

Session Chairs: Hideyuki Hirata, Kagawa University
Yu Song, Kagawa University

Kagawa International Conference Hall, 11:00-12:00, Monday, 7 August 2017

MA1-P(31) 11:00-12:00

Modeling of Natural Interaction and Algorithm of Intelligent Humanoid Robot for Education

Widodo Budiharto, Anggita Dian Cahyani and Pingkan C.B. Rumondor
School of Computer Science, Bina Nusantara University Jl. KH Syahdan no. 9, Jakarta-Indonesia

- This research on Intelligent humanoid robot for education focuses on model natural interaction in order to be able to interact with students naturally.
- Behavior-based humanoid robot.
- This kind of robot can teach basic mathematics and give entertainment such as storytelling and singing.

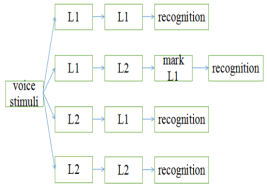
Intelligent humanoid robot

MA1-P(32) 11:00-12:00

Research on Phonological Processing in Cross-language Switching

Sa Lu, Kun Wang,Yanfying Fan , Xiaoyu Tang, Jinglong Wu
Department of Foreign Language,Ningbo University of Technology
Ningbo, China

- This thesis is to explore the speech recognition difference between Chinese and Japanese characters. In this behavioural experiment, twenty Chinese and twenty Japanese nation speakers are selected to identify vowels and three affecting factors (word frequency, cross language or not, target vocabulary) are designed of which each has two variables. After data analysis and discussion, two conclusions are drawn: 1. L1 and L2 are not only mutually independent but also mutually affect in speech representation and the impact that L1 has on unskilful L2 is greater than that unskilful L2 has on L1; 2. high-frequency words contributes to phonetic recognition..

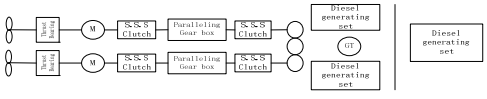


Context and Speech Recognition

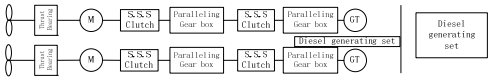
MA1-P(33) 11:00-12:00

Research on the control method of ship powered by gas turbine and motor

Chen Hongli Li Qiang
College of Automation, Harbin Engineering University
Harbin, Heilongjiang, China



Schematic diagram of single –turbine hybrid system



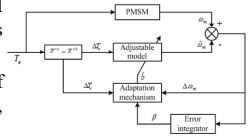
Schematic diagram of two gas turbine hybrid power

MA1-P(34) 11:00-12:00

Inertia Identification Based on Model Reference Adaptive System with Variable Gain for AC Servo Systems

Zhe Song, Xuesong Mei, and Gedong Jiang
Shaanxi Key Lab. of Intelligent Robots, Xi'an Jiaotong University
Xi'an, China

- The MRAS is used as the control object, and the adaptive gain β is adjusted by an error integrator.
- The integrator takes deviation of angular velocity as control error, adjusting the adaptive gain β on-line.
- Finally, the output of the adjustable model tracks that of the actual system.



MRAS with Variable Gain

MA1-P(35) 11:00-12:00

A quick Otsu-Kmeans algorithm for the internal pipeline detection

Tao Song,Ji Li,Xue Han,Lei,Shao
Tianjin University of Technology,391, Binshui Xidao, Xiqing District, Tianjin, 300384, China

- Introduction
- Image segmentation algorithms
- The method of this paper
- Experimental results
- Conclusion

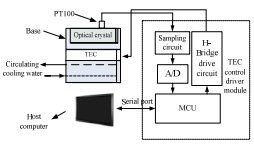
The pipeline robot

MA1-P(36) 11:00-12:00

High power laser constant temperature control system

Jiaqiang Li # , Xiaoming Xu , Jinyu Zhang ,Xuemei Wang , Jian Cao
Research Institue of Physical and Chemical Engineering of Nuclear Industry
#Jingtang Gonglu 168,Tianjin 300180,China

- To solve the waste heat problem in optical crystals of semiconductor lasers, this paper designs and implements a high-precision automatic thermostat control system based on Thermo-Electric Cooler (TEC).
- This system realizes an embedded interactive program based on winCE system , adopt PT100 as a temperature sensor, use H bridge to driven the TEC module and apply classical PID algorithm to control and adjust temperature automatically.After mechanical packaging, this system is finally completed. The experimental results showed that the temperature of this system can be maintained stably at the setting level for a long time after about 2 minutes adjustment. And its temperature fluctuation is less than 0.01 degrees Celsius with great stability.



System structure diagram

MA1-P: Poster Session (Intelligent Mechatronics and Automation)

Session Chairs: Hideyuki Hirata, Kagawa University
Yu Song, Kagawa University

Kagawa International Conference Hall, 11:00-12:00, Monday, 7 August 2017

MA1-P(37) 11:00-12:00

Model Based Control of 3 DOF Parallel Delta Robot using Inverse Dynamic Model

Meryam Rachedi
LRPE Lab., University of Science and Technology (USTHB), Algiers, Algeria

- Design of an H∞ controller to the Parallel Delta robot.
- Linearization of the inverse dynamic model (IDM) of the system around a functional point.
- Implementation of the controller with the association of the IDM.
- Experimental results compared to those of the classical PID.

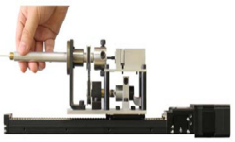
The 3 DOF Parallel Delta Robot

MA1-P(38) 11:00-12:00

A Stable Control Method for Minimally Invasive Surgery System

Xu Ma, Jinpeng Zhouand Miao Liu, Xu Zhang , Jinchu Ma and Zuxin Pan
Tianjin Key Laboratory for Control Theory& Applications in Complicated System, The School of Electrical and Electronics Engineering, Tianjin University of Technology

- Manual operation of steerable catheter is inaccurate in minimally invasive surgery, requires dexterity for efficient manipulation of the catheter, and exposes the surgeons to intense radiation.



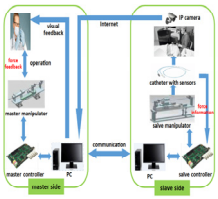
Surgeon console

MA1-P(39) 11:00-12:00

Design a New Control Method for Vascular Interventional Surgery

Xu Ma and Ming Li, Xu Zhang and Xin Mao
Tianjin Key Laboratory for Control Theory& Applications in Complicated System, The School of Electrical and Electronics Engineering, Tianjin University of Technology

- Vascular Interventional surgery (VIS) is the main method for diagnosis and treatment of endovascular diseases. However, the surgeon operates the surgery with hands in conventional VIS, which need the surgeons exposed to X-ray radiation with long time.



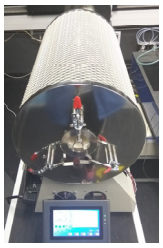
The System map as a whole concept

MA1-P(40) 11:00-12:00

Temperature Control Based on a Single Neuron PID Algorithm for a Blackbody Radiation Source

Zhigang Wang, Xiuli Li, and Xiaofeng Lu
Tianjin University of Technology
Tianjin, China

- Discussing the background and necessity to control the temperature of the blackbody.
- Introducing tow algorithms and comparing the advantages and disadvantages of them.
- Using the software to simulate the performance of presented algorithms.
- Summarizing the possibility for the presented algorithms in practice.



The Blackbody

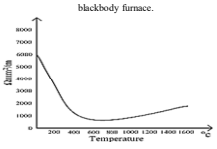
MA1-P(41) 11:00-12:00

A New Algorithm in Blackbody Temperature Control System Based on ADRC

Yan Wang, Jing Zhang, Wei Dong
Key Research Laboratory for Control Theory & Applications in Complicated Systems
Tianjin University of Technology
Tianjin, China

- Discussing the background and calculating the mathematical model of blackbody furnace.
- Introducing the principle of ANN algorithm and ADRC method.
- Presenting a control method which combines the neural networks with ADRC and proposes a new kind of controller.
- Verifying the feasibility and effectiveness of the proposed method and the new controller by MATLAB/SIMULINK platform.

blackbody furnace.



Electrical characteristic of carbon silicon rod

MA1-P(42) 11:00-12:00

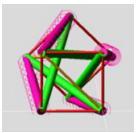
Research on Driving Method of Four-Bar Tensegrity Mechanism

Heping Liu, Hongxi Chen and Ani Luo
College of Mechanical and Electrical Engineering
Harbin Engineering University

•Use mathematical modeling and solid model to test the feasibility of several main driving methods.

•Carry out ADAMS simulation of the feasible scheme.

•The results of experiment show that when the oblique cable is a string, the position of the center of mass can be changed.



Four-Bar Tensegrity Mechanism

MA1-P: Poster Session (Intelligent Mechatronics and Automation)

Session Chairs: Hideyuki Hirata, Kagawa University
Yu Song, Kagawa University

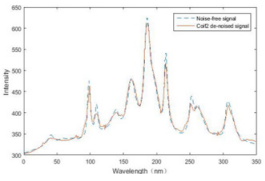
Kagawa International Conference Hall, 11:00-12:00, Monday, 7 August 2017

MA1-P(43) 11:00-12:00

Design of the Comprehensive Index for the Signal Processing Quality Evaluation and Its Application in the Spectral Signal Denoising

Liyun Zhao, Jie Sun and Bingsheng Liu
School of the Electrical and Electronic Engineering
Tianjin University of Technology
Tianjin, China

- Introduction of the signal denoising methods and the wavelet denoising theory
- Introduction of denoising evaluation index
- Theoretical foundation of the comprehensive evaluation index
- Experimental analyses
- Conclusion



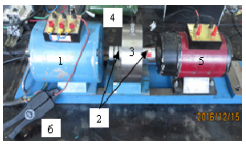
The denoising effect of Coif2 for spectral data

MA1-P(44) 11:00-12:00

Simulation and Analogy Experiment Research Response of Motor Current for Local Fault in Rollin Bearing

Xianjiang Shi, Wantao Li, Zhenmeng Wang and Hua Guo
School of Mechanical and Power Engineering, Harbin University of Science and Technology
Harbin, China

- The response mechanism for motor stator current signal to mechanical vibration fault signal.
- Obtain the actual motor stator current signal and the vibration acceleration signal of rolling bearing.
- The motor stator current signal can effectively sense the local fault of rolling bearing.



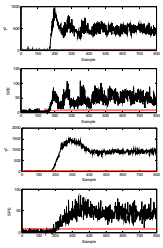
The fault simulation test bench photo of the rolling bearing

MA1-P(45) 11:00-12:00

Research and Application of the Distillation Column Process Fault Prediction based on the Improved KPCA

Qiang Gao, Wenjie Liu, Xuewen Zhao, and Junfang Li
Tianjin Key Laboratory for Control Theory & Application in Complicated Systems ,
Tianjin University of Technology, Tianjin, China

- A new improved kernel principal component analysis method is presented which uses the concept of indiscernibility and eigenvector applied to distillation column process fault prediction.
- Compared with traditional statistical techniques.
- Compared with the traditional KPCA, the improved KPCA is more effective.



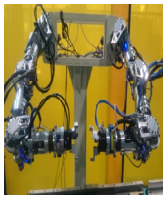
improved KPCA fault prediction results for process fault

MA1-P(46) 11:00-12:00

Research of Peg - in - Hole Assembly for A Redundant Dual-Arm Robot Based on Neural Networks2017

Qiang Gao, Jianghai Zhao and Meiling Wang
Motion Control Lab., University of Science and Technology of China
Hefei, China

- Introduces the design of the dual-arm robot architecture.
- Proposed the force feedback loop control based on neural networks to realize the on-line error correction during the assembly process.
- The controller will transform the force error into the position error in the end of the robot arm and output a revised position value.
- Verified the control strategy have higher precision and flexibility than traditional methods through assembly experiment.



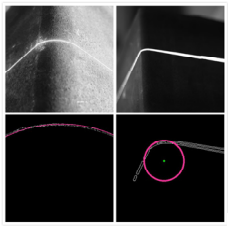
The Dual-Arm Robot

MA1-P(47) 11:00-12:00

Circle Detection of Short Arc Based on RandomizedHough Transform

Dahua Li, Fang Nan, Tao Xue, and Xiao Yu
Tianjin Key Laboratory for Control Theory & Applicationsin Complicated System.,
Tianjin University of Technology, Tianjin, China

- This paper proposes a circle detection method based on RHT combined with the circle features and gradient algorithm.
- This method can accurately detect the edge image, locate the arc position and detect the circle.
- Compared with the existing common detection algorithms, this method can achieve higher recognition effect.



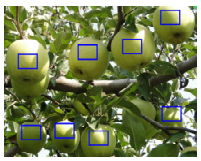
The Results of circle detection

MA1-P(48) 11:00-12:00

Green Apple Recognition Method Based on the Combination of Texture and Shape Features

Dahua Li, Mingming Shen, Dong Li, and Xiao Yu
Tianjin Key Laboratory for Control Theory & Applications in Complicated Systems
Tianjin University of Technology
Tianjin, China

- The method combines texture features, shape features and color features to recognize apples in complex background.
- Experimental results show that this method can achieve the high accuracy and speed.
- It has better segmentation effect for fruit with slight background occlusion.



recognized Image

MA1-P: Poster Session (Intelligent Mechatronics and Automation)

Session Chairs: Hideyuki Hirata, Kagawa University
Yu Song, Kagawa University

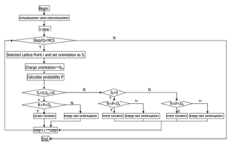
Kagawa International Conference Hall, 11:00-12:00, Monday, 7 August 2017

MA1-P(49) 11:00-12:00

Simulation of Microstructure Evolution and Prediction of Mechanical Properties of Material of Alumina Ceramic Cutting Tools

Gu Tingting, Du Hao, and Zhao Baiqiang
Department of Mechanical Engineering, Hebei University of Technology
Tianjin, China

The model is verified by the grain growth of porous Al_2O_3 ceramics in the sintering process. The results show that when the grain growth index was 2.95, the grain growth tendency in the simulation were in good agreement with that in the experiment. The modified Monte Carlo reflects the physical process of grain growth more reliably.



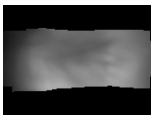
Simulation Flowchart

MA1-P(50) 11:00-12:00

Research on The Finger Vein Image Capture and Finger Edge Extraction

Qingchang Guo , Bing qiao
Yichang Testing Technology Research Institute
Ychang, Hubei Province, China

- According to the principle of the finger vein capture and application requirements, the finger vein image capture device and algorithm are designed.
- The finger region extraction algorithm is proposed according to the characteristics of the finger image edge, which can accurately extract the finger region from the background.
- Through different finger testing, the device can capture more clear finger vein image and get more accurate finger vein area



The Fingervein Area

MA1-P(51) 11:00-12:00

Review on Fault diagnosis in active distribution networks with distributed generation

Xuesong Zhou, Yu Sun, Youjie Ma and Zhiqiang Gao
Key Research Laboratory for Control Theory&Applications in Complicated Systems
Tianjin University of Technology
Tianjin, China

- discussing the background and necessity to develop the DG system.
- introducing four maximum power point tracking algorithms
- summarizing eight island detection methods and key technologies of inverter and their basic principle is analyzed.

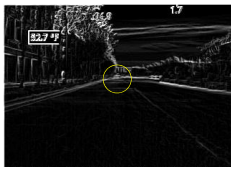
The Smart Grid

MA1-P(52) 11:00-12:00

Scaled Multi Gradient Edge Detection Algorithm for Infrared Image Detection

Qiang Gao, XinXin Lv and Xiao Yu
Tianjin Key Laboratory for Control Theory & Applications in Complicated Systems.,
Tianjin University of Technology, Tianjin, China

- The paper applies a scaled multi gradient edge detection algorithm to infrared criminal investigation images to extract the edge of the targets.
- It is applied in the infrared criminal investigation images to combat crime.
- The algorithm can achieve the decrease in the edge deletion for the edges whose gray scale changes are not fierce, and a great advance in the continuity and smoothness of edges.



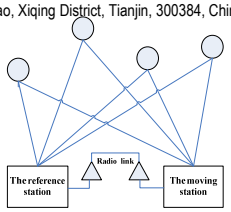
The Results of the Edge Detecion

MA1-P(53) 11:00-12:00

Study on Wave Measurement Based on RTK Technology and Analysis and Spectral Estimation

Xiaokang Hou,Yusen Li
Tianjin University of Technology,391, Binshui Xidao, Xiqing District, Tianjin, 300384, China

- INTRODUCTION.
- THE MEASUREMENT PRINCIPLE
- THE SYSTEM DESIGN
- EXPERIMENTAL RESULTS
- CONCLUSION



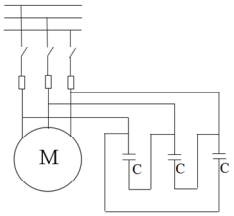
The Schematic Diagram of RTK

MA1-P(54) 11:00-12:00

Reactive Power Compensation in Motor

Xuesong Zhou, Shaowei Zhang, Youjie Ma, and Zhiqiang Gao
School of Electrical and Electronic Engineering, Tianjin University of Technology
Tianjin, China

- The brief introduction about status of motor energy saving in China .
- Analysis and advantage of motor energy saving by using reactive power compensation technology.
- Introduction about the defination of reactive power and power fator in different circuits.
- Three different compensation method of motor energy saving and brief introdution about optimal voltage tracking.



Mode of Connection

MA1-P: Poster Session (Intelligent Mechatronics and Automation)

Session Chairs: Hideyuki Hirata, Kagawa University
Yu Song, Kagawa University

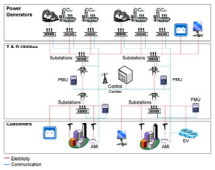
Kagawa International Conference Hall, 11:00-12:00, Monday, 7 August 2017

MA1-P(55) 11:00-12:00

Summary of Smart Metering and Smart Grid Communication

Xuesong Zhou, Hui Wang, Youjie Ma, Zhiqiang Gao
Key Research Laboratory for Control Theory & Applications in Complicated Systems
Tianjin University of Technology
Tianjin, China

- Discussing the background and necessity to develop the Smart Grid.
- Introducing The smart infrastructure system which includes smart energy system besides smart information systems.
- Summarizing the communication technologies used in smart grid



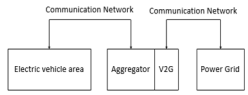
Power generation, control, and measurement diagram

MA1-P(56) 11:00-12:00

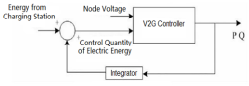
A Controller of V2G Based on Fuzzy Logic

Youjie Ma, Chang Liu, Xuesong Zhou and Zhiqiang Gao
Department of Electrical engineering
Tianjin University of Technology
Tianjin, China

- Introducing the electric vehicle battery state and current power grid operation conditions.
- Discussing the necessary to properly coordinate electric vehicle charging and discharging time.
- Presenting a control method and designing a controller of V2G based on Fuzzy Logic.
- Establishing a system and analyzing two states of V2G in this system.



The aggregator in V2G system.



V2G controller

MA1-P(57) 11:00-12:00

Summary of the novel MPPT (maximum power point tracking) algorithm based on few intelligent algorithms specialized on tracking the GMPP (global maximum power point) for photovoltaic systems under partially shaded conditions

Youjie Ma, Xuesong Zhou and Zhiqiang Gao, Tianqi Bai
Tianjin University of Technology 391, Binshui Xidao, Xiqing District, Tianjin, 300384, China 752504626@qq.com

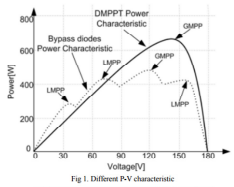


Fig 1. Different P-V characteristic

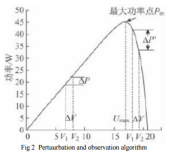


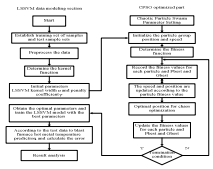
Fig 2 Perturbation and observation algorithm

MA1-P(58) 11:00-12:00

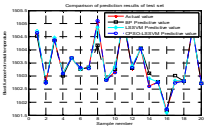
Study on Prediction Model of Blast Furnace Hot Metal Temperature

Hui Zhao,Detao Zhao,Youjun Yue,and Hongjun Wang
Tianjin Key laboratory for Control Theory and Applications in Complicated System,
Tianjin University of Technology Tianjin, China

- Firstly, using the Grey Relational Analysis method select input variables.
- Secondly,selecting the appropriate sample data of hot metal's temperature in the blast furnace for data processing
- Thirdly, using the improved Chaos Particle Swarm Optimization algorithm optimizes the parameters of g and c of the least squares support vector machine.
- Finally, using the optimized least squares support vector machine model predicts the blast furnace hot metal's temperature
- The experimental results show that CPSO-LSSVM model has faster and more accurately than BP and LSSVM model.



parameters of the CPSO-LSSVM optimization



Comparison of the prediction methods

MA1-P(59) 11:00-12:00

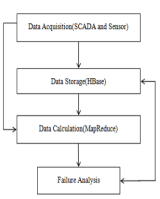
Research on Data Processing for Condition Monitoring of Wind Turbine Based on Hadoop Platform

Hongjun Wang*1,Shaowei Zhao*1,Hui Zhao*1*2 ,Youjun Yue*1
*1Tianjin Key laboratory for Control Theory and Applications in Complicated System, Tianjin University of Technology,Tianjin, China;*2Tianjin Agricultural University,Tianjin, China

- The basic wind turbine fault monitoring model is proposed.As shown on the right.
- This paper mainly introduces two odules of data storage and data calculation.The MapReduce process of fuzzy C mean algorithm is emphasized
- Data storage and data calculations are tested.

A.With the increase of data, HBase has higher storage efficiency.

B. With the increase in the number of nodes, MapReduce is faster than stand-alone computing.



The condition monitoring model

MA1-P(60) 11:00-12:00

Summary on Development of Wind Generators

Xuesong Zhou, Cheng Ma, Zhiqiang Gao , Youjie Ma
Mechatronics Research Lab., Tianjin University of Technology
Tianjin, China

1.Development status on wind power generation

2. Problems of cutting-edge technology

3.THE DEVELOPMENT TREND

Offshore wind turbines

MA1-P: Poster Session (Intelligent Mechatronics and Automation)

Session Chairs: Hideyuki Hirata, Kagawa University
Yu Song, Kagawa University

Kagawa International Conference Hall, 11:00-12:00, Monday, 7 August 2017

MA1-P(61) 11:00-12:00

Research of Night Vision Image Denoising Method Based on the Improved FastICA

Hongjun Wang, Weiyang Duan, Hui Zhao, Youjun Yue
Tianjin Key laboratory for Control Theory and Applications in Complicated System
&Tianjin University of Technology,Tianjin, China

- Introduction
- Noise Analysis
- Research on Denoising Algorithm
- Simulation and Analysis
- Conclusions

MA1-P(62) 11:00-12:00

MPPT Control Method of PV System Based on Active Disturbance Rejection Control

Hongjun Wang*1,Xin Jin*1,Hui Zhao*1*2 ,Youjun Yue*1
*1Tianjin Key laboratory for Control Theory and Applications in Complicated System, Tianjin University of Technology,Tianjin, China;*2Tianjin Agricultural University,Tianjin, China

- Using $\frac{\Delta I}{\Delta V}$ replace $\frac{dI}{dV}$ in the conventional incremental conductance method, this will inevitably loses a certain degree of accuracy.
- Two tracking-differentiators are used to get the differential signal, $\frac{dI}{dV}$.And LADRC is used to stabilize the system.
- Validated by Matlab simulation, comparing with conventional incremental conductance method, the results of the improved algorithm are superior and feasible.

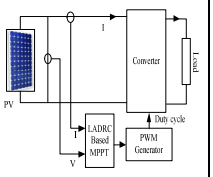


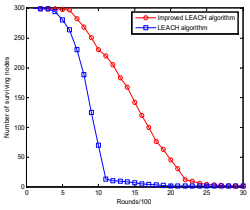
Diagram of proposd algorithm

MA1-P(63) 11:00-12:00

Research on LEACH Algorithm Based on Double Cluster Head Cluster Clustering and Data Fusion

Hongjun Wang, Huiqing Chang, Hui Zhao, and Youjun Yue
Tianjin Key laboratory for Control Theory and Applications in Complicated System, Tianjin University of Technology, Tianjin, China

- The k-Medoids clustering algorithm is used to divide the nodes of the whole network area into several classes.
- Selecting two levels of cluster heads in a well-divided cluster.
- Two cluster heads are used for data fusion and transfer.
- The algorithm can effectively prolong the life cycle of the network and has a good energy saving effect.



Two pairs of algorithms for each remaining node

MA1-P(64) 11:00-12:00

Harmonic Analysis and Suppression of Electric Vehicle Charging Station

Gang Zhao[1], Yunfei Yue[2]
Tianjin University of Technology391, Binshui Xidao, Xiqing District, Tianjin, 300384, China

- INTRODUCTION.
- HARMONIC MODEL OF ELECTRIC VEHICLE CHARGING STATION
- THE ESTABLISHMENT OF CHARGER MODEL
- THE HARMONIC TREATMENT METHOD OF CHARGER
- CONCLUSION

Electric Vehicle Charging Station

MP1-1: Invited Workshop on MEMS-based Intelligent Devices

Session Chair: Hidekuni Takao, Kagawa University, Japan

Conference Room 61 on 6th floor, 13:30-15:00, Monday, 7 August 2017

Time	Topics	Speaker List
13:30-14:00	MEMS Vibrational Energy Harvesters Using High Density Solid-Ion Electret	Prof. Hiroshi Toshiyoshi The University of Tokyo, Japan
14:00-14:30	3D Fabrication of Microneedle for Blood Collection Biomimicking Mosquito	Prof. Seiji Aoyagi Kansai University, Japan
14:30-15:00	MEMS-based Tactile Display	Prof. Norihisa Miki Keio University, Japan

MP1-2: Medical Robots for Minimal Invasive Surgery (I)

Session Chairs: Toshio Fukuda, Beijing Institute of Technology
Nan Xiao, Beijing Institute of Technology

Conference Room 62 on 6th floor, 13:30-15:00, Monday, 7 August 2017

MP1-2(1) 13:30-13:45

Design and Implementation of an Omnidirectional Mobile Robot Platform with Unified I/O Interfaces

Jingyang Wu, Chaoshun Lv, Lijun Zhao, Ruifeng Li, and Guanglin Wang
School of Mechatronics Engineering, Harbin Institute of Technology
Harbin, China

- We developed an Omnidirectional mobile robot with sufficient unified I/O interfaces, named Savvy.
- Savvy performed well in a variety of functions, such as SLAM, autonomous navigation and pedestrian following.
- Based on ROS, Savvy robots could be extended as multi-robot systems.

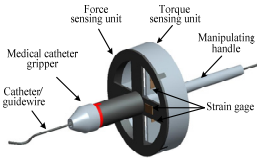
The Savvy Robot

MP1-2(2) 13:45-14:00

A Novel Sensing System of Catheter Guidewire Operation for Vascular Interventional Surgery

Yan Zhao[1], Shuxiang Guo[1,2*], Nan Xiao[1*], Yuxin Wang[1], Chaonan Zhang[1], Xianqiang Bao[1], Jiaqing Wu[1]
[1] Key Laboratory of Convergence Biomedical Engineering System and Healthcare Technology, The Ministry of Industry and Information Technology, Beijing Institute of Technology,Beijing, China
[2] Faculty of Engineering, Kagawa University, Kagawa, Japan

- A novel sensing system is proposed to detect catheter operation force and torque during VIS surgery based on strain gage principle and elegant structure design of elastic component
- The average error of torque and force detecting are 0.455 mN·m and 0.0278N. The average relation error of torque and force detection are 2.13% and 0.327% respectively



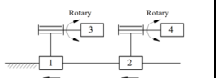
The Sensing System

MP1-2(3) 14:00-14:15

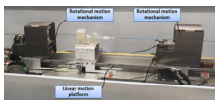
Toward Cooperation of Catheter and Guidewire for Remote-controlled Vascular Interventional Robot

Xianqiang Bao[1], Shuxiang Guo[1,2*], Nan Xiao[1*], Yan Zhao[1], Chaonan Zhang[1], Cheng Yang[1], Rui Shen[1]
1. Key Laboratory of Convergence Medical Engineering System and Healthcare Technology, the Ministry of Industry and Information Technology, School of Life Science, Beijing Institute of Technology, No.5, Zhongguancun South Street, Haidian District, Beijing, China.
2. Faculty of Engineering, Kagawa University, 2217-20 Hayashi-cho, Takamatsu, Kagawa, Japan.

- Remote-controlled vascular interventional surgery robots (RVIR) are being developed to reduce the occupational risk of the intervening physician, such as radiation, chronic neck and back pain, and increase accuracy and stability of surgery operation.
- Lacking of cooperation of catheter and guidewire is a great challenge for complete or complex surgery. A cooperation of catheter and guidewire concept is firstly introduced in RVIR in this paper.
- The prototype operating catheter and guidewire respectively and accurately, is feasible for minimally invasive surgery.



Cooperation principle of catheter and guidewire.



Prototype of the RVIR.

MP1-2(4) 14:15-14:30

SVM Based Simultaneous Hand Movements Classification Using sEMG Signals

Feifei Bian, Ruifeng Li* and Peidong Liang
State Key Laboratory of Robotics and Systems., Harbin Institute of Technology
Harbin, Heilongjiang, China

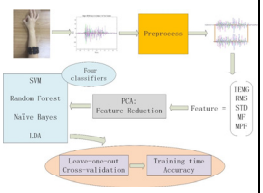
Prediction of motion volitions using surface electromyographic (sEMG) signals.

Propose a sEMG signal processing tube composed of feature extraction, feature reduction and movements classification for myoelectric pattern recognition.

SVM outperforms the other classifiers on both model training time and classification accuracy.

The user-depend classification accuracy reaches as high as 92.25% while the accuracy of user-independent is about 80%.

This work is for a rehabilitation robot being research in us laboratory.



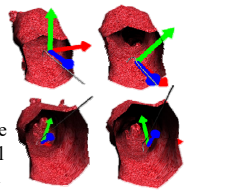
The flow block diagram for sEMG processing.

MP1-2(5) 14:30-14:45

Tensor-Mass Model Based Real-time Simulation of Vessel Deformation and Force Feedback for the Interventional Surgery Training System

Shuxiang Guo1,2, Xiaojuan Cai1, Baofeng Gao1, *, Qiuxia Yang1, Yan Zhao1, Nan Xiao1
1 Key Laboratory of Convergence Biomedical Engineering System and Healthcare Technology, School of Life Science, Beijing Institute of Technology,
No.5, Zhongguancun South Street, Haidian District, Beijing 100081, China
2 Faculty of Engineering, Kagawa University, 2217-20 Hayashi-cho, Takamatsu, Kagawa 760-8521, Japan

- Proposed an improved non-linear elastic tensor-mass modelling method, which realizes fast computation of non-linear mechanical deformations.
- Introduced a haptic force feedback device for interactions between the vessel model and the virtual medical instrument which improves the realism of the simulation.



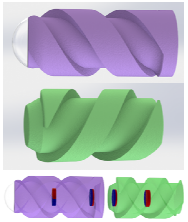
Vessel deformation simulation

MP1-2(6) 14:45-15:00

Development of a Novel Wireless Spiral Capsule Robot with Modular Structure

Jian Guo[1], Pengyu Liu[1], Shuxiang Guo[1,2*], Lili Wang[3] and Gang Sun[4]
1 Tianjin Key Laboratory for Control Theory & Application in Complicated Systems and Biomedical Robot Laboratory, Tianjin University of Technology, Binshui Xidao 391,Tianjin, China
2 Intelligent Mechanical Systems Engineering Department, Kagawa University, Takamatsu, Kagawa, Japan
3 Internal Medicine-Oncology, Tianjin Hospital of ITCWM Naikai Hospital,Three latitude Road 122, Tianjin, China
4 Gastrointestinal Surgery, Tianjin Hospital of ITCWM Naikai Hospital,Three latitude Road 122, Tianjin, China

- This paper proposed the wireless spiral capsule robot with active locomotion and a new mechanism for docking two robots by the modular docking interface.
- This robot system has two robots, namely the guide robot and auxiliary robot.
- The robots are driven by the rotating magnetic field using a three-axis Helmholtz coils system.
- The paper proposed a mechanism to make the auxiliary dock with the guide robot by the modular interface with the magnets, and the modular structure is generic with multiple auxiliary robots.



The Capsule Robot with Modular Structure

MP1-3: Biomimetic Measurment and Control in Robotics

Session Chairs: Keigo Watanabe, Okayama University
Yanlin He, Beijing Institute of Technology

Conference Room 63 on 6th floor, 13:30-15:00, Monday, 7 August 2017

MP1-3(1) 13:30-13:45

Development and Control of Tilt-wings for a Tilt-type Quadrotor

Ryuta Takeuchi, Keigo Watanabe and Isaku Nagai
Graduate School of Natural Science and Technology, Okayama University

- UAVs which have ability for VTOL, wide flying-range and high cruising-speed, are attracts attention.
- Designing and manufacturing a tilt-wing for tilt rotor type UAVs.
- Conducting the experiments to check the influence of the VTOL performance by the tilt-wings
- There is almost none influence of the VTOL performance if the tilt-wings are mounted.

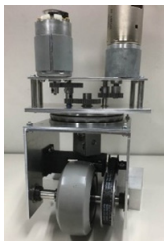
The Tilt-wings Mounted Quadrotor

MP1-3(2) 13:45-14:00

Design and Development of Steered Active Wheel Casters and Its Application

Yutaro Ueno, Keigo Watanabe, and Isaku Nagai
Graduate School of Natural Science and Technology, Okayama University
Okayama, Japan

- Steered active wheel caster can be used for an omnidirectional mechanism and use general rubber tires.
- The objective of this study is to develop an omnidirectional mobile platform that uses several steered active wheel casters.
- Rocker-bogie system is used for the platform.
- Verify the movement of a steered active wheel caster.



The Steered Active Wheel Caster

MP1-3(3) 14:00-14:15

Development of iOS Application Handlers for Quadrotor UAV Remote Control and Monitoring

Zeming Lu [1], Fusaomi Nagata [1] and Keigo Watanabe [2]
[1]Tokyo University of Science, Yamaguchi
[2]Okayama University

- Basic handlers for obtaining compass information, controlling a gimbal, automatic return function, photo and video preview, photo shoot and movie video recording are developed and implemented.
- The functionalities of the developed programs are evaluated and confirmed through experiments using a quadrotor and an iOS device.

Overview of the quadrotor

MP1-3(4) 14:15-14:30

Post Processor for Industrial Robots

– Circular Arc Interpolation of CLS Data to Generate FANUC Robotic Program –

Fusaomi Nagata [1], Yudai Okada [1], Akimasa Otsuka [1]
Takeshi Ikeda [1],Takamasa Kusano [2], Keigo Watanabe [3]
[1]Tokyo University of Science, Yamaguchi, [2]SOLIC Co., Ltd., [3]Okayama University

- A post processor for an industrial robot FANUC R2000*i*C is designed to realize complete nonteaching operation.
- The post processor can generate rigorous and complex FANUC robotic programs from well-used CLS data.
- The post processor works as a straightforward and cooperative interface between CLS data and FANUC robotic program.

Machining scene using FANUC R2000*i*C

MP1-3(5) 14:30-14:45

Improvements of One-wheel Driven Personal Mobility for Use on a Public Road

Takanori Sakata, Isaku Nagai, and Keigo Watanabe
Graduate School of Natural Science and Technology, Okayama University
Okayama, Japan

- The Oteller is a low production cost personal mobility which is used freely on a Japanese public road.
- The purpose of this study is to solve two problems; i.e., uncontrollable speed in sunlight and sudden stop due to battery exhaustion.
- A circuit with AC coupling makes the speed control robust against sunlight.
- A function, which stops Oteller gently when the remaining battery is low, prevents the sudden stop.

The Personal Mobility "Oteller"

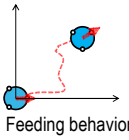
MP1-3(6) 14:45-15:00

Experiment of Imitating Ant Feeding Behavior using Kilobot

Akimasa Otsuka, Ryota Ueda and Fusaomi Nagata
Department of Mechanical Engineering, Tokyo University of Science, Yamaguchi, Yamaguchi, Japan

- Algorithm for swarm behavior is proposed by imitating ant feeding behavior.
- The proposed method is mainly consisting of two parts, which are behaviors of finding a bait and coming back home.
- The proposed algorithm is evaluated through experiments using the Kilobot.
- The experimental result shows that kilobot comes home closer if bait is far from home.

Kilobot



Feeding behavior

MP1-4: Biomimetic Underwater Robots

Session Chairs: Liwei Shi, Beijing Institute of Technology
Kaneko Makoto , Osaka University

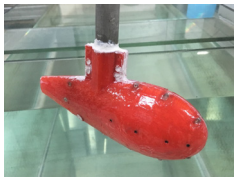
Conference Room 64 on 6th floor, 13:30-15:00, Monday, 7 August 2017

MP1-4(1) 13:30-13:45

A Fish-Shaped Minimal Prototype of Lateral Line System Based on Pressure Sensing

Mingjiang Ji, Yong Zhang, Xiande Zheng, Guanjun Liu and Jing Qiu
Science and Technology on Integrated Logistics Support Laboratory, National University of Defense Technology, Changsha, China

- Two pressure sensor arrays act as trunk lateral line.
- The effectiveness is validated by localizing a dipole source.
- Different kinds of methods are adopted to assess the sensing performance.
- Performing better in the direction along than perpendicular to the lateral line.



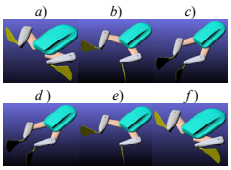
The Fish-Shaped Prototype

MP1-4(2) 13:45-14:00

Optimization of a Frog Inspired Robot Powered by Pneumatic Muscles

Fan Jizhuang, Kong Pengcheng, Yuan Bowen, Zhang Wei, Liu Yubin and Liu Gangfeng
State Key Laboratory of Robotics and System., Harbin Institute of Technology
Harbin, China

- Powered by pneumatic muscles in
- bioarticular method.
- Structure optimization of the frog inspired robot and trajectory planning of joint
- Swimming simulation based on the virtual components in Adams.
- Experiment using prototype



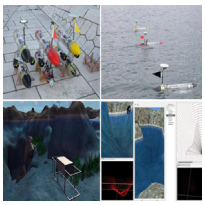
The Frog Inspired Robot

MP1-4(3) 14:00-14:15

Multi-AUV Cooperative Task Allocation Based on Improved Contract Network

LI Juan, ZHANG Kunyu and XIA Guoqing
College of Automation, Harbin Engineering University
Harbin, China

- Task allocation is a necessary part of the multi-AUV system.
- A multi-AUV target allocation strategy based on improved contract network is proposed.
- The introduction of token ring network and task load rate can effectively improve the overall efficiency.



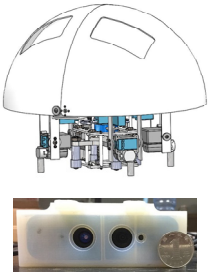
Multi-AUV

MP1-4(4) 14:15-14:30

RGB-D Camera-based Tracking System for an Amphibious Spherical Robot

Shaowu Pan, Shuxiang Guo, Liwei Shi
Key Laboratory of Convergence Medical Engineering System and Healthcare Technology, the Ministry of Industry and Infor-mation Technology, Beijing Institute of Technology, Beijing, China

- A RGB-D camera was adopted for the amphibious spherical robot to perceive the surroundings.
- A RGB-D tracker was constructed on the basis of the union feature and the adaptive updating mechanism.
- The depth image was segmented to realize the occlusion detection and the scale adjustment.

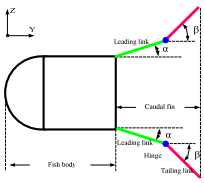


MP1-4(5) 14:30-14:45

Hydrodynamic performance study on a dual-caudal fin

Bo Liu, Zhongze Guo and Bin Liao
Institute of Systems Engineering, China Academy of Engineering Physics
Mianyang, China

- Fish model with hinge-connected flexible dual-caudal fin is studied by fluid-structure interaction.
- The hydrodynamic performances of two propulsive types, namely, jet propulsion and undulatory propulsion, which are realized by the control of the dual-caudal fin, are investigated.
- Three sets of fin flexiblity of the two propulsive types are also studied and compared.



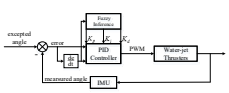
Fish model

MP1-4(6) 14:45-15:00

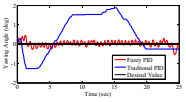
A Fuzzy PID Control Method for the Underwater Spherical Robot

Liwei Shi, Shuxiang Su, Shuxiang Guo, Kun Tang, Shaowu Pan, Yanlin He, Huiming Xing, Zhan Chen, Ping Guo
Key Laboratory of Convergence Medical Engineering System and Healthcare Technology, the Ministry of Industry and Information Technology, School of Life Science, Beijing Institute of Technology

- To improve the dynamic performance of underwater spherical robot, a fuzzy PID was designed and applied to this robot.
- To demonstrate fuzzy PID was more suitable for the underwater spherical robot, we carried out some comparative experiments.
- The experimental results demonstrated that the fuzzy PID for the underwater spherical robot has better dynamic performance and robustness.



Block diagram of fuzzy PID controller system



The relationship between the yawing angle and the time of the robot in the forward motion

MP1-5: Industrial, Manufacturing Process and Automation

Session Chairs: Kosuge Kazuhiro, Tohoku University
Xiao Yu, Tianjin University of Technology

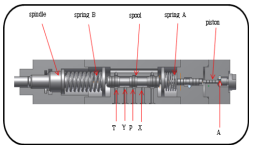
Conference Room 65 on 6th floor, 13:30-15:00, Monday, 7 August 2017

MP1-5(1) 13:30-13:45

Application of AMESim® & CFX®- based Technique to the Valve Behavior Characteristics of Regulator for Hydraulic Winch

San Seong Lee, Won Jee Chung, Sang seok Seol
Jun Rak Hong, Yoo Seong Jeong, Jung Min Lee, Kee Tae Noh
Robotics & System Lab., Changwon National University
Changwon, Korea

- Among the hydraulic equipments, the regulator used in the hydraulic winch, which is an item of the deck machinery, is one of the important parts that can improve the efficiency and the output in the hydraulic winch system.
- Our research defines a parameter design of the hydraulic regulator



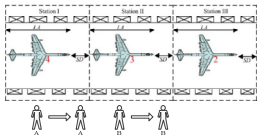
The main components of regulator

MP1-5(2) 13:45-14:00

Modeling and Optimization of Multi-skill Resource Investment Problem Considering Workload Balancing of Resources

Yifei REN, Zhiqiang LU
School of Mechanical Engineering, Tongji University
Shanghai, China

- Moving assembly line
- Extended the multi-skill resource investment problem with considering workload balancing of resource.
- An improved serial schedule generation scheme based on the resource usage adjustment module



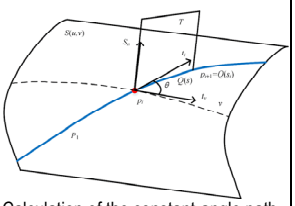
Moving assembly line

MP1-5(3) 14:00-14:15

A Novel Path Planning Algorithm in Robotic Fibre Placement for Complex Closed Surface Structures

Min Jiang, Baolin Wu and Liping Ma
Institute of Automation, Chinese Academy of Sciences, Beijing 100190, China
University of Chinese Academy of Sciences, Beijing 100049, China
TianJin Intelligent Tech. Institute of Casia, Tianjin 300300, China

- Path planning based on laying efficiency and laying quality evaluation
- Path angle modification by the retaining the longest normal path segment method
- Path angle modification by the reducing offset distance method



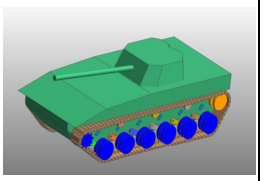
Calculation of the constant-angle path

MP1-5(4) 14:15-14:30

A Rigid Flexible Coupling Dynamics Simulation of One Type of Tracked Vehicle Based on the RecurDyn

Bingyan Chen, Xiaoce Sun, Kaifeng Zheng, Chunsheng Liu, Shenyi Wang and Xiaohang Shi
Department of General technology
China North Vehicle Research Institute
Beijing, China

- Established a rigid flexible coupling dynamics model of tracked armored vehicle.
- Analyzed the dynamic stress data of the torsion bar.
- Provides a new idea for the acquisition of complicated structure load and stress of armored vehicle.



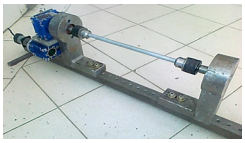
armored vehicle dynamic model

MP1-5(5) 14:30-14:45

Low cost solution of performing torsion testing of materials

Aqeela Mir[1], Ali Hassan[2]
[1]Department of Mechatronics Engineering, National University of Sciences and Technology, Islamabad, Pakistan

- An economical and easy to use automated torsion testing machine
- Practical demonstration of the stress-strain relation within elastic limit for different materials
- The machine can be used for the analysis and study of Biomechanical Engineering problems like shear failures of bone
- Source of expansion of the mechanical testing capabilities at University level



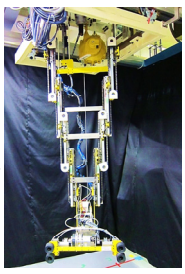
Automated Torsion Testing Machine

MP1-5(6) 14:45-15:00

B-PaDY: Robot Co-Worker in a Bumper Assembly Line: System Integration of the Prototype

Kazuya Konada, Jun Kinugawa, Shogo Arai, Kazuhiro Kosuge
Tohoku University, Sendai, Japan

- We have been developing a robot, which works in cooperation with workers in an automobile bumper assembly line, named B-PaDY.
- B-PaDY detects the bumper position and posture for grasping by using image processing.
- B-PaDY uses bumper vibration suppression trajectory and hand it over to the worker safely and correctly.



Prototype of B-PaDY

MP1-6: Manipulator Control and Manipulation (I)

Session Chairs: Pelletier Jean-Charles, The University of Electro-Communications
Zhilin Liu, Harbin Engineering University

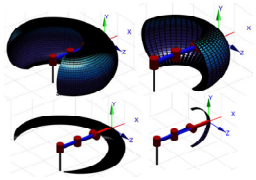
Conference Room 66 on 6th floor, 13:30-15:00, Monday, 7 August 2017

MP1-6(1) 13:30-13:45

Safe Robot Operation Alongside Humans using Spring-Assisted Modular and Reconfigurable Robot

Harshita Patel, Christopher Singh, and Guangjun Liu
Aerospace Systems and Control Laboratory, Ryerson University
Toronto, Canada

- Confine serial manipulator selectively to allow safe overlap of human and robot workspaces
- Uninterrupted robot operation in human presence
- Counterbalance gravity to increase dexterity and payload-handling ability while saving energy



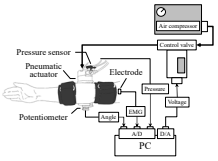
Workspace Restriction

MP1-6(2) 13:45-14:00

A Pneumatic Arm Power-Assist System Prototype With EMG-based Muscle Activity Detection

Takahiro Kosaki[1], Keita Atsuumi[1], Yuzo Takahashi[1], and Shigang Li[1]
[1] Graduate School of Information Sciences, Hiroshima City University
Hiroshima, Japan

- An approach for detecting muscle-burst onset based on EMG signals is proposed.
- A pneumatic arm power-assist system with the proposed detection approach as an EMG trigger is developed.
- Experimental results demonstrate that our system can reduce the wearer's muscle activity.



Pneumatic power-assist device

MP1-6(3) 14:00-14:15

Chemically Assisted Visualization for Fluidic Micro Manipulation

Pelletier Jean-Charles, Yuuka Irie, Chisato Kanamori, Hisayuki Aoyama, Nadine Piat
The University of Electro-Communication, Tokyo, Japan
Ecole Nationale Superieure de Mecanique et des Microtechniques, Besancon, France

- The objective is to catch and manipulate soft micro targets inside a fluid.
- Using a flow to spread a pressure around the surface of the target.
- Theoretical models are complex, we built a chemical tool to assist the confirmation of our hypothesizes.
- A first prototype can catch and maintain a small target (ø1.2mm) in position using 3 flows.

Flow-Target interaction made observable by chemical visualization

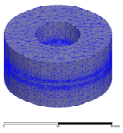
MP1-6(4) 14:15-14:30

Structure Design and Optimization of Thrust Magnetic Bearing for the High-speed Motor

Hao Lv, Haipeng Geng, Jian Zhou, Tingchen Du, Hao Li
State Key Laboratory for Strength and Vibration of Mechanical Structures
Xi'an Jiaotong University
Xi'an, Shaanxi Province, China

- Active thrust magnetic bearings are designed for the high-speed motor considering the limited internal space.
- Establish a new functional relationship between thrust and partial parameters by magnetic circuit method.

$$F = \frac{\mu_0 \lambda^2 I^2}{4 g_0^2} A_0 A_c^2$$



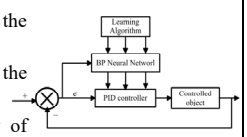
The mesh of TMB

MP1-6(5) 14:30-14:45

Burner-electrode Position Control of Calcium Carbide Furnace Based on BP-PID Controller

Yanjie Liu*, Hao Xu, and Yangguang zhang
State Key Laboratory of Robotics and System, Harbin Institute of Technology
Harbin, China

- Studying the characteristics of the arc of the burner-electrode
- Deducing the arc current under the maximum heating power theoretically
- Determing the position control strategy of the electrode
- Implementing the BP-PID controller by using the S-function in Matlab and simulated in Matlab/Simulink



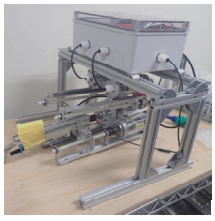
The basic structure of BP-PID controller

MP1-6(6) 14:45-15:00

Flexible lengthening-shortening arm mechanism for an underwater vehicle

Yoshiki Iwamochi, Motoki Takagi , and Tasuku Miyoshi
Department of Mechanical Engineering, Iwate University, Iwate, Japan

- The goal of this study was to monitor and record the condition of an obstructed seabed by underwater robots.
- It is difficult to investigate marine resources that live in deep water shaded by rock due to large and/or small rocks on the seabed.
- We demonstrate the newly developed flexible lengthening-shortening arm mechanism (FLSAM) and experimental results of a path-tracing controller.



The FLSAM

MP2-1: OS: Navigation Mechanism Analysis (I)

Session Chairs: Hashimoto Koichi, Tohoku University
Kimura Kotaro, Osaka University

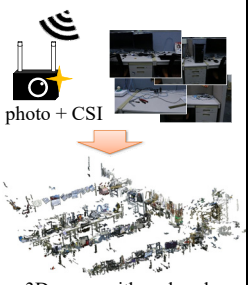
Conference Room 61 on 6th floor, 15:20-16:50, Monday, 7 August 2017

MP2-1(1) 15:20-15:35

Metric Structure from Motion by Indoor Localization using Wi-Fi Channel State Information

Kazuya Ohara, Taisei Hayashi, Takuya Maekawa and Yasuyuki Matsushita
Graduate School of Information Science and Technology, Osaka University, Osaka, Japan

- **SFM**: reconstruct a 3D scene in an environment from camera images
- **Issue**: scale ambiguity of the 3D scene reconstructed by SFM
- **Objective**: reconstruct the 3D scene with real scale based on camera coordinates estimated by a indoor localization technique using Wi-Fi CSI
- **Evaluation**: scale error rate between ground truth and our method was about 4.7%



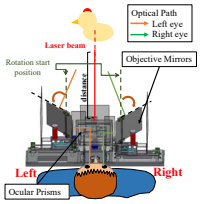
3D scene with real scale

MP2-1(2) 15:35-15:50

Development of a Tool that Increases / Reverses the User's Binocular Parallax with Optical Elements to Change the Feeling of Depth of a Physical Object

Tomotaka HORIUCHI, Yutaro YAMADA, and Shigeru WESUGI
Faculty of Science and Engineering, Waseda University, Tokyo, Japan

- Proposal of unique experience that the feeling of depth of a physical object is changed in real environment
- Method of influencing on a feeling of depth by changing binocular parallax arbitrarily
- Development of a tool that increases / reverses the user's binocular parallax through the movement of objective mirrors and ocular prisms
- Subjective experience that the feeling of depth changed by using this tool



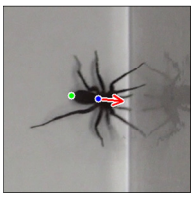
The tool that increases / reverses the user's binocular parallax

MP2-1(3) 15:50-16:05

Feature-based Orientation Estimation for Wandering Spiders from Top-view Image Sequences

Yasushi Iwatani[a], Kaori Tsurui[b], and Atsushi Honma[c]
[a]Hirosaki University, Japan, [b]University of the Ryukyus, Japan,
[c]Okinawa Prefectural Plant Protection Center, Japan/University of the Ryukyus, Japan

- The wolf spider is an important predator of some agricultural pests.
- This presentation proposes an image processing algorithm that estimates the orientation of a wolf spider in an observation box from top-view image sequences.
- The proposed estimation algorithm provides the best performance compared to existing algorithms.



Wolf spider and estimated orientation

MP2-1(4) 16:05-16:20

Modelling the Vertical Dynamics of Unmanned Ground Vehicle with Rocker Suspension

Si Chen, Xueyuan Li, Junjie Zhou, Wei Wu, Shihua Yuan and Shuxian Liu
Science and Technology on Vehicular Transmission Lab., Beijing Institute of Technology
Beijing, China

- A mathematical model is established to investigate the vertical dynamic characteristics of three-axle UGV with rocker suspension.
- This mathematical model is validated by the multi-body dynamics software Adams.
- The influence of rocker suspension stiffness and damping on the ride comfort of UGV is analysed.

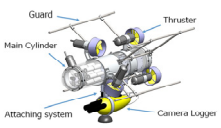
UGV with rocker suspension

MP2-1(5) 16:20-16:35

Underwater Drone for Bio-logging of Sperm Whale

Hyun-Tae Han[1], Masaki Hiwatashi[1], Takumi Toyoshima[1], Hiroki Tomori[1],
Yuichi Tsumaki[1] and Kyoichi Mori[2]
[1]Department of Mechanical Systems Engineering, Yamagata University, JAPAN
[2]Department of Animal Science, Teikyo University of Science, JAPAN

- We suggest a novel concept for bio-logging with an underwater drone.
- The prototype has designed with a maximum speed of 1.2m/s to chase sperm whale.
- It has 6 thrusters for 6 DOF of omni-directional motion.
- It has designed with an attaching system.



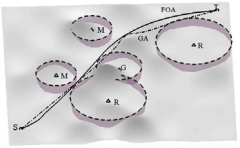
Overview of the prototype

MP2-1(6) 16:35-16:50

Design of the Fruit Fly Optimization Algorithm based Path Planner for UAV in 3D Environments

Xiangyin Zhang, Songmin Jia, Xiuzhi Li and Meng Jian
Faculty of Information Technology, Beijing University of Technology, Beijing, PR China

- The major contribution of this paper is the application of the fruit fly optimization algorithm (FOA) in UAV path planning.
- The FOA-based path planner is used to find the path that has the minimum cost function in terms of length, threat probability, altitude, turning angle, climbing/gliding angle, and terrain.
- The performance of FOA is compared with those of GA, and it can be concluded that FOA is better than GA.



The best flight paths produced by FOA and GA.

MP2-2: Medical Robots for Minimal Invasive Surgery (II)

Session Chairs: Nan Xiao, Beijing Institute of Technology
Chunfeng Yue, University of Electronic Science and Technology of China

Conference Room 62 on 6th floor, 15:20-16:50, Monday, 7 August 2017

MP2-2(1) 15:20-15:35

Dynamic Modelling and Embryo Zona Pellucida Perforation Experiments With Piezoelectric Actuated Micro-Needles

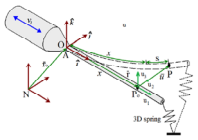
Issam Bahadur[1], Christopher Yee Wong[3], Xinggang Jiang[2] James K. Mills[3]

[1]Dept. of Mech. & Ind. Eng.Sultan Qaboos University P.O. Box 33, Al Khod 123 Sultanate of Oman

[2]School of Mech. Eng. and Automation Beihang University Beijing 100191, China

[3]Dept. of Mech. and Ind. Eng. University of Toronto Toronto, Ontario, Canada M5S 3G8

- Noniinear three-dimensionai dynamics of a micro-needle is derived.
- Micro-needle is simulated as an Euler-Bernoulli cantilever beam.
- Modelled with contact with embryo zona pellucida, submerged in a fluid medium.
- Experimental tests determine a threshold frequency below which zona perforation is unsuccessful.

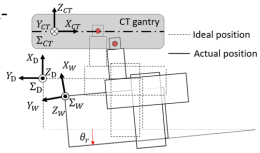


MP2-2(2) 15:35-15:50

Installation Angle Offset Compensation of Puncture Robot Based on Measurement of Needle by CT Equipment

Akisato Nagao, Takayuki Matsuno, Kazusi Kimura, Tetsushi Kamegawa, Mamoru Minami
Graduate School of Natural Science and Technology, Okayama University
Okayama, Japan
Takao Hiraki
Department of Radiology, Okayama University Hospital
Okayama, Japan

- We have been developed a interventional radiology support robot.
- The installation angle offset of the robot was not considered.
- A method to compensation of installation angle offset using CT equipment is proposed.



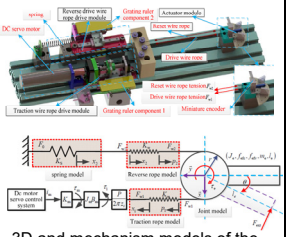
Installation angle offset

MP2-2(3) 15:50-16:05

Dynamical Model and Experimental Identification of a Cable-driven Finger Joint for Surgical Robot

Lingtao Yu [1], Wenjie Wang[1※], Zhengyu Wang[1], Lan Wang[1]
1College of Mechanical and Electrical Engineering, Harbin Engineering University
Harbin, Heilongjiang, China
※corresponding author: wangwenjie07@hrbeu.edu.cn

- Proposed a new type of wire rope drive, and designed the single joint for surgical robot micro devices.
- Built the dynamic model, designed the joint angle estimator, and the model of motor drive system.
- Parameter identification experiment result shown that the joint angle estimator, the joint dynamic model and the servo motor drive system model have a good precision.



3D and mechanism models of the single joint unit based on cable-driven

MP2-2(4) 16:05-16:20

Design of a Wearable Sensing System for a Lower Extremity Exoskeleton

Chunfeng Yue1, Hong Cheng1,Ye Chen 2, Qinglong Deng2, Xichuan Lin1
1. School of Automation Engineering, University of Electronic Science and Technology of China
2. Graduate School of University of Electronic Science and Technology of China

- We design a wearable sensing system for exoskeleton;
- The wearable sensing system can realize force and posture detection.
- Experiments are carried out to verify the performance of wearable sensing system.

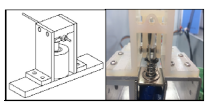
The prototype of wearable sensing system

MP2-2(5) 16:20-16:35

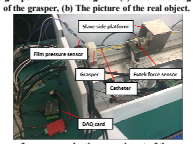
A Novel Design of Grasper for the Interventional Surgical Robot

Shuxiang Guo1, 2 *, Cheng Yang 1, Xianqiang Bao1 and Nan Xiao1 *
1. Key Laboratory of Convergence Medical Engineering System and Healthcare Technology, the Ministry of Industry and Information Technology, School of Life Science, Beijing Institute of Technology, No.5, Zhongguancun South Street, Haidian District, Beijing, China.
2. Faculty of Engineering, Kagawa University, 2217-20 Hayashi-cho, Takamatsu, Kagawa, Japan.

- ◆ Proposed a grasper for holding a guide wire of a catheter. When slide reaches the movement limit and need to move backward, it will hold the guide wire to prevent it from retreating and affect the safety and accuracy of the experiment.
- ◆ The performance evaluation experiments of the novel grasper were done, and the results show that the grasping clamp effectively clamps the catheter to improve the accuracy of the operation and can meet the design requirements.



The grasper's structure diagram: (a) Schematic diagram of the grasper, (b) The picture of the real object.



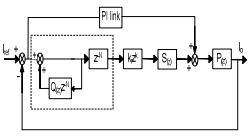
The performance evaluation experiment of the grasper.

MP2-2(6) 16:35-16:50

Research on Improved Control Strategy Based on PI Control in Photovoltaic Inverter

Demin Zhang,Na Liu
Tianjin University of Technology391, Binshui Xidao, Xiqing District, Tianjin, 300384, China

- Center algorithm of the equal area to achieve SPWM.
- Control strategy based on fractional order PI.
- Inverter control strategy based on repetition and PI control.
- Effectively improves the dynamic response speed and steady state accuracy, and reduces the harmonic content.



The structure diagram of repeated PI control

MP2-3: Medical, Biomedical and Rehabilitation Systems (I)

Session Chairs: Shuxiang Guo, Kagawa University
Wei Wei, Soochow University

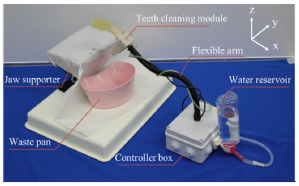
Conference Room 63 on 6th floor, 15:20-16:50, Monday, 7 August 2017

MP2-3(1) 15:20-15:35

Development of automatic teeth cleaning robot driven by cam mechanism

Gen Sakaeda[1], Takanobu Matsubara[2], Hiroyuki Ishii[3], Atsuo Takanishi[3]
[1]School of Advanced Science and Engineering, Waseda University, Tokyo, Japan
[2] School of Creative Science and Engineering, Waseda University, Tokyo, Japan
[3]Faculty of Science and Engineering/HRI. Waseda University, Tokyo, Japan

- A teeth cleaning mouthpiece for oral care of elders and handicap people were developed.
- A safety system was then designed to prevent aspirations.
- An eccentric cam mechanism was designed to achieve the horizontal scrubbing motion.
- A wiper guide mechanism was designed to change linear motions to rounded motions.



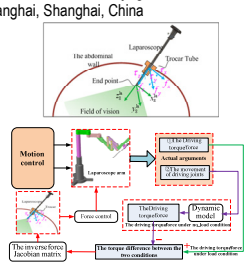
Automatic teeth cleaning robot

MP2-3(2) 15:35-15:50

Modeling and Analysis of laparoscope Arm for Minimally Invasive Surgical Robot

Jing Yang1, Lingtao Yu1※, Ning Zhang2 , Lan Wang1, Jiliang Zhao3
1College of Mechanical and Electrical Engineering, Harbin Engineering University
Harbin, Heilongjiang Province, China
2National Research Center for Rehabilitation Technical Aids, Beijing, China
3Aerospace System Engineering Shanghai, Shanghai, China

- Based on the general equation of multi-body dynamics and Lagrange equations, the inverse dynamic model of the laparoscope arm is established.
- According to the analysis of the actual operation, dynamic simulation is executed with an intermittent motion based on the correct dynamic model of the laparoscope arm.
- Combined with the force of the trocar point, a complete dynamic model is established and the influence on the joints is analyzed.
- According to the complete dynamical model, a strategy of force sensing for trocar force is put forward.



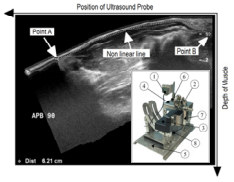
The strategy of force sensing for trocar force

MP2-3(3) 15:50-16:05

Estimation of Thumb-Muscle Length by Ultrasound on Portable Thumb Training System

Shahrul Naim Sidek[1],Muhammad Rozaidi Roslan[1],Sabrilhakim Sidek[2],Mohd Shukry Mohd Khalid[2]
[1]Mechatronics Engineering Department,IIUM, Kuala Lumpur, Malaysia
[2]Medical Imaging Unit, Universiti Teknologi MARA, Selangor, Malaysia

- Measurement of length of thumb muscles
- Ultrasound image and MRI
- Flexion angle as range of motion
- Curve fitting for muscle lengths
- Portable thumb training system



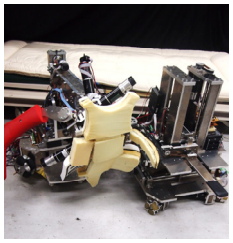
Ultrasound Image of
Abductor Pollicis Brevis Muscle

MP2-3(4) 16:05-16:20

Proposal of Self-Transfer Assistance System Enabling a Transfer from the Supine Position

Tomoya Nagasawa, Tsukasa Nishikawa, Toshihiko Yasuda,
Yasutaka Nishioka, and Mitsuhiro Yamano
Mechatronics Lab., University of Shiga Prefecture
Hikone, Japan

- Some people with physical disabilities have difficulty transferring alone.
- We propose to transfer from the supine position by "Transfer assistance system".
- A part of the self-transfer assistance robot, a leg assistance robot, and a pneumatic soft actuator arranged on the bed were prototyped.
- Experiments of assistance showed that the transfer from the supine position using this system was feasible.



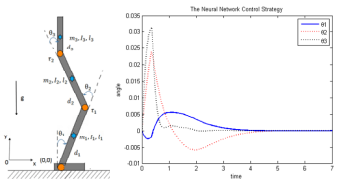
Transfer assistance system

MP2-3(5) 16:20-16:35

A Disturbing Recovery Approach for Lower ExtremityExoskeletons with Passive Ankle Joints

Wei Wei, Lidan Cheng, Pengcheng Zhang,
Shengjie Zhao, Qunlong Li, Yuxuan Xia, Weidong Wang and Jiaqian Li
Soochow University
Suzhou, China

- A disturbing recovery approach for lower extremity exoskeletons with passive ankle joints, which particularly works when an external disturbance is applied on the standing exoskeleton.



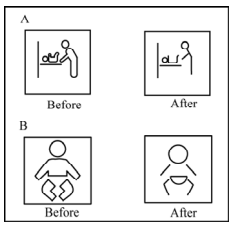
The Control Algorithm

MP2-3(6) 16:35-16:50

A Study of Shape Discrimination for Tactile Guide Maps

Jiabin Yu, Qiong Wu, Jiajia Yang, Satoshi Takahashi, Yoshimichi Ejima and Jinglong Wu
Biomedical Engineering Laboratory, Graduate School of Natural Science and Technology,
Okayama University, Japan

- The hand is a vital organ that allows us manipulate and discriminate objects with unmatched dexterity and versatility
- Properties of objects play a vital important in discriminating perception.
- Spatial complexity is an important attribute of objects, which have an influence on recognition of tactile guide maps.



Pattern simplification processing

MP2-4: Biomimetic Systems (I)

Session Chairs: Arai Tatsuo, Beijing Institute of Technology
Sawada Hideyuki, Waseda University

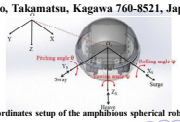
Conference Room 64 on 6th floor, 15:20-16:50, Monday, 7 August 2017

MP2-4(1) 15:20-15:35

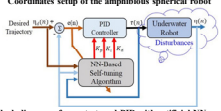
Design and Implementation of Self-tuning Control Method for the Underwater Spherical Robot

Yanlin He, Shuxiang Guo, Liwei Shi, Huiming Xing, Zhan Chen, Shuxiang Su
The Institute of Advanced Biomedical Engineering System, School of Life Science, Beijing Institute of Technology, No.5, Zhongguancun South Street, Haidian District, Beijing 100081, China.
Faculty of Engineering, Kagawa University, 2217-20 Hayashi-cho, Takamatsu, Kagawa 760-8521, Japan

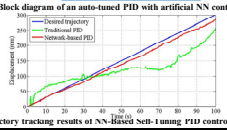
- In this paper, an auto-tune PID controller based on Neural Networks was applied to our amphibious spherical underwater robot, which has a great advantage on processing online for the robot.
- The performance of controlling method was evaluated in two instances: a numerical simulation and implemented on the spherical underwater robot in real-time.
- Experimental results showed that the NN-based PID controller attained the best performance with less trajectory tracking error and yawing angle, especially when the robot swims in underwater with disturbances.



Coordinates setup of the amphibious spherical robot



Block diagram of an auto-tuned PID with artificial NN control



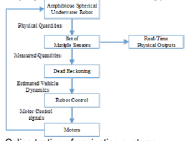
Trajectory tracking results of NN-based Self-tuning PID control vs PID

MP2-4(2) 15:35-15:50

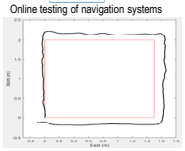
Kalman Filter-based Navigation System for the Amphibious Spherical Robot

Huiming Xing, Shuxiang Guo, Liwei Shi, Shaowu Pan, Yanlin He, Kun Tang, Shuxiang Su, Zhan Chen
Key Laboratory of Convergence Medical Engineering System and Healthcare Technology, the Ministry of Industry and Information Technology, School of Life Science, Beijing Institute of Technology

- To enlarge the exploration area of the amphibious spherical robot, the amphibious spherical robot III was redesigned.
- For scientific purposes, we proposed a new Kalman filter-based navigation system for the ASR-III and applied to it.
- The experimental results demonstrated that the navigation system for the amphibious spherical robot has better dynamic performance and robustness.



Online testing of navigation systems



Position trajectory of IMU

MP2-4(3) 15:50-16:05

Step Length Adaptation for Walking Assistance

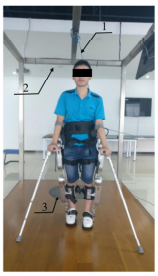
Qiming Chen, Hong Cheng, Chunfeng Yue, Rui Huang, Hongliang Guo
Center for Robotics, School of Automation Engineering,
University of Electronic Science and Technology of China, Chengdu, China

1.A novel step length adaptation method is proposed to adapt to the patient's motion, in which the exoskeleton with the pilot is modeled as a HHEA;

2 .We employ a DMP architecture to model the exoskeleton gait flexibly, which combining the CoM of the

HHEA and the gait length;

3. Parameters of the gait models are updated online with RL method.



Exoskeleton Robot

MP2-4(4) 16:05-16:20

COLD: A ROS Package for Continuous Learning from Demonstration: teaching a robot to write

Mostafa Hussein[1] Yasser Mohammad[1,2] Samia A. Ali[1]
[1] Department of Electrical Engineering, Assiut University, Egypt
[2] KDDI Research Inc., Japan

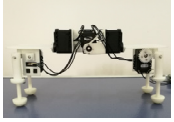
- The paper presents a ROS based modular system for continuous learning from demonstration.
- The system was applied to the problem of teaching robots with varying form factors to write both in Arabic and English
- The main contribution is allowing the robot to learn from continuous sensor streams without any need for pre-segmentation.

MP2-4(5) 16:20-16:35

Effect of Swing Legs on Turning Motion of a Free-Falling Cat Robot

Jiaxuan Zhao, Lu Li and Baolin Feng
School of Engineering Science, University of Science and Technology of China, Hefei, China

- A multi-rigid-body dynamic model of a cat robot is built with the consideration of swing legs.
- The relation between turning rate and swing angle of legs is got.
- Mechanical structure of the cat robot is designed and dynamics simulation is carried out.
- A cat robot prototype is developed and the turning motion of the prototype is implemented successfully in the experiment.



The prototype of robotic cat

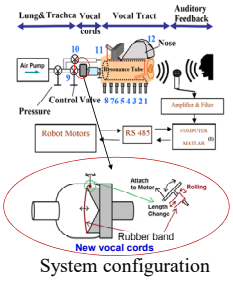
MP2-4(6) 16:35-16:50

Singing Performance of the Talking Robot with Newly Redesigned Artificial Vocal Cords

Vo Nhu Thanh
Graduate School of Engineering,
Kagawa University, Japan

Hideyuki Sawada
School of Advanced Science and Engineering
Waseda University, Japan

- A talking robot is constructed based on the human articulatory system.
- A new design of the vocal cords is developed using functional approach.
- The fundamental frequency of the vocal cords is controlled by a motor.
- The vocal pitch of the new vocal cords varies from 50Hz to 250Hz.
- Singing performance is realized with the wider pitch range.



System configuration

MP2-5: Elements, Structures, and Mechanisms

Session Chairs: Liying Zheng, Harbin Engineering University
Lihua Liang, Harbin Engineering University

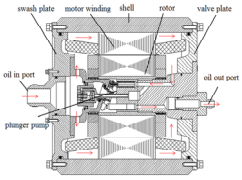
Conference Room 65 on 6th floor, 15:20-16:50, Monday, 7 August 2017

MP2-5(1) 15:20-15:35

Power Losses and Thermal Analysis of a Designed Electro-Hydraulic Pump

Deming Zhu, Yongling Fu, Jian Fu,Liming Yu
School of Mechanical Engineering & Automation, Beihang University, Beijing, China; Flying College, Beihang University, Beijing, China

- Focuses on the power losses and thermal model of a designed Electro-Hydraulic Pump (EHP) .
- The temperature effects of the distribution in fluid field and thermal field of the hydraulic oil in the inner chamber of the shell.
- The thermal field distribution of EHP is verified by experiments.



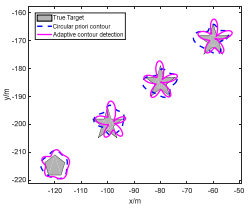
The geometric model of the EHP

MP2-5(2) 15:35-15:50

An Adaptive Contour Algorithm for Irregular Shape Extended Target

Hui Chen, Jinrui Du
School of Electrical and Information Engineering, Lanzhou University of Technology
Lanzhou, China

- Considering the unknown priori shape target with irregular extent, an adaptive contour algorithm is proposed based on the Center Contour Distance.
- On the basis of adaptive contour algorithm, a detection method to cope with a sudden shape change in the process of target evolution is proposed.



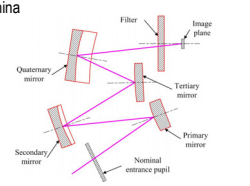
Adaptive Contour Algorithm

MP2-5(3) 15:50-16:05

Thermal Design and Verification of the Large-temperature-difference Space Optical System

Huabin Yang[1], Fei Shen[1], Zhengtao Zhang[1], Liheng Chen[2] and Qingwen Wu[2]
1. Institute of Automation, Chinese Academy of Sciences
Beijing, China
2. Changchun Institute of Optics, Fine Mechanics and Physics, Chinese Academy of Sciences
Jilin Province, China

- The large-temperature-difference (LTD) optical system, including 4 mirrors, 1 transmission filter, 1 photo counting Micro-Channel-Plate (MCP) detector et al, is to provide an opportunity to obtain the light intensity map of the aurora.



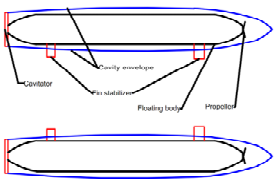
Optical configuration

MP2-5(4) 16:05-16:20

Research on Hydrodynamic Characteristics of Supercavitating Vehicle's Fin Stabilizer

Lihua Liang, Jianfeng Li and Zhiwen Le
College of Automation, Harbin Engineering University
Harbin, Heilongjiang, China

- Applying supercavitation theory to the floating body of SWATH.
- The simulation carried out in CFD shows that the hydrodynamic characteristics of the fin stabilizer on the SWATH at different speeds and different angles of attack.
- Results provide certain reference for the stabilization control system of supercavitating vehicle.



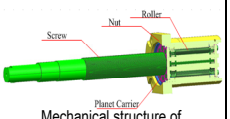
Configuration of supercavitation

MP2-5(5) 16:20-16:35

Analytical and experimental of planetary roller screw axial stiffness

Jianan Guo[1], He Peng[1], Hongyan Huang[1], Zhansheng Liu[1],Yuping Huang[2] and Weitao Ding[2]
1.Institute of Vibration and Acoustic Control Technology for Power Machinery, Harbin Institute of Technology, Harbin, China
2.China Academy of Launch Vehicle Technology, Beijing, China

- Establish the stiffness formula of planetary roller screw(PRS).
- Analyze the load distribution of planetary roller screw for different load condition.
- Simulate the effect of contact angle and roller number on PRS stiffness.
- An experiment is carried out to validate the PRS stiffness model.



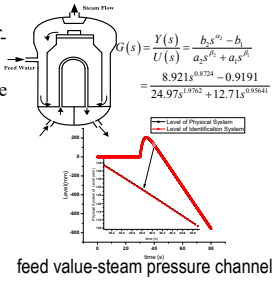
Mechanical structure of planetary roller screw

MP2-5(6) 16:35-16:50

System Identification of Fractional-Order For Non-Minimum-Phase and Non-Self-Balancing System

Mo Tao,Zhiwu Ke and Yagang Yu
Sci. & Tech. on Thermal Energy & Power Lab., Xi'an Aeronautics Computing Tech. & Res. Ins.

- Non-Minimum-Phase and Non-Self-Balancing System in nuclear power
- The fractional order calculus is quite suitable in describing the materials or processes that with memory or genetic property.
- Optimal parameter of fractional order identification



feed value-steam pressure channel

MP2-6: Manipulator Control and Manipulation (II)

Session Chairs: Xiaopeng Chen, Beijing Institute of Technology
Yi Liu, Kagawa University

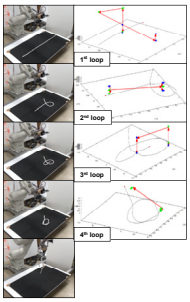
Conference Room 66 on 6th floor, 15:20-16:50, Monday, 7 August 2017

MP2-6(1) 15:20-15:35

String Tying Operation by Industrial Manipulator Based on Shape Abstracted Data

Tomotoshi Watanabe, Takayuki Matsuno, Tomoya Shirakawa, and Mamoru Minami
Intelligent Robotics and Control Lab., Okayama University, Okayama, Japan

- Planning method of string tying operation based on knot theory
- Algorithms to generate the motion of a manipulator
- We propose Face List as shape abstraction data of string projection
- The result of string tying experiment using a manipulator to evaluate proposed algorithm is reported.
- Proposed algorithms do not need human interventions and a lot of teacher

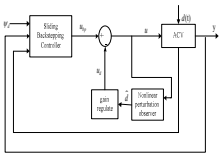


MP2-6(2) 15:35-15:50

Based on Disturbance Observer Of Air Cushion Vehicle Course Sliding Backstepping Control

Fuguang Ding, Xiaohui Meng, Tan Zhang
Automation department of Harbin Engineering University
Harbin, China

- Disturbance observer is important component of the Air Cushion Vehicle Course control.
- Based on disturbance observer of sliding backstepping is an efficient air cushion vehicle course control scheme.
- This method effectively restraining chattering and strong robustness.
- The observer eliminate the disturbances .



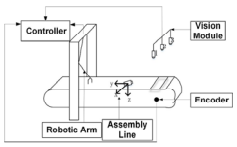
The Control system

MP2-6(3) 15:50-16:05

An Energy Optimization based Planning Approach for Moving Bottle Grasping Task Using a Seven-DoF Robotic Arm

Xiaopeng Chen, Weizhong Zhang, Yi Shi, Di Fan, Taoran Zhang, Guilin Liu, Qingqing Li and Qiang Huang
Intelligent Robotics Institute, Beijing Institute of Technology, Beijing, China

- Two optimization step: optimal interception pose optimization and trajectory optimization from start pose to interception pose.
- Quadrature programming provided by GPOPS is used for optimization.
- Dynamics is taken for consideration and redundancy is removed based on maximizing workspace rule.
- Simulation verified the performance of the approach.



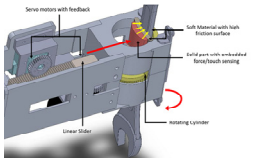
Moving Object Grasping Platform

MP2-6(4) 16:05-16:20

A Novel Gripper Design For Multi Hand Tools Grasping Under Tight Clearance Constraints and External Torque Effect

Mohammad Shaqura and Jeff S. Shamma
Robotics, Intelligent Systems and Control Lab. (RISC), King Abdullah University of Science and Technology (KAUST)
Thuwal, Saudi Arabia

- Multi hand tools gripper mechanism.
- Minimizes actuators activity which reduce power consumption.
- Embedded feedback for grip sensing and to assist manipulator safe operations and alignment control
- Designed to withstand relatively high external torques.



RISC G1 Robotic Gripper

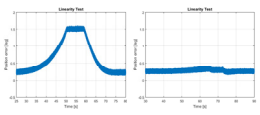
MP2-6(5) 16:20-16:35

Compensation of load-dependent position error for a hybrid stepper motor

Bin Liu, Peter Fransson
Department of Automation Solutions
ABB Corporate Research, Sweden

Anton Ronquist, Birger Winroth
Department of Electrical Engineering
Linköping University

- Load-dependent position error and its compensation approach in a hybrid stepper motor has been studied.
- Low position stiffness feature for a stepper motor has been explained.
- A field oriented control has been proposed to maximize stepper motor position stiffness.
- Experimental verification shows the effectiveness of the proposed method.



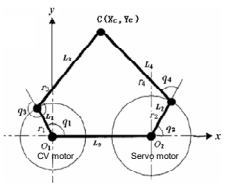
Conveyor belt – CSTs start up power analysis

MP2-6(6) 16:35-16:50

Adaptive PD-SMC in Position Domain for Contour Tracking of Hybrid Actuated system

PR. Ouyang[1], M. Kuang[2], S. Jayasinghe[1], W.H. Yue[2], and H.M. Kang[2]
[1] Department of Aerospace, Ryerson University, Toronto, Canada
[2] Hunan University of Science and technology, Xiangtan, China

- Deal with the contour tracking problem of hybrid actuated system.
- Apply the adaptive PD-SMC in position domain.
- Compare the performances with different controllers.
- Demonstrate the effectiveness of the adaptive PD-SMC for contour tracking.



Hybrid Actuated System

MP3-1: OS: Navigation Mechanism Analysis (II)

Session Chairs: Jian Guo, Tianjin University of Technology
Yong Yu, Kagoshima University, Japan

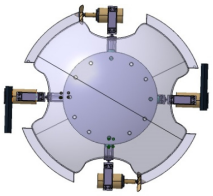
Conference Room 61 on 6th floor, 17:00-18:00, Monday, 7 August 2017

MP3-1(1) 17:00-17:15

A Hybrid Propulsion Device for the Spherical Underwater Robot

Shuoxin Gu, Shuxiang Guo, Linshuai Zhang, Yi Yao
Graduate School of Engineering, Kagawa University
Takamatsu, Kagawa, Japan

- A novel hybrid propulsion device with both water-jet thrusters and propellers.
- The diversity of the movement is proposed for the different target as remote or hover.
- The hydrodynamic characteristics of the propeller is analyzed.
- The experimental device with a 6-DOFs load cell is set up to measure the thrust of the propeller.



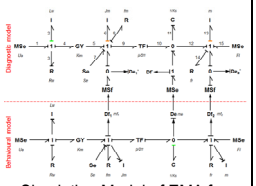
The novel Hybrid Propulsion System for the Spherical Underwater Robot (SUR III)

MP3-1(2) 17:15-17:30

Analytical Method of Fault Detection and Isolation Based on Bond Graph for Electromechanical Actuator

Hongfei Liu[1], Liming Yu[2]
[1]School of Automation Science and Electrical Engineering, Beihang University
[2]Flying College, Beihang University
Beijing, China

- A fault diagnosis methodology based on bond graph has been used to detect and isolate free-run fault of electromechanical actuator (EMA).
- Derive the analytical redundancy relations (ARRs) for fault detection.
- Establish the fault signature matrix (FSM) for fault isolation.

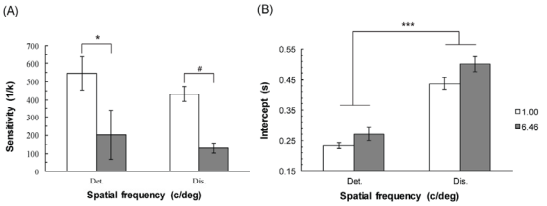


Simulation Model of EMA for Fault Detection & Isolation

MP3-1(3) 17:30-17:45

Effects of Stimulus Features on Visual Processing for Communication between Human and Robot

Fengxia Wu, Yanna Ren, Qiong Wu, Yoshimichi Ejima, Xiaoyu Tang, Weiping Yang, Jiajia Yang, Satoshi Takahashi, Jinglong Wu
The Graduate School of Natural Science and Technology, Okayama University, Japan



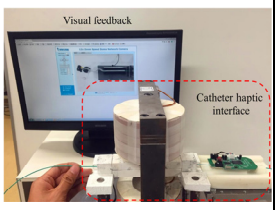
- Task altered processing latencies intrinsic of sensory pathway and motor time of the effector system, but not basic visual detectability.

MP3-1(4) 17:45-18:00

Haptic Feedback in Robot-assisted Endovascular Catheterization

Yu Song[1] , Shuxiang Guo[2, 3], Linshuai Zhang[1] and Miao Yu[1]
[1] Graduate School of Engineering, Kagawa University, Hayashi-cho, Takamatsu, 761-0396, Japan
[2]Key Laboratory of Convergence Medical Engineering System and Healthcare Technology, The Ministry of Industry and Information Technology, School of Life Science and Technology, Beijing Institute of Technology, Haidian District, Beijing 100081, China
[3]Department of Intelligent Mechanical Systems Engineering, Kagawa University, Takamatsu, Kagawa 761-0396, Japan

- A remote catheter navigation system was presented, and the MR (Magnetorheological) fluids based haptic interface was as the master site.
- To evaluate the performance of the haptic feedback in catheter insertion, ten subjects were recruited to manipulate designed remote catheter navigation system.
- Experimental results showed that haptic feedback has a benefit to decreasing the contact force between the catheter and blood vessel phantom during the remote catheter navigation.



Catheter operation process

MP3-2: Medical Robots for Minimal Invasive Surgery (III)

Session Chairs: Liwei Shi, Beijing Institute of Technology
Shuxiang Guo, Kagawa University

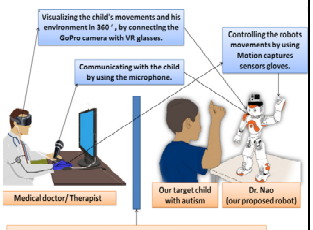
Conference Room 62 on 6th floor, 17:00-18:00, Monday, 7 August 2017

MP3-2(1) 17:00-17:15

Avatar Based Interaction Therapy: A Potential Therapeutic Approach for Children with Autism

M. Alahbabi[1], F. Almazroei[1], M. Almarzoqi[1], A. Almeheri[1], M. Alkabi[1], A. AlNuaimi[2], M. Cappuccio[1], F. Alnajjar[1]
[1]UAE University, UAE. [2]Veus Technology, Brazil
fady.alnajjar@uaeu.ac.ae

- We investigated the response levels of 5 healthy children to a robotic avatar therapeutic system specially designed for children with Autism.
- Our results show that the avatar robot can increase the response and the interaction time of the child.
- Our system can also automate measuring the progress of robot-child interaction.



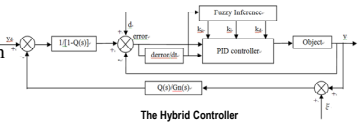
Proposed robot-avatar rehabilitation

MP3-2(2) 17:15-17:30

A Study on Telecommunication Technology and Remote-control Algorithm in Minimally Invasive Surgical Robotic System

Shuxiang Guo[1,2*], Rui Shen[1], Nan Xiao[1*], Xianqiang Bao[1], Changqi Xu[1]
[1] Key Laboratory of Convergence Medical Engineering System and Healthcare Technology, the Ministry of Industry and Information Technology, School of Life Science, Beijing Institute of Technology, No.5, Zhongguancun South Street, Haidian District, Beijing 100081, China
[2] Faculty of Engineering, Kagawa University, 2217-20 Hayashi-cho, Takamatsu, Kagawa 760-8521, Japan

- This paper focuses on the controlling algorithm of the tele-operative robot-assisted system.
- The proposed algorithm combines Adaptive Fuzzy PID Controller and disturbance observer.
- The hybrid controller not only supplies the self-adaptive tuning for the parameters of the PID controller, but solve the time-delay trouble.



The Hybrid Controller

MP3-2(3) 17:30-17:45

Effects of the Transverse Micro–vibration on Guide Wires for Endovascular Therapy

Chaonan Zhang, Shuxiang Guo, Nan Xiao, Jiaqing Wu, Yan Zhao, Changqi Xu, Guangxuan Li, Xianqiang Bao
Key Laboratory of Convergence Medical Engineering System and Healthcare Technology
Ministry of Industry and Information Technology
Beijing Institute of Technology, Beijing, China

- This paper has carried on the research on the mechanism of the viscous force of the catheter and the guide wire in the surgery.
- A method is pioneered to supplement the transverse micro-vibration in the proximal end of the guide wire to study the effects on the viscous force of the guide wires for the endovascular therapy.
- The result demonstrated that the proposed method can reduce the viscous force of the catheter and the guide wire exerted by the blood during the push process.

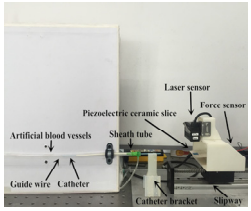


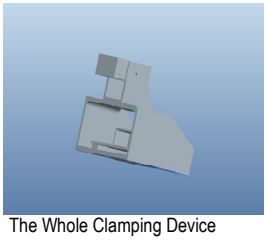
Fig.1 The experimental setup for the viscous force detection of the transversemicro-vibration guide wire.

MP3-2(4) 17:45-18:00

A Novel Vibrating Device for the Interventional Surgical Robotic System

Shuxiang Guo, Jiaqing Wu, Nan Xiao, Chaonan Zhang, Yan Zhao, Guangxuan Li, Changqi Xu
Key Laboratory of Convergence Medical Engineering System and Healthcare Technology,
Ministry of Industry and Information Technology
Beijing Institute of Technology, Beijing, China

- This paper proposes a new method that guide the catheter with micro vibration, and design a novel device to realize it after studying on vibration of the piezoelectric plate.
- It is shown that this device can achieve the goal of this research and it is effective according to the experiment's result.



The Whole Clamping Device

MP3-3: Medical, Biomedical and Rehabilitation Systems (II)

Session Chairs: Wei Wei, Soochow University
Mingai Li, Beijing Institute of Technology

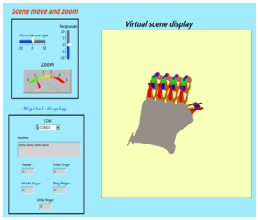
Conference Room 63 on 6th floor, 17:00-18:00, Monday, 7 August 2017

MP3-3(1) 17:00-17:15

A LabVIEW-Based Human-Computer Interaction System for the Exoskeleton Hand Rehabilitation Robot

Jian Guo*1, Nan Li*1 ,Shuxiang Guo*1*2*3 and Jiange Gao*1*2
*1 Tianjin Key Laboratory for Control Theory & Applications in Complicated Systems and Biomedical Robot Laboratory, Tianjin University of Technology, Tianjin, Binshui Xidao 391, China
*2 Tianjin Key Laboratory of the Design and Intelligent Control of the Advanced Mechatronical System, Tianjin, China
*3 Intelligent Mechanical Systems Engineering Department ,Faculty of Engineering, Kagawa University, Takamatsu, Kagawa, Japan

- The human-computer interaction system was proposed to swiftly deliver the data to the virtual fingers and implement synchronized movement between hand robot and virtual hand when patients do rehabilitation training exercises.
- The system could make it better for operators to observe the rehabilitation training of patients.
- The system could be the basic platform of designing some games for patients, which could bring about many interests during rehabilitation training.



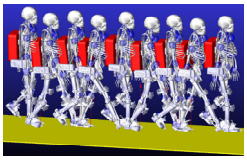
human-computer interaction system

MP3-3(2) 17:15-17:30

Research on the Cable-pulley Underactuated Lower Limb Exoskeleton

Yang Liu, Yongsheng Gao, Feiyun Xiao and Jie Zhao
Research LabState Key Laboratory of Robotics and System. Harbin Institute of Technology
Harbin, China

- Mechanical design of the cable-pulley underactuated principle-based lower limb exoskeleton.
- Dynamic analysis of the robotic leg.
- Control strategy of synergies of torque and power assistance of the coupled joints.
- Simulation of the load-carrying walking through the biological method.



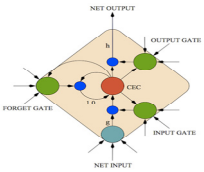
The walking simulation animation of load-carrying model

MP3-3(3) 17:30-17:45

The Novel Recognition Method with Optimal Wavelet Packet and LSTM based Recurrent Neural Network

Mingai Li[1], Wei Zhu[1], Meng Zhang[1], Yanjun Sun[1] and Zhe Wang[2]
1. Faculty of Information Technology
2. College of Mechanical Engineering and Applied Electronics Technology
Beijing University of Technology
Beijing, China

- OWPT is applied to each channel of MI-EEG
- The improved distance criterion is used to find the optimal wavelet packet subspaces
- The OWPS coefficients of multi-channels are fused to construct the MI-EEG feature set
- LSTM based RNN is used for classifying MI-EEG features



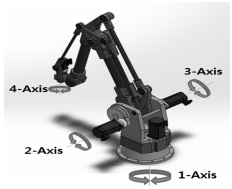
LSTM memory cell

MP3-4(4) 17:45-18:00

Selection of Major Components of a Four-Axis Transfer Robot through Dynamic Analysis

Yong Jae Jeon, Hyeon Yeol Lee, Dae Sun Hong
Automation Lab., Changwon National University
Changwon, Korea

- This study conceptually designs the structure of a four-axis transfer robot of which major components such as motors and reducers are initially selected with designer's experience.
- Also, this study proposes a method to determine the specifications of the major components through dynamic analysis.



The configuration of the four-axis robot

MP3-4: Biomimetic Systems (II)

Session Chairs: Cabibihan John-John, Qatar University
Dahua Li, Tianjin University of Technology

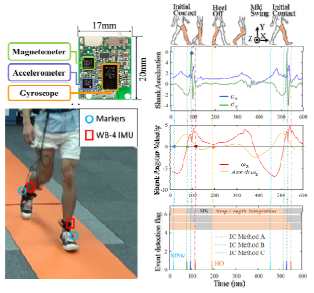
Conference Room 64 on 6th floor, 17:00-18:00, Monday, 7 August 2017

MP3-4(1) 17:00-17:15

Reliability of stride length estimation in self-pace and brisk walking with an inertial measurement unit on shank

R. Kasai, T. Kodama, Z. Gu, D. Zhang, W. Kong, S. Cosentino, S. Sessa, Y. Kawakami, and A. Takanishi
Robotics Research Lab., Waseda University, Tokyo, Japan

- Gait analysis by IMU sensor is getting popular because of low cost and non-limited workspace
- This is the validation of stride length estimation algorithms in normal and fast pace walking
- 3 event detection algorithms for removing initial contact noise
- 2 double integration algorithms of acceleration



MP3-4(2) 17:15-17:30

A Spatial Soft Module Actuated by SMA Coil

Yihong Zhang, Manjia Su, Mingjun Li, Rongzhen Xie, Haifei Zhu, Yisheng Guan*
Biomimetic and Intelligent Robotics Lab., Guangdong University of Technology
Guangzhou, China

- A spatial soft module (SSM) actuated by SMA coils is designed.
- Special fabrication method is performed.
- Kinematics is established in configuration and task spaces.
- Experiments are setup to measure precision of bending angle and defection angle, as well as bearing capacity.

SSM and MSSR

MP3-4(3) 17:30-17:45

Anti-Spoofing Device for Biometric Fingerprint Scanners

Kishor Kumar Sadasivuni, Mohammad Talal Houkan, Mohammad Saleh Taha, and John-John Cabibihan
Department of Mechanical and Industrial Engineering,Qatar University, P.O. Box 2713, Doha, Qatar

- This paper describes an easy-to-integrate and inexpensive method to improve the security of fingerprint scanners.
- An added layer of protection is proposed by integrating an anti-spoofing device that can be integrated to any commercial fingerprint scanners.
- The proposed device senses the capacitance and pulses from human fingers.
- The device has a potential for being a cost-efficient and robust solution against spoofing.

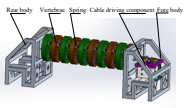
Figure: Prototype of the fingerprint scanner with the add-on parts

MP3-4(4) 17:45-18:00

Bionic Body Bending Driven by Cables for Quadruped Robot

Jingtao Lei, Yunqi Jiang
School of Mechatronic Engineering and Automation, Shanghai University
Shanghai, China

- The body of the quadruped robots are generally designed with the rigid structure, which is lack of the flexibility. It is difficult for quadruped robot to achieve mobility and stability similar to the four-legged creatures.
- In order to improve the maneuverability of the quadruped robot, a kind of bionic body driven by cables is presented, which is composed of the front body, bionic spine, two cable driving components and rear body. The bionic body can achieve lateral or pitch bending.
- The kinetics of the bionic body is analyzed. The Euler cantilever theory is adopted to analyze the bionic body bending, and the relationship between the cable driving force and the bending angle is determined. The simulation of the bionic body bending with different stiffness based on virtual prototyping technology is performed.



Bionic body

MP3-5: Rotor Dynamics Vibration Analysis and Vibration Control

Session Chairs: Yan Chu, Harbin Engineering University
Maoxun Li, National University of Singapore

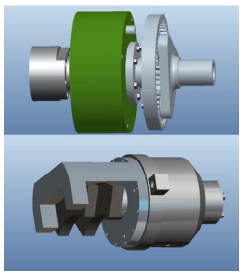
Conference Room 65 on 6th floor, 17:00-18:00, Monday, 7 August 2017

MP3-5(1) 17:00-17:15

Clamping Force Control of Sensor-less Electro-Mechanical Brake Actuator

Zhen WEI, John XU and Dunant HALIM
University of Nottingham Ningbo Campus, Ningbo, China

- Compact design of Electro-Mechanical Brake (EMB) actuator
- Brushless permanent magnet motor direct torque control against EMB system
- Clamping force estimation method based on mathematic model and experiment result



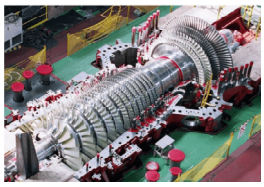
EMB actuator

MP3-5(2) 17:15-17:30

Study on the Calculation Methods of Vibration Characteristics of the Rotor with Initial Bending

Lihua Yang, Haoliang Xu and Lie Yu
State Key Laboratory for Strength and Vibration of Mechanical Structures
Xi'an Jiaotong University,Xi'an China

- Three equivalent calculation methods of initial bending are given in rotor dynamics analysis, and the indirect equivalent calculation method of initial moment is mainly discussed.
- The forced vibration equation of the initial bending rotor system is given by the lumped parameter method.



Gas turbine rotor system

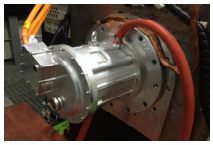
- A combined rotor system of F-class gas turbine is analyzed by three different equivalent calculation methods, and the corresponding different calculation results are compared.

MP3-5(3) 17:30-17:45

E-Drive Motor Torque Ripple Suppression Algorithm Research

Chen Xianzhang, Yu Zhuoping, Xiong Lu
Automotive Insititute, Tongji University
Shanghai, China

- Introduction
- Current Ripple Influence Factors Analysis
- High Performance PMSM Control
- Simulation and experimentation
- Conclusion

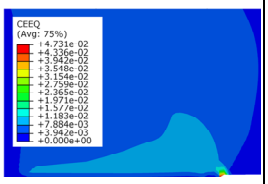


MP3-5(4) 17:45-18:00

Investigation of the Constraint Effect of the P92 Steel Under High Temperature Based on the Parameter Ac and Creep

Lanlan Tian, Jun Liu, Weimin Ge
Mechatronics Research Lab., Tianjin University of Technology, Tianjin, China

- The creep crack growth (CCG) behavior contains the non-steady state creep, the steady state creep and the tertiary state creep.
- In the steady state creep stage, the CCG rate is correlated with the C* and the creep strain increased to a large area at the crack tip.
- During the propagation of the creep crack, the elastic area decreases quickly and the plastic strain changes a little.



Creep Strain

MP3-6: Manipulator Control and Manipulation (III)

Session Chairs: Shaowu Pan, Beijing Institute of Technology
Songhua Yan, Wuhan University

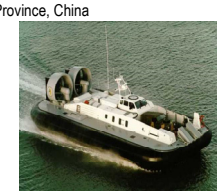
Conference Room 66 on 6th floor, 17:00-18:00, Monday, 7 August 2017

MP3-6(1) 17:00-17:15

Heading Control of Air Cushion Vehicle with Disturbance Observer Based on Terminal Sliding Mode

Xiaogong Lin and Linfeng Wang
Automation department of Harbin Engineering University,
Harbin, Heilongjiang Province, China

- Design a heading controller of ACV based on nonsingular terminal sliding mode control with disturbance observer.
- The trajectory error converges to zero quickly due to TSM.
- Reducing chattering problem by sliding mode control combine with DO and replacing the traditional sign function with Sigmoid function.



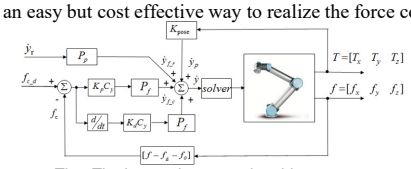
Air Cushion Vehicle

MP3-6(2) 17:15-17:30

Interaction Control for Manipulator with compliant end-effector based on hybrid position-force control

Dingqiang Han, Xingguang Duan*, Meng Li ,Tengfei Cui and Anji Ma
Intelligent Robotics Institute , Beijing Institute of Technology
Beijing, China

- The paper has presented a control framework for interaction control between manipulator and the environment based on hybrid position-force control within the iTaSC-framework.
- The developed control algorithm is a velocity-resolved scheme.
- The proposed method avoids the dynamic modelling which presents an easy but cost effective way to realize the force control.



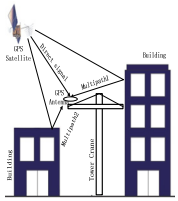
The The interaction control architecture

MP3-6(3) 17:30-17:45

The Research on Multipath Mitigation of GNSS in Intelligent Crane

Songhua Yan and Zhouzhou Yan
Wuhan University and Wuhan University of Technology
Wuhan China

- Intelligent crane has various sensors to get the environmental information and uses core control computer to ensure the safety operation.
- The position information is the essential data for intelligent control.
- This paper introduces the frequently-used position technology and sensors.
- It discusses the multipath of GNSS and employs the MEDLL technology to separate the direct signal and the multipath .



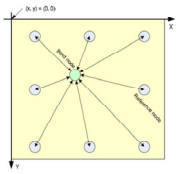
GPS multipath in the construction site

MP3-6(4) 17:45-18:00

A ZigBee Position Technique for Indoor Localization based on Proximity Learning

Chung-Wei Ou, Chin-Jung Chao, Lih-Tyng Hwang, Yi-Ying Huan, Fa-Shian Chang, Shun-Min Wang, Guan-Xun Liu, Min-Ren Wu, and Kai-Yi Cho
Dept. of Electronics, Cheng Shiu University
Kaohsiung, Taiwan

- This paper proposes a new method of position along with node teaching and placement.
- Different from the traditional triangulation position, the proposed method employs a faster computation technique with special proximity learning and placement, which leads to reduced computational time. In position computation, the received signal strength indication (RSSI) values from ZigBee CC2431 modules (by Texas Instruments) were processed.
- The simple and efficiency position technique can be extended to many applications; for example, the handover mechanism for reference node, position using WSN protocols like Wi-Fi and Bluetooth, and basic indoor navigation.



Positioning estimation diagram

Tuesday
August 8, 2017

Morning Sessions

TA1-1	Intelligent Mechatronics and Application (I)
TA1-2	Signal and Image Processing (I)
TA1-3	Control Theory and Application (I)
TA1-4	Modeling, Simulation Techniques and Methodologies (I)
TA1-5	Robot Navigation and Control Algorithm (I)
TA1-6	Human-System Interaction and Interface (I)
TA2-1	Intelligent Mechatronics and Application (II)
TA2-2	Signal and Image Processing (II)
TA2-3	Control Theory and Application (II)
TA2-4	Modeling, Simulation Techniques and Methodologies (II)
TA2-5	Robot Navigation and Control Algorithm (II)
TA2-6	Human-System Interaction and Interface (II)

Tuesday
August 8, 2017

Afternoon Sessions

TP1-1	Intelligent Mechatronics and Application (III)
TP1-2	Signal and Image Processing (III)
TP1-3	Control Theory and Application (III)
TP1-4	Modeling, Simulation Techniques and Methodologies (III)
TP1-5	Mobile Robot System (I)
TP1-6	Humanoid Robot System
TP2-1	Intelligent Mechatronics and Application (IV)
TP2-2	Signal and Image Processing (IV)
TP2-3	Control Theory and Application (IV)
TP2-4	Modeling, Simulation Techniques and Methodologies (IV)
TP2-5	Mobile Robot System (II)
TP2-6	Intelligent Biomedical Instrument Technology

TA1-1:Intelligent Mechatronics and Application (I)

Session Chairs: Toshio Fukuda, Beijing Institute of Technology
Qinxue Pan, Beijing Institute of Technology

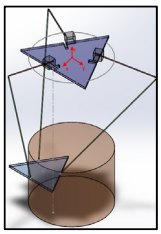
Conference Room 61 on 6th floor, 9:30-10:30, Tuesday, 8 August 2017

TA1-1(1) 9:30-9:45

Kinematic resolution of delta robot using four bar mechanism theory

Luis Escobar, Alexander Ibarra, Eduardo Bolaños, Xavier Bravo, Mayra Comina and José Luis Hidalgo
Mechatronics Lab., Universidad de las Fuerzas Armadas ESPE
Quito, Ecuador

- Four bar mechanism analysis is used to model a delta robot.
- The analysis of closed chains in arms of delta robots are modeled.
- Robot position were experimentaly evaluated with ISO 9283 standard for accuracy and repeatability.



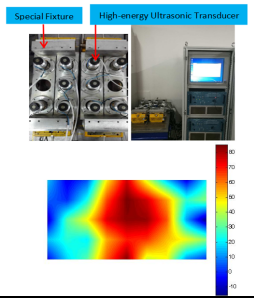
Volume of delta robot

TA1-1(2) 9:45-10:00

The Experimental Research on Residual Stress Regulation Based on High-Energy Acoustic Wave

Qinxue Pan, Wei Song, Chang Shao, Yanfei Ren
Key Laboratory of Fundamental Science for National Defense for Advanced Machining Technology, Beijing Institute of Technology

- On the basis of high-energy ultrasonic theory, it proposed a method that can regulate residual stress.
- The experimental system based on high-energy ultrasonic is built. The stress regulation of aluminum alloy plate is carried out on this system.
- It found the change regularity of residual stress, and confirm the feasibility of stress control with high-energy ultrasonic.

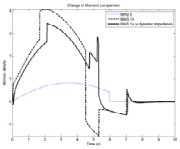


TA1-1(3) 10:00-10:15

Modified Ashworth Scale (MAS) Integrated Adaptive Impedance Control Framework for Upper Extremity Training Platform

Shahrul Naim Sidek[1], Hadi Mat Rosly[1], Hazlina Md Yusof[1], Asmarani Ahmad Puzi[1], Narimah Daud[2], Maziah Mat Rosly[3]
[1]Dept. of Mechatronics Engineering, IIUM, Kuala Lumpur, Malaysia
[2]Dept. of Physical Rehabilitation Sciences, IIUM, Kuantan, Malaysia
[3]Dept. of Physiology, Universiti Malaya,Kuala Lumpur, Malaysia

- Adaptive impedance control
- Upper extremity training
- Muscle assessment
- Modified Ashworth Scale
- Upper extremity training system



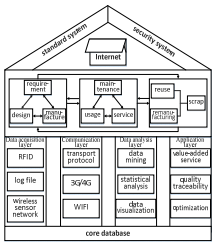
Change in Moment of Elbow Extension

TA1-1(4) 10:15-10:30

A Novel Product Life-cycle Management Architecture of Construction Machinery

Hehong Shen, Qicai Zhou, Jiong Zhao, and Xingchen Liu
School of Mechanical Engineering, Tongji University
Shanghai, China

- Introduction of what is product life-cycle management and the influence among three stages of PLM.
- The concept of Product Life-cycle Management House is raised for the first time, which is the architecture of PLM system.
- Application: Performance Evaluation, Quality Traceability, Value-added Services, and Product Optimizations.
- Case: PLM system of bucket wheel machine



Product Life-cycle Management House

TA1-2:Signal and Image Processing (I)

Session Chairs: T. J. Tarn, Washington University
Enzeng Dong, Tianjin University of Technology

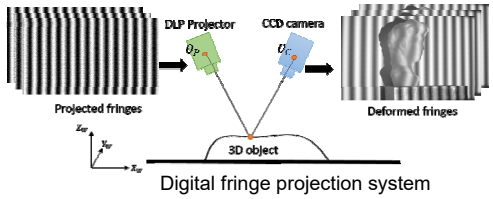
Conference Room 62 on 6th floor, 9:30-10:30, Tuesday, 8 August 2017

TA1-2(1) 9:30-9:45

Binary fringe patterns generation for high-quality digital fringe projection

Yi Xiao, Youfu Li
Department of Mechanical and Biomedical Engineering
City University of Hong Kong, Kowloon, Hong Kong

- Generate binary fringes for digital fringe projection.
- Combine intensity and phase based optimization in dithering optimization.
- High phase quality and robustness to projector defocus levels.



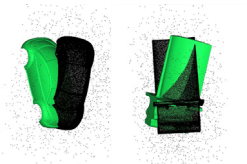
Digital fringe projection system

TA1-2(2) 9:45-10:00

Robust Registration of 3D Point Sets for Free-Form Surface Inspection

Ji Ding, Qiang Liu, Pengpeng Sun and Jian Wang
School of Mechanical Engineering and Automation, Beihang University
Beijing, China

- Robust registration of 3D point sets disturbed by noise for free-form surface inspection
- A robust extension of tangent-squared distance minimization (TDM) method using M-estimation with better robustness and faster convergence speed



(a) Beetle car (b) Turbine blade

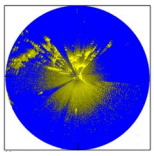
Test Registration Models

TA1-2(3) 10:00-10:15

Research on Rainfall Identification and Rainfall Intensity Retrieval from X-band Navigation Radar Image

Zhizhong Lu, Hong Liu, Rong Zhou, Ying Zhou, Yanbo Wei and Yu Huang
College of Automation, Harbin Engineering University
Harbin, China

- The radar image in different rainfall intensity usually has different echo intensity .
- The method to identify rainfall and retrieve rainfall intensity from X-band navigation radar imageis proposed .
- The experimental results show that it is better to use the occlusion area for rainfall identification and rainfall intensity inversion compared with the whole area.



The Radar Image

TA1-2(4) 10:15-10:30

Classification of Four Categories of EEG Signals Based on Relevance Vector Machine

Enzeng Dong, Guangxu Zhu, Chao Chen
Complex system control theory and application key laboratory,
Tianjin University of Technology, Tianjin, China

- Introduction.
- Detail primary methods including CSP, RVM and the proposed kernel function.
- Show the experimental results and analysis.
- Summary conclusions.

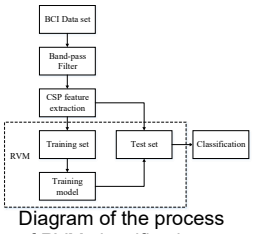


Diagram of the process of RVM classification

TA1-3:Control Theory and Application(I)

Session Chairs: Kaneko Makoto, Osaka University
Zhen Liu, University of Chinese Academy of Sciences

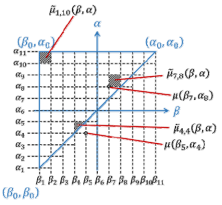
Conference Room 63 on 6th floor, 9:30-10:30, Tuesday, 8 August 2017

TA1-3(1) 9:30-9:45

Adaptive Control of Magnetostrictive Actuators Based on Modified Preisach Model

Tomoyuki Aoyagi, Akira Yonenaga, and Xinkai Chen
System Control Lab., Shibaura Institute of Technology
Saitama, Japan

- Hystresis modeling by using Preisach Model.
- Implementation of Preisach model on computer modified smoothly.
- Adaptive control design for magnetostrictive actuators.
- Effectiveness of the modified model and adaptive control are verified by experiments



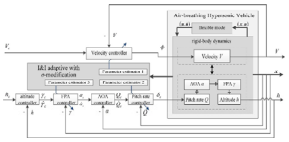
Interpolated Density Function

TA1-3(2) 9:45-10:00

Immersion and Invariance Adaptive Control with σ-modification for Air-breathing Hypersonic

Chao Han, Zhen Liu, and Jianqiang Yi
Institute of Automation, Chinese Academy of Sciences
Beijing, China

- Decompose the longitudinal model of AHV into two subsystems from control viewpoint.
- I&I adaptive controllers with σ-modification are designed for each subsystem based on backstepping.
- The design procedure indicates the proposed method is structured and robust to nonparameteric uncertainties.
- Simulations shows the control system is characterized by good tracking performance and strong robustness.



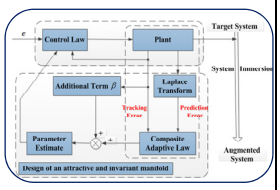
The Block Diagram of the Control System

TA1-3(3) 10:00-10:15

Composite Adaptive Control of Uncertain Nonlinear Systems Using Immersion and Invariance Method

Zhen Liu, Chao Han, Ruyi Yuan, Guoliang Fan, and Jianqiang Yi
Institute of Automation, Chinese Academy of Sciences
Beijing, China

- Two sources of parameter information are combined for the parameter adaptation: tracking-error based adaptation law and prediction-error based adaptation law.
- Representative simulations are carried out, which illustrate the superiority of the proposed composite I&I control scheme over the standard one.



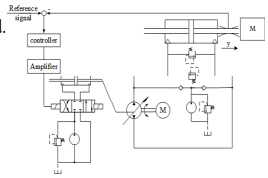
Block Diagram of the Control System

TA1-3(4) 10:15-10:30

Frequency Analysis and PID controller design for a Pump-Controlled Electrical Hydraulic System

Lihua Liang, Zhiwen Le and Jianfeng Li
College of Automation, Harbin Engineering University
Harbin, Heilongjiang, China

- A Pump-Controlled Electrical Hydraulic Servo system is introduced.
- The model of the system is established, and the frequency response is analyzed in frequency domain
- A PID controller is designed for the system.
- The simulation is carried out in real-time domain.



The scheme of the system

TA1-4:Modeling, Simulation Techniques and Methodologies (I)

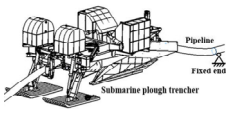
Session Chairs: Arai Tatsuo, Beijing Institute of Technology
Wei Guo, University of Electronic Science and Technology of China
Conference Room 64 on 6th floor, 9:30-10:30, Tuesday, 8 August 2017

TA1-4(1) 9:30-9:45

Study on the Interaction of Pipeline and Soil during Submarine Plough Trencher Working

Xiaodong Xing and Guifu Yu
Harbin Engineering University
Harbin, Heilongjiang, China

- Submarine Plough Trencher can cut a subsea trench and lay a pipeline in it.
- The pipeline is lifted by the mechanical hands to specified height and left inside stingers during the trencher working.
- Study the interaction of pipeline and soil to investigate the deformation and stress of the pipeline.
- The trencher's initial operating position should have enough distance from the fixed end, at least 80m for 24" pipelines.



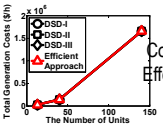
Submarine Pipeline Lifted by Plough Trencher

TA1-4(2) 9:45-10:00

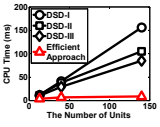
An Efficient Approach for Power System Economic Dispatch with Non-Convex Objectives and Constraints

Lufeng Liu, Lijun Fu, Yan Zhang, and Wanlu Zhu
National Key Lab. of Science and Technology on Vessel Integrated Power System, Naval University of Engineering, Wuhan, China

- Economic Dispatch (ED) determines the power outputs of thermal units to minimize the total generation costs.
- ED with non-convex objectives and constraints is difficult, and existing methods lack efficiency for the task.
- An efficient approach derives from a state-of-the-art DSD method, but possesses comparable effectiveness and superior efficiency to DSD.



Comparable Effectiveness



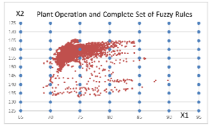
Superior Efficiency

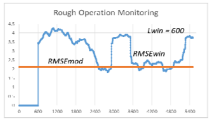
TA1-4(3) 10:00-10:15

Grid Fuzzy Models with Variable Boundaries and their Application to Monitoring of Plant Operations

Gancho Vachkov, Abbas Alili and Manafaddin Namazov
Process Automation Engineering Department, Baku Higher Oil School (BHOS)
Baku, Azerbaijan

- The Grid Fuzzy Models (GFM) include all *Active Fuzzy Rules* that are automatically extracted by the algorithm, based on the concrete D*ata Distribution* in the Input space.
- The proposed Monitoring System uses the GFM created for a known previous operation and compares it with the current operation.



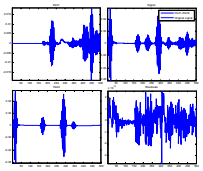


TA1-4(4) 10:15-10:30

Simultaneous Multi-Mode and Disperse Ultrasonic Guided Waves Signal Analysing Using Morphological Componenet Analysis (MCA) Method

Xiang Li, Wei Guo
School of Mechatronic Engineering, University of Electronic Science and Technology of China, Chengdu, Sichuan, China

- The morphology dictionary was constructed by different sub dictionaries.
- Match pursuit decomposition and morphology decomposition and the morphology method could achieve more efficient result.
- The decomposition results were validated by simulation and experiment signals.



Morphological decomposition result

TA1-5:Robot Navigation and Control Algorithm (I)

Session Chairs: Kosuge Kazuhiro, Tohoku University
Yanming Pei, Monash University

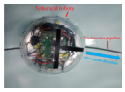
Conference Room 65 on 6th floor, 9:30-10:30, Tuesday, 8 August 2017

TA1-5(1) 9:30-9:45

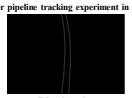
An Underwater Pipeline Tracking System for Amphibious Spherical Robots

Liwei Shi, Zhan Chen, Shuxiang Guo, Ping Guo, Yanlin He, Shaowu Pan, Huiming Xing, Shuxiang Su, Kun Tang
The Institute of Advanced Biomedical Engineering System, School of Life Science, Beijing Institute of Technology, No.5, Zhongguancun South Street, Haidian District, Beijing 100081, China.
Faculty of Engineering, Kagawa University, 2217-20 Hayashi-cho, Takamatsu, Kagawa 760-8521, Japan

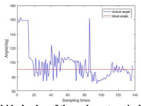
- Based on monocular camera, an underwater detection and tracking system for amphibious spherical robot is proposed to realize autonomous cruise of underwater pipelines.
- The detection of underwater pipeline image includes image gray, image filtering, histogram equalization, image binarization, edge detection and Hough transform.
- In this paper, the actual angle and ideal value of the underwater pipeline for a spherical robot.



Underwater pipeline tracking experiment in the pool



Edge detection



Actual angle and ideal value of the underwater pipeline for a spherical robot

TA1-5(2) 9:45-10:00

A Novel Odometry Model for Wheeled Mobile Robots Incorporating Linear Acceleration

Yanming Pei and Lindsay Kleeman
Department of Electrical and Computer Systems Engineering, Monash University
Melbourne, Australia

- Propose a new fourth parameter that accounts for wheel slip proportional to linear acceleration of a differential driven robot with pneumatic tyres.
- Verify our model using two independent experiments (laser to wall distance and occupancy grid map quality) with an accurate sensor synchronisation technique.
- Use tyre road contact theory as the theoretic basis for our model.

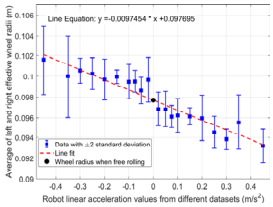


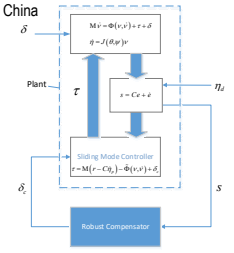
Figure 1. Results with 95% error bars confirming the linear variation of effective wheel radius with acceleration.

TA1-5(3) 10:00-10:15

Underwater Vehicle Near-surface Dynamic Positioning: Compensating Sliding Mode Trajectory with Robust Optimal Controller

Xiaoyang Wang, Xiufen Ye, Chuanlong Li, and Wenzhi Liu
Lab of the Biomimetic Micro Robot and System, Harbin Engineering University
Harbin, Heilongjiang, China

- Sliding mode controller based dynamic positioning system
- Compensating sliding mode trajectory based on a residual model and robust control theory
- Weighting the performance with the reference of wave force model
- Optimize the parameters for promoting the performance



DP Control System

TA1-5(4) 10:15-10:30

Research of USV Obstacle Avoidance Strategy Based on Dynamic Window

Xiaogong Lin and Yang Fu
Department of Automation, Harbin Engineering University
Harbin, Heilongjiang Province, China

- Research on the dynamic window path planning method.
- Deal with the obstacle according to its aspect ratio.
- Put forward a obstacle avoidance stategy based on unknowned environment of dynamic window
- Simulation and analysis.

Unmanned Surface Vessel

TA1-6:Human-System Interaction and Interface (I)

Session Chairs: Vu Minh Nhat, Korea Institute of Science and Technology
Aiguo Ming, The University of Electro-Communications

Conference Room 66 on 6th floor, 9:30-10:30, Tuesday, 8 August 2017

TA1-6(1) 9:30-9:45

Mechanism Design of A Multifunctional Motion Assistant Robot Combined Wheelchair and Exoskeleton

Chuanyin Tian, Zhibin Song, and Tianyu Ma
School of Mechanical Engineering, Tianjin University
Tianjin, China

- A novel motion assistant robot.
- Which can be transformed between wheelchair and exoskeleton.
- Also has the function of supporting people from sitting to standing.
- In order to minimize the weight of the robot, the concept of multi-use of the actuator is proposed, and a minimum number of actuators are used to drive the robot.

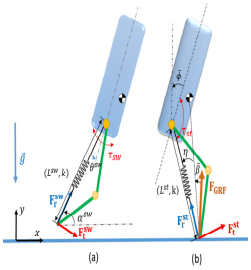
The Multifunctional Robot

TA1-6(2) 9:45-10:00

Walking Control Algorithm of the 5-link robot based on Operational Space Control

Minh Nhat Vu, Jongwoo Lee, and Yonghwan Oh
Korea Institute of Science and Technology

- Inspiring by the Virtual Pendulum concept into the Biped Trunk – SLIP model.
- Implementing the virtual springy leg to 5-link biped model.
- Force direction controller to balance the trunk motion, Velocity – based Leg Adjustment for swing controller
- Robust against disturbance forces, and rough terrain surface, having double peak pattern GRF.
- Matlab and ODE Simulation.



Force Direction Controller

TA1-6(3) 10:00-10:15

The remote operation and environment reconstruction of outdoor mobile robots using virtual reality

Antti Tikanmäki, Tomáš Bedrník, Rajesh Raveendran, Juha Röning
Biomimetics and Intelligent Systems Group,
Faculty of Information Technology and Electrical Engineering,
University of Oulu

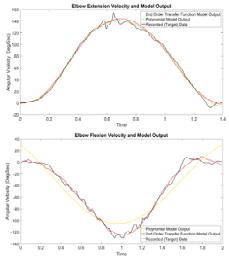
- A system for virtual reality based remote operation is presented
- The real world is reconstructed to the virtual reality using UAVs and UGVs online and interactively
- Operator can control, and draw routes for multiple semi-autonomous robots and study collected world data in VR during the operation

TA1-6(4) 10:15-10:30

Efficient Upper Limb Joint Displacement Modeling using EMG Signal for Driving an Assistive SCARA

Rodrigo Ramon, Ou Bai
Human Cyber-Physical Systems Lab., Florida International University
Florida, United States

- State-dependent kinematic modeling using electromyography (EMG) signals
- Single-joint planar modeling to velocity
- To be used in assistive robotics in neurological rehabilitation
- Efficient kinematic modeling to assure precise intent recognition



TA2-1: Intelligent Mechatronics and Application (II)

Session Chairs: Baofeng Gao, Beijing Institute of Technology
Linshuai Zhang, Kagawa University

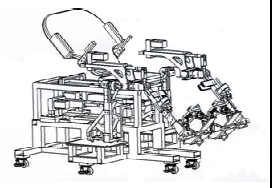
Conference Room 61 on 6th floor, 10:40-12:10, Tuesday, 8 August 2017

TA2-1(1) 10:40-10:55

Passive Training Control for the Lower Limb Rehabilitation Robot

Xianyao Lv, Chifu Yang, Xiang Li, Junwei Han, Feng Jiang
School of Mechatronics Engineering, Harbin Institute of Technology
Harbin, China

- It is difficult to obtain the accurate and complete mathematical model;
- The neural network robust control for the lower limb rehabilitation robot based on the computed torque method is presented in this paper;
- Analysis and the experimental results indict that the proposed algorithm is much more effective and stable than the other control methods when do the passive training.



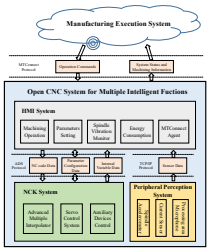
The Lower Limb Rehabilitation Robot

TA2-1(2) 10:55-11:10

Open CNC System Design for Multiple Intelligent Functions Based on TwinCAT and .NET Framework

Pengpeng Sun, Qiang Liu, Ji Ding and Shiwei Pi
School of Mechanical Engineering and Automation, Beihang University
Beijing, China

- A PC-based open CNC system is proposed for multiple intelligent functions.
- Various types of signals are collected for monitoring the machining status.
- The machining information is transferred on line based on MTConnect protocol.



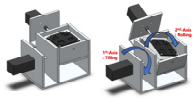
The Open system architecture

TA2-1(3) 11:10-11:25

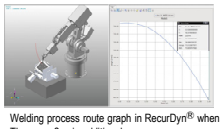
Implementation of a RecurDyn® and LabVIEW® -based 2-Axis Additional Axes (Tilting/Rolling) Strategy on a 6-Axis Articulate Robot for Improving Process Efficiency of Welding

Jun Rak Hong and Won Jee Chung and Seung Kyu Park and Seong Hoon Noh
Robotics & Systems Lab., Changwon National University
Changwon, Korea

- This paper aims to realize 2-axis additional axes, which increases processing efficiency of a robot by controlling in harmful environments or design fields beyond human reach.
- The motion paths of the welding rod will be compared for two cases in order to verify the necessity of the 2-axis additional axes



2-axis additional axes prototype



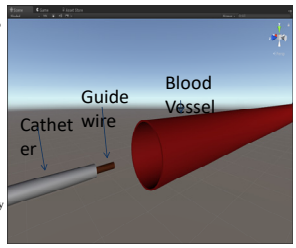
Welding process route graph in RecurDyn® when There are 2-axis additional axes

TA2-1(4) 11:25-11:40

The Virtual Reality Simulator-based Catheter Training System with Haptic Feedback

Shuxiang Guo*1*2, Miao Yu*3, Yu Song*3, Linshuai Zhang*3
*1 Key Laboratory of Convergence Medical Engineering System and Healthcare Technology, The Ministry of Industry and Information Technology, School of Life Science and Technology
*2 Department of Intelligent Mechanical Systems Engineering
*3 Graduate School of Engineering

- The endovascular surgery need the doctor with superb skill in order to not made damage to the patients.
- This training system is cooperated with VR simulator system, which could simulate the movement of the catheter.
- To get the novice surgeons get trained, a controlling device makes training system effective.
- The performance is evaluated from the displacement in VR system and force feedback from haptic device.
- The purposed training system provides a effective way which combined the VR catheter system and force feedback system.



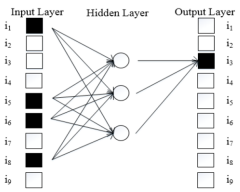
New 3D model based on

TA2-1(5) 11:40-11:55

Short-Term Recommendation With Recurrent Neural Networks

Yan Chu, Fang Huang, Hongbin Wang, Guang Li, and Xuemeng Song
College of Computer Science and Technology, Harbin Engineering University
Harbin, Heilongjiang, China

- Collaborative filtering is a popular recommender algorithm that leverages its predictions and recommendations on the ratings or behaviors of other users.
- We build a recurrent neural network to address the problem concerning on a time sequence and use gated recurrent units in recurrent neural network.
- The network treats a user's recent ratings or behaviors as a sequence, and each hidden layer models a user's rating or behavior which is in order.
- We intergrate the gated recurrent unit with back propagation neural network to increase the prediction accuracy.



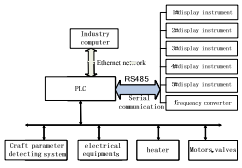
BPNN training model

TA2-1(6) 11:55-12:10

The design of automatic control system for high-temperature and high-pressure reaction tank

Mei-FENG, Liancheng-JIANG
Institute of Chemical Materials, China Academy of Engineering Physics, Mianyang , China

- Overall automatic control and data collecting were executed to the control.
- Automatic, remote controlling and anti-explosive requirements were satisfied.
- Whole produce process were automatically controlled and realized.
- The safety and performance were raised largely compared with before.



Overall structural diagram of control system

TA2-2: Signal and Image Processing (II)

Session Chairs: Sirigrivatanawong, Tohoku University
Peng Wang, Chinese Academy of Sciences

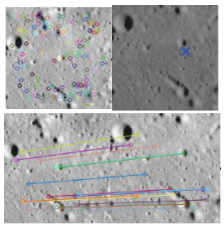
Conference Room 62 on 6th floor, 10:40-12:10, Tuesday, 8 August 2017

TA2-2(1) 10:40-10:55

Planetary Landing Point Tracking Based on Multiple Reference Points

Peng Wang, Zhengke Qin and Wei Zou
Institute of Automation, Chinese Academy of Sciences
Beijing, China

- This paper describes an approach for tracking the objective planetary landing point based on reference points matching and homography.
- The proposed method is evaluated on the datasets of different planets from Google Earth.
- The qualitative tracking result and the quantitative precision evaluation results demonstrate the effectiveness and robustness of the proposed method.



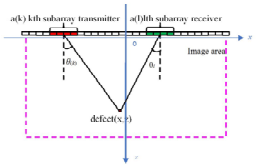
Reference Points matching and tracking

TA2-2(2) 10:55-11:10

Crack like Defect characterization based on the scattering coefficient distribution using ultrasonic arrays

Tao Meng , Benchun Yao, Deguo Wang, Jingpin Jiao
College of Mechanical and Transportation Engineering., China University of Petroleum - Beijing
Beijing, China

- The scattering coefficient calculation model of the defect is built.
- An approach of crack like defect characterization based on the scattering coefficient distribution is developed.
- Results in simulation show that the crack like defect characterization method is effective.



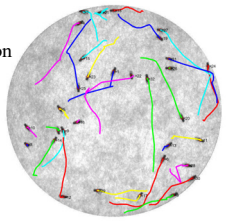
The detection of ultrasonic subarray

TA2-2(3) 11:10-11:25

Multiple Drosophila Tracking with Behavior Classification

Pudith Sirigrivatanawong and Koichi Hashimoto
Graduate School of Information Sciences, Tohoku University, Japan

- Tracking of Drosophila Melanogaster (common fruit fly) is discussed.
- Posture of each fly obtained in detection part assists the program in tracking process.
- The output of a video of multiple flies in a circular arena provides trajectories of each fly that is used for behavior classification.
- Random forest classifier is used to classify the simple behavior of each fly.



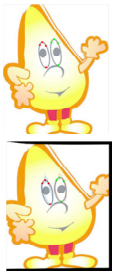
Tracked trajectories

TA2-2(4) 11:25-11:40

Image Deformation Using Modified Moving Least Squares with Outlines

Chong Yu, Xi Chen, Qiwei Xie, Lei Yin, and Hua Han
Institute of Automation, Chinese Academy of Sciences Beijing, China

- Image deformation is an useful technology.
- Most of the traditional methods are based on the deformation of control points, and we extend them to the general control curves.
- We give the closed form solution of the deformation function and compare it with the original control point method. We can see from the experimental result that our modified method is obviously better.



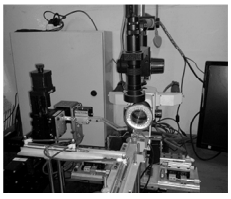
Our deformation method

TA2-2(5) 11:40-11:55

Design Based on Microscopic Vision with Stereo Light Microscope for Gripping Microscopic Objects

Yuezong Wang, Chao Long and Yundong Sun
The College of Mechanical Engineering and Applied Electronics Technology.,
Beijing University of Technology Beijing, China

- The design of micro-gripping system.
- The design of micro gripper.
- The process of gripping wire.
- Spatial positioning of SLM vision system.
- Positioning Experiments and Gripping Experiment.



The System of Micro Gripping

TA2-2(6) 11:55-12:10

Binocular Vision-based Underwater Ranging Methods

Shuxiang Guo , Shangze Chen, Fagen Liu, Xiufen Ye and Hongbiao Yang
Guo Laboratory, Graduate School of Engineering, Kagawa University
Takamatsu, Japan

- Improved a new method for underwater ranging.
- Improved two calibration planes algorithm for monocular camera.
- Use a kind of nonlinear calibration algorithm.
- The ranging method show the better measure precision

A homemade binocular camera

TA2-3: Control Theory and Application(II)

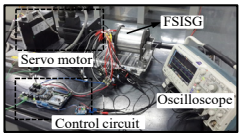
Session Chairs: Perng Jau-Woei, National Sun Yat-Sen University
Vu Minh Nhat, Korea Institute of Science and Technology
Conference Room 63 on 6th floor, 10:40-12:10, Tuesday, 8 August 2017

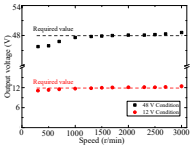
TA2-3(1) 10:40-10:55

Study on the Control Circuits of Flux Switching Integrated Starter and Generator for HEV Application

Minchao Cui[1], Shengdun Zhao[1], Chao Chen[1], Dengzhu Fan[2] and Jing Hao[2]
[1]School of Mechanical Engineering, Xi'an Jiaotong University, China
[2]School of Automobile and Traffic Engineering, Nantong Vocational University, China

- The control circuits were designed based on the working principle of FSISG system.
- In generating mode, the output voltages of FSISG show a high precision and a well stability in wide rotational speed range, which meets the requirement of HEV.
- In starting mode, the output torque of FSISG reaches the required value through the driving of the control circuits.





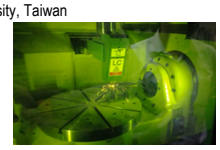
FSISG system of HEV

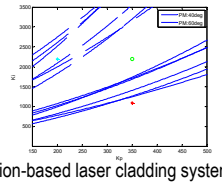
TA2-3(2) 10:55-11:10

Robust Vision-based Controller Design for Laser Cladding Processes

Yi-Horng Lai, Ya-Wen Hsu, Guan-Yan Chen, Der-Min Tsay and Jau-Woei Perng
Department of Mechanical and Electro-Mechanical Engineering,
National Sun Yat-Sen University, Taiwan

- **A practical nonlinear laser cladding processes was modelled as a fuzzy parametric uncertain model.**
- **A fuzzy α-cut representation is used to describe the uncertain parameters of the process.**
- **By using the generalized Kharitonov theorem, the robust PI controller parameters can be obtained from the graphic $k_P - k_I$ parameter plane.**





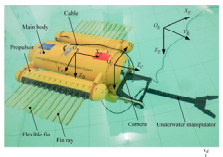
The vision-based laser cladding system

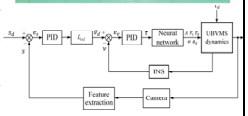
TA2-3(3) 11:10-11:25

Visual Servo Control for Dynamic Hovering of an Underwater Biomimetic Vehicle-Manipulator System by Neural Network

Rui Wang, Yu Wang, Shuo Wang, Chong Tang, and Min Tan
State Key Laboratory of Management and Control for Complex Systems,
Institute of Automation, Chinese Academy of Sciences, Beijing, China

- An underwater biomimetic vehicle-manipulator system with undulatory fins.
- A dual closed-loop visual servo control for dynamic hovering of the underwater robot.
- Calculate the desired controllable velocity according to image feature error using PID and the velocity direction transformation matrix.
- Dynamic inverse model of undulatory fins is established using the neural network.



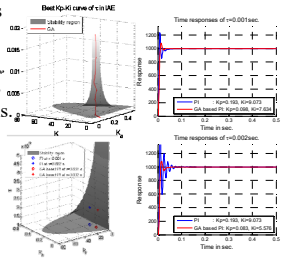


TA2-3(4) 11:25-11:40

PI Speed Controller Design Based on GA with Time Delay for BLDC Motor using DSP

Guan Yan Chen*, Jau-Woei Perng
Department of Mechanical and Electro-Mechanical Engineering
National Sun Yat-sen University, Kaohsiung, 80424, Taiwan

- A GA-based PI control method is implemented on a DSP platform.
- The GA-based PI method found the optimal PI control parameters for different time delay conditions.
- The experimental results show that the transient responses obtained using the proposed control design are better than those obtained using the PI control design.



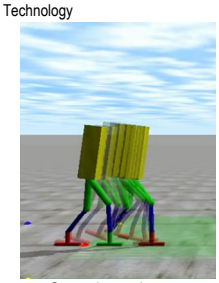
The simulation results at known τ

TA2-3(5) 11:40-11:55

Balancing and Walking Control Algorithm of the Biped Robot with Flat Foot

Minh Nhat Vu, Jongwoo Lee, and Yonghwan Oh
Korea Institute of Science and Technology

- Implementing the virtual springy leg to 7-link biped model.
- Finite State Machine algorithm
- Force direction controller to balance the trunk motion, Velocity – based Leg Adjustment for swing controller, ankle control for push-off and damping the impulsive impact
- Robust walking on rough terrain surface.
- Open Dynamic Engine Simulation



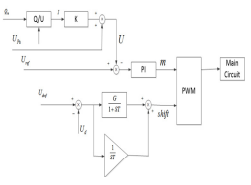
Snapshots show one swing phase motion

TA2-3(6) 11:55-12:10

Study on STATCOM Principle and Control Strategy under Short Circuit Fault

Lian Li ,Xiao Zhang
Tianjin Key laboratory of in electrical engineering ,Tianjin University of Technology
No.391, Binshui Xidao, Xiqing District, Tianjin, China

- The principle and characteristics of Static Synchronous Compensator .
- PWM and voltage control strategy are designed in detail to realize the recovery of system short circuit fault.
- The simulation results show that the proposed control strategy is feasible and effective, which can effectively solve the fault problem and stabilize the system voltage.



Control strategy

TA2-4: Modeling, Simulation Techniques and Methodologies (II)

Session Chairs: Yiming Li, Northeastern University
Jingtai Liu, NanKai University

Conference Room 64 on 6th floor, 10:40-12:10, Tuesday, 8 August 2017

TA2-4(1) 10:40-10:55

Research on Sensor Fault Diagnosis Technology of Dynamic Positioning Vessel Based on Filter and Support Vector Machine

Guoqing Xia, Ting Liu,Weidong Zhong and Juan Li
Department of Automation, Harbin Engineering University
Harbin, Heilongjiang, China

- Sensors have a great impact on vessel reliability in dynamic positioning systems.
- When the sensor fails, the filter can quc detected the faults in real time.
- SVM can identify the fault after the filter detects the faults.

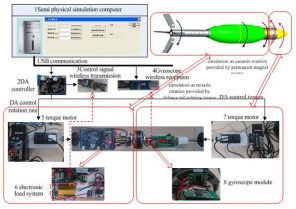
Offshore Oil 201

TA2-4(2) 10:55-11:10

Research on Control scheme of Dual-Spin Projectile with Fixed Canards

Yanru Zhang[1], Wenhui Chen[1], Cheng Guo[1], Zhe zhang[1], Peng Li[2]
[1]Beijing Aerospace Automatic Control Institute
Beijing, China
457133417@qq.com
[2]School of Management
Harbin University of Commerce
Harbin, Heilongjiang Province, China
lipeng@hrbcu.edu.cn

- In order to reduce the cost and volume of the control mechanism, the concept of dual-spin guided mortar is put forward.
- From the purpose of reducing the cost and volume of the control cabin of the guided mortar, the cross canards are replaced by the canards with fixed rudder angle.
- In order to further reduce the cost and volume of the control cabin, the oblique tail is used to modified the skirt tail for providing the roll torque to make the body roll.



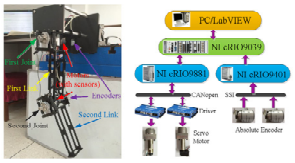
Simulated flight test of dual-spin projectile

TA2-4(3) 11:10-11:25

Design and Parameters Identification of Flexible Joint Robot

Wei Yin[1], Lei Sun[1], Meng Wang[1], Xinwei Chen[2] and Jingtai Liu[1]
[1]Institute of Robotics and Automatic Information System, Nankai University
[2]Minjiang University,Fujian

- Flexible joint robot (FJR) with 2 degrees of freedom
- Design of a compact series elastic actuator (SEA)
- Hardware architecture of FJR parameters value in
- Dynamic model of FJR



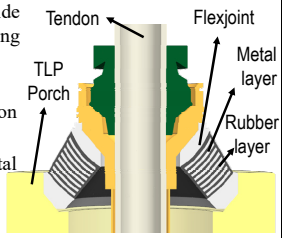
Hardware architecture

TA2-4(4) 11:25-11:40

Study on Non-Linear Static Behavior of the Tendon Connector Flexjoint

Liquan Wang, Songyu Li, Lin Ma, Dong Lv, Wenxue Jin and Luyao Zhang
College of Mechanical and Electrical Engineering, Harbin Engineering University
Harbin, Heilongjiang, China

- The flexjoint is designed to provide flexibility in rotation while bearing vertical load.
- The effects of Poisson's ratio of the rubber on the flexjoint's compression stiffness is studied.
- The effect of the number of the metal layers is also studied.
- The Non-Linear finite element analysis is carried out to simulate the static behavior of the flexjoint.



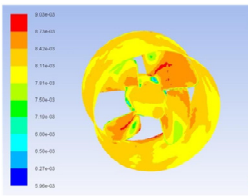
Tendon Top Connector(TTC)

TA2-4(5) 11:40-11:55

Analysis of Multiphase Unsteady Flow in Whole Passage of Bulb Tubular Turbine

Yiming Li, Guiqiu Song*, Yunlei Yan, Gong Zhang
School of Mechanical Engineering & Automation, Northeastern University
Liaoning, China

- Apply pressure correction theory, dynamic mesh of the bulb turbine to simulate a full three-dimensional dynamic channel phase flow turbulence .
- Conducted a complex analytical calculation of sediment particles wear process to obtain the basic law of bulb turbine flow passage components sediment abrasion.



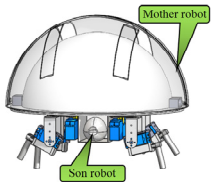
Bulb Hydraulic Turbine

TA2-4(6) 11:55-12:10

Design of a SMA-based Salps-inspired Underwater Microrobot for a Mother-son Robotic System

Shuxiang Guo*†2 , Shan Sun*1 and Jian Guo*1
*1 Tianjin Key Laboratory for Control Theory & Application in Complicated Systems and Biomedical Robot Laboratory, Tianjin University of Technology, Binshui Xidao 391, Tianjin, China
*2 Intelligent Mechanical Systems Engineering Department, Faculty of Engineering
Kagawa University, Takamatsu, Kagawa, Japan

- This paper proposed a novel biomimetic microrobot for a mother-son robot system, which is consisted of an amphibious spherical mother robot and a Salps-inspired son robot.
- In this system, the mother robot supply energy and signal by the wire. The Salps-inspired son robot was actuated by SMA wires, and it was controlled by an independent hardware.
- The son robot could complete the basic movement; floating up and down, rotating and forward. Experimental results shown that the maximum forward speed is 8.5mm/s and the maximum rotating speed is 11.3 ° /s.



The conceptual design of the Mother-son robot

TA2-5: Robot Navigation and Control Algorithm (II)

Session Chairs: Varol Huseyin Atakan, Nazarbayev University
Ogawa Shintarou, Tokushima University

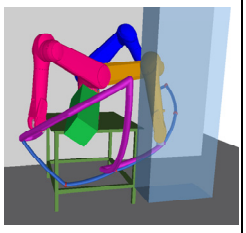
Conference Room 65 on 6th floor, 10:40-12:10, Tuesday, 8 August 2017

TA2-5(1) 10:40-10:55

A Novel RRT*-Based Algorithm for Motion Planning in Dynamic Environments

Olzhas Adiyatov and Huseyin Atakan Varol
Department of Robotics and Mechatronics, Nazarbayev University
Astana, Kazakhstan

- Dynamic environments (changing over time) are prevalent in real world scenarios.
- We are extending our memory efficient RRT*FN algorithm to dynamic scenarios.
- To test the proposed method we conducted an extensive set of benchmark experiments in dynamic environments using two robot models: a non-holonomic mobile robot and an industrial manipulator.



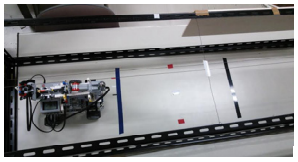
Dynamic motion planning for the industrial manipulator

TA2-5(2) 10:55-11:10

Dual Mode Operation of Electric Vehicles Using an Active Trolley Pole with an Ultrasonic Sensor

Shintarou Ogawa, Yuichi Okumi, Fumiya Fujimoto and Tomohiro Kubo
Graduate School of Advanced Technology and Science, Tokushima University
Tokushima, Japan

- About a method of guiding the trolley pole by an ultrasonic sensor attached to the tip of the pole.
- The trolley pole is connected automatically to the overhead lines.
- Experiments are carried out using a model of about 1/10 scale.



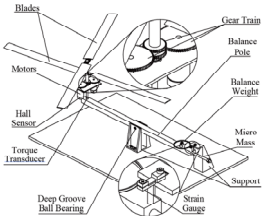
The Experimental Setup

TA2-5(3) 11:10-11:25

Design of Experimental Setups for Evaluating Hover Performance of a Martian Coaxial Rotorcraft

Pengyue Zhao, Zhijun Zhao, Shuitian Chen, Qiquan Quan*, He Li, Deen Bai, and Zongquan Deng
School of Mechatronics Engineering, Harbin Institute of Technology

- Martian atmosphere simulator (MAS) is established to accurately control the air density, pressure, composition and temperature for simulating the Martian atmosphere.
- Seesawed hover stand is mounted in the center of MAS to measure the thrust and power directly for testing the aerodynamic performance of rotor in the hovering state by the counterweight method.



Hover Stand

TA2-5(4) 11:25-11:40

Design of Flight Attitude Control Model for the Mini-quadrotor

Ma Zhongli, Li Huixin, Gu Yanming, Li Qianqian, Li Zuoyong
College of Automation, Harbin Engineering University
Harbin, Heilongjiang, China

- Introducing the flight attitude control system of mini-quadrotor, including design and simulation of calculations and controllers.
- By using distributed multi-sensors, the attitude and horizontal position information of mini-quadrotor is obtained.
- The simulation of the attitude controller is applied with the MATLAB Simulink library.

The Mini-quadrotor

TA2-5(5) 11:40-11:55

A Detection Method Using Ultrasonic Sensors for Avoiding a Wall Collision of Quadrotors

Kenjiro Niwa, Keigo Wtanabe, and Isaku Nagai
Graduate School of natural Science and Technology, Okayama University
Okayama, Japan

- Quadrotors are used for infrastructure inspection.
- A wall surface detection method is presented using ultrasonic sensors, so as to realize collision avoidance between walls and the camera mounted Quadrotors.
- The Omni-directional detection device is developed.
- The produced device can detect all the directions around the airframe.

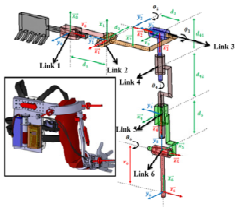
The Omni-directional Detection Device

TA2-5(6) 11:55-12:10

A Novel sEMG Control-based Variable Stiffness Exoskeleton

Yi Liu, Shuxiang Guo, Songyuan Zhang and Luc BOULARDOT
Guo Lab., Kagawa University
Kagawa, Japan

In this paper, a variable stiffness exoskeleton which utilizes EMG signals to adjust the stiffness of the output link to meet different environmental requirements and guarantee the wearer's safety has been proposed. Combining sEMG signals with variable stiffness actuator (VSA) in the proposed exoskeleton, different outputs of stiffness could be realized in a compact and light hardware system.



Schematic of the proposed exoskeleton

TA2-6: Human-System Interaction and Interface (II)

Session Chairs: Ghazi Mustafa, University of Oklahoma
Zhibin Song, Tianjin University

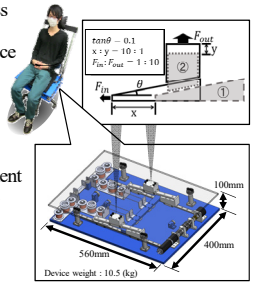
Conference Room 66 on 6th floor, 10:40-12:10, Tuesday, 8 August 2017

TA2-6(1) 10:40-10:55

Development of Thin-type Rocking Device Mounted on Office Chair for Supporting Falling Asleep

Junpei MAEDA, Hiroto SHINOHARA, and Shigeru WESUGI
Graduate School of Creative Science and Engineering, Waseda University, Tokyo, Japan

- Decreases of work efficiency by sleepiness during daytime
- Significance of the short nap that can reduce sleepiness of an office worker
- High effect of inducing sleep by vibrating whole-body in running a train
- Thin-type rocking mechanism based on wedge effect and counter balance which can be available in office environment
  - High thrust to move a person of 100kg with only 2.93 kgf output of motor
  - Adjustable vibration conditions according to user's preference
    Amplitude : up to 15 mm
    Frequency : up to 2 Hz



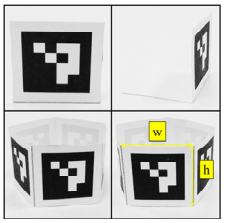
Rocking device based on wedge mechanism

TA2-6(2) 10:55-11:10

Vision-Based Motion Capture System for Tracking Crawling Motions of Infants

Mustafa A. Ghazi*, Lei Ding*, Andrew H. Fagg*, Thubi H. Kolobe** and David P. Miller*
*University of Oklahoma, Norman, Oklahoma, USA
**University of Oklahoma Health Sciences Center, Oklahoma City, Oklahoma, USA

- Motivation: new mode of intervention for infants with motor disabilities
- Design: inspired by markers used in Augmented Reality (AR)
- Novelty: our approach comprises a system of wearable bracelets
- Results: preliminary results are consistent with the requirements for tracking crawling motions in infants



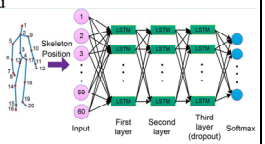
Our bracelet design is more visible after rotation

TA2-6(3) 11:10-11:25

Sequential Learning for Multimodal 3D Human Activity Recognition with Long-Short Term Memory

Kang Li, Xiaoguang Zhao, Jiang Bian, and Min Tan
The State Key Laboratory of Management and Control for Complex System,
Institute of Automation, Chinese Academy of Sciences, Beijing, China

- In this paper, we present a three-layer LSTM feature learning method for human activities recognition.
- The proposed recognition algorithm focuses on design and implementation of fully human skeleton feature self-learning.
- Experimental results on a publicly available UTD multimodal human activity dataset demonstrate the effectiveness of the proposed recognition method.



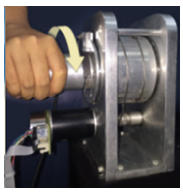
The three-layer LSTM network for 3D human activity recognition

TA2-6(4) 11:25-11:40

A Novel Concept and Impedance Schematic Analysis for Nonlinear Stiffness Compliant Actuator (NSCA)

Dong Gao, Zhibin Song, and Yaru Zhao
School of Mechanical Engineering, Tianjin University
Tianjin, China

- A novel concept: low load, low stiffness; high load, high stiffness.
- Nonlinear stiffness compliant actuator verifies it is unnecessary to decouple contact force and stiffness of VSA.
- Impedance control tests the performance of NSCA via simulations and experiments.



NSCA

TA2-6(5) 11:40-11:55

The Effect of Visual Stimuli on Auditory Detection in a Auditory Attention Task

Jingjing Yang[1] , Xiujun Li[1], Qi Li[1] ,Xinwei Xiao[1],Qiong Wu[2] and Jinglong Wu[2]
1 School of Computer Science and Technology, Changchun University of Science and Technology, China
2 Graduate School of Natural Science and Technology, Okayama University, Japan

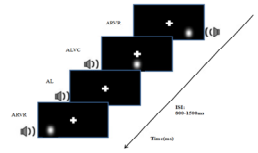


Fig. Experimental arrangement of the display and speakers. The participants' task was to attend only to the auditory modality and instructed to indicate whether a auditory stimulus appeared in the left or the right hemispace

•we investigated the effect of visual spatial information on auditory detection in a auditory attention task.

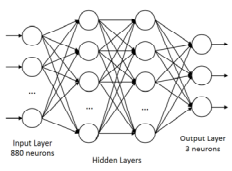
•The auditory stimuli were presented through two speakers that was placed on the left and right of the display.The visual stimuli were presented on the left (-8°), right (+8°) or central (0°) locations.Visual stimuli and auditory stimuli were presented in a consistent or inconsistent position. From the results, the responses to consistent audiovisual stimuli were faster and more accurate than inconsistent stimuli.

TA2-6(6) 11:55-12:10

Brain Activity Recognition with a Wearable fNIRS Using Neural Networks

Gauvain Huve, Kazuhiko Takahashi, and Masafumi Hashimoto
Doshisha University
Kyoto, Japan

- Usage of fNIRS to measure the frontal cortex activity
- Stimulation of the brain through mental exercises: subtractions, word generation, and rest
- Recognition of the fNIRS signals using deep neural networks and convolutional neural networks
- Recognition rate of 64% was achieved by deep neural network



TP1-1: Intelligent Mechatronics and Application (III)

Session Chairs: Baofeng Gao, Beijing Institute of Technology
Miao Yu, Kagawa University

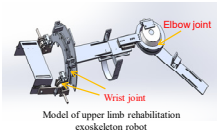
Conference Room 61 on 6th floor, 13:30-15:00, Tuesday, 8 August 2017

TP1-1(1) 13:30-13:45

Design and Evaluation of a 3-degree-of-freedom Upper Limb Rehabilitation Exoskeleton Robot

Baofeng Gao[1*], Hongdao Ma[1], Shuxiang Guo[1,2*], Hao Xu[1], Shu Yang[1]
1. Key Laboratory of Convergence Medical Engineering System and Healthcare Technology, the Ministry of Industry and Information Technology, School of Life Science, Beijing Institute of Technology, No.5, Zhongguancun South Street, Haidian District, Beijing, China.
2. Faculty of Engineering, Kagawa University, 2217-20 Hayashi-cho, Takamatsu, Kagawa, Japan.

- A 3-degree-of-freedom upper limb rehabilitation exoskeleton robot is developed to provide continuous, effective and multimodal rehabilitation training for patients with hemiplegia.
- Compared with the previous device, this robot can overcome some shortcomings. And it is designed to be flexible, portable, light weight, high accuracy and easy to wear.
- The application of flexible transmission can greatly reduce the burden on patient's arm, but it may lead some errors in accuracy. Therefore, a experiment to test and analyze the error has conducted and the result shows that the robot works with a high accuracy.



Model of upper limb rehabilitation exoskeleton robot

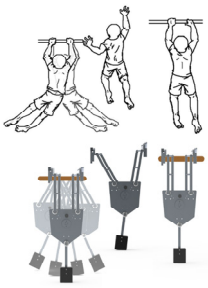

The patient wearing the robot

TP1-1(2) 13:45-14:00

Design and Swing Strategy of a Bio-Inspired Robot Capable of Transverse Ricochetal Brachiation

Chi-Ying Lin*, Shr-Jie Shiu, Zong-Han Yang, and Rong-Shen Chen
Advanced Systems and Controls Lab., National Taiwan University of Science and Technology
Taipei, Taiwan

- A novel bio-inspired robot inspired by the "cliffhanger challenge" in a Japanese TV show Sasuke.
- Use strategy of resonant excitation to achieve transverse ricochetal brachiation.
- Develop a dynamic model to validate the swing strategy and confirm its efficacy with ADAMS simulation.
- Experiments demonstrate the feasibility of this first generation robot.

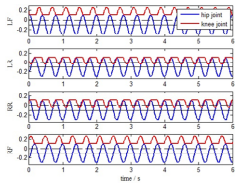


TP1-1(3) 14:00-14:15

Hopf Oscillator Based Adaptive Locomotion Control for A Bionic Quadruped Robot

Handi Liu, Wenchuan Jia, Liangyu Bi
School of Mechatronical Engineering and Automation, Shanghai University
Shanghai, China

- Design an adaptive locomotion controller for a quadruped robot based on CPG.
- Generate natural gait patterns by constructing a symmetrically netted CPG model and realize smooth gait transition by introducing rotation matrix.
- Modulate motion states on the slope through adopting the body attitude as sensory feedback to CPG network.


Control signals during up-slope motion

TP1-1(4) 14:15-14:30

Development of a Chained barrel-shaped ELSA for a Pneumatic Corset aim to prevent a Muscle Weakening

Yutaro Usui, Yasutaka Nishioka, Toshihiko Yasuda, and Mitsuhiro Yamano
Mechatronics Lab., University of Shiga prefecture
Hikone, Japan

- A corset for lower back pain has a problem as a muscle weakening by wearing for a long time.
- We proposed the corset built pneumatic soft actuators (ELSA) and has on/off switching function in order to solve the problem.
- We instituted the EMG experiment to show the performance evaluation of the corset.
- We designed a new structure of the actuator (Chained barrel-shaped ELSA) to improve the responsiveness.

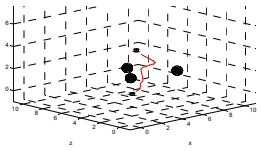

The corset and ELSA

TP1-1(5) 14:30-14:45

The Hybrid Automatic Control of a Quadrotor in Non-deterministic Environments

Denis Beloglazov*, Valery Finaev*, Igor Shapovalov*, Viktor Soloviev*, and Ivan Polovko**
*Department of Automatic Control Systems, **Department of Security in Data Processing Technologies, Southern Federal University
Taganrog, Russia

- A two-loop control system is proposed.
- The flight path planning using fuzzy logic is performed in the outer loop.
- The altitude and orientation angles required to implement the planned path are calculated in the inner loop using PID controllers.


3D trajectory of quadrotor.

TP1-1(6) 14:45-15:00

Simulation of Composite Electric Power for Electric Vehicles

Ruiyang Xu, Yunliang Wang
Key Research Laboratory for Control Theory & Applications in Complicated Systems
Tianjin University of Technology
Tianjin, China

- Design to a new energy storage system for electric vehicles
- DC / DC converters in composite power supplies use parallel staggered technology
- Using method of fuzzy control to achieve energy management strategies


Energy storage system

TP1-2: Signal and Image Processing (III)

Session Chairs: Jin Guo, National University of Singapore
Li Su, Harbin Engineering University

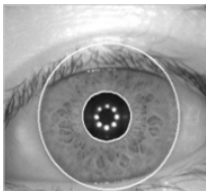
Conference Room 62 on 6th floor, 13:30-15:00, Tuesday, 8 August 2017

TP1-2(1) 13:30-13:45

Location Based on Regional Property and Iterative Searching

Li Su, Junjie Wu, Qian Li and Zhilin Liu
College of Automation, Harbin Engineering University Harbin, Heilongjiang, China

- The important part of iris recognition is iris location, whose precision directly affects the accuracy of iris recognition.
- An iris location algorithm based on regional property and iterative searching is presented in this paper.
- The experimental results show that more accurate iris inner edge location can be achieved and a range of comprehensive advantages of faster location speed and higher location accuracy are.



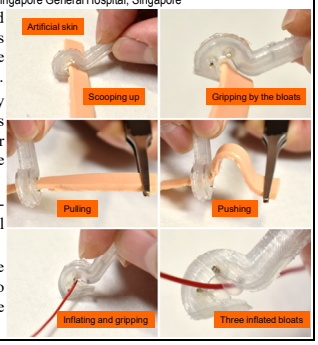
The Iris Location

TP1-2(2) 13:45-14:00

Design and Fabrication of a Pneumatic Soft Robotic Gripper for Delicate Surgical Manipulation

Jin Guo, Yi Sun, Xinquan Liang, Jin-Huat Low, Yoke-Rung Wong, Vincent Shian-Chao Tay, Chen-Hua Yeow
Department of Biomedical Engineering, National University of Singapore, Singapore
Department of Hand Surgery, Singapore General Hospital, Singapore

- A new soft robotic gripper is designed to minimize the risk of soft tissues damage due to the over-gripping force generated by the conventional forceps.
- Three-fingers-like bloats can firmly grip the soft tissues by multi-contacts between the tissues and the gripper when the air pressure is applied to the pneumatic channel.
- The hook structure allows scooping-up motion during delicate surgical manipulation.
- The gripping tests and pulling force sensing experiments are carried out to evaluate the performance of the proposed soft robotic gripper.

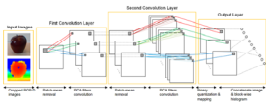


TP1-2(3) 14:00-14:15

RGB-D Object Recognition based on RGBD-PCANet Learning

Shiying Sun[1,2], Xiaoguang Zhao[1], Ning An[1,2] and Min Tan[1]
1. State Key Laboratory of Management and Control for Complex Systems, Institute of Automation, Chinese Academy of Sciences, Beijing, China
2. University of Chinese Academy of Sciences, Beijing, China

- A simple deep learning method namely RGBD-PCANet is proposed for object recognition effectively.
- The original PCANet method is extended to deal with the preprocessed RGB and depth images.
- Experiments on Washington RGB-D Object dataset demonstrate the effectiveness and the runtimes are low without GPU acceleration.



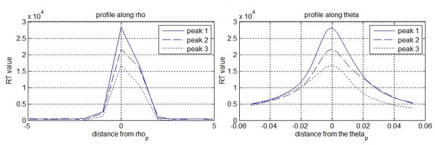
The block diagram of RGBD-PCANet method

TP1-2(4) 14:15-14:30

Detection of Radon Peaks with Matched Filters

Liying Zheng, Yan Chu, and Kai Tian
Harbin Engineering University
Harbin, Heilongjiang, China

- Point out that the profiles of an RT peak along its ρ-axis can be approximated by a triangular function.
- Point out that the profiles of an RT peak along θ-axis can be approximated by a cosecant function.
- Design two 1-D matched filters to enhance RT peaks.



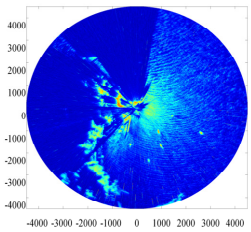
The profiles of three RT peaks

TP1-2(5) 14:30-14:45

A Design of Target Detector Based on Fractal Difference Value

Zhizhong Lu, Gen Pian, Yanbo Wei and Yu Huang
College of Automation, Harbin Engineering University
Harbin, China

- The importance of the research on target detector.
- Introduce The Fractal Method of Sea Clutter.
- Present the novel Target Detector Based on Fractal Difference Value.
- Show the validity of the novel method with the required radar data.

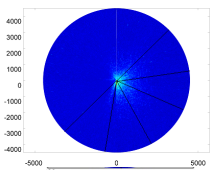


TP1-2(6) 14:45-15:00

Research on Retrieving Wave Height from Radar Shadow Images Based on Wind Angle Feature

ZhiZhong Lu, YaJuan Wang , Yujian Yuan, YanBo Wei and Yu Huang
College of Automation, Harbin Engineering University
Harbin, China

- The radar image in different wind angle usually has different echo intensity .
- The method to retrieve wave height based on the wind angle feature is proposed .
- The experimental results show that the novel method shows better performance in estimation wave height compared with the existing method.



The original radar image is divided according to the wind angle

TP1-3: Control Theory and Application(III)

Session Chairs: Yanlin He, Beijing Institute of Technology
Jian Guo, Tianjin University of Technology

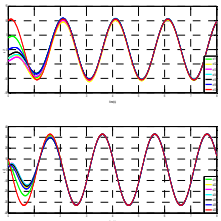
Conference Room 63 on 6th floor, 13:30-15:00, Tuesday, 8 August 2017

TP1-3(1) 13:30-13:45

Distributed Event Triggered Control with State Dependent Threshold for Leader Following Consensus of General Linear Multi Agent Systems

Bekhadda Nacera, Wu QingHe, Du Changkun
School of Automation, Beijing Institute of Technology, Beijing 100081, China.

- In this paper, an event triggered strategy is proposed to achieve the tracking consensus for general linear multi agent systems under undirected graph. Where, no need for continuous communication in either controller updates or triggering condition monitoring.



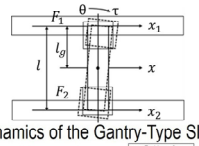
The States of agents

TP1-3(2) 13:45-14:00

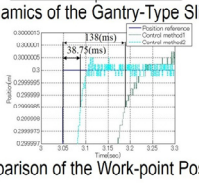
Consideration on Control Method of the Large-sized Gantry-Type Linear Motor Slider

Tetsuya Ojiro*, Hideki Honda*, Tsuyoshi Hanamoto*, and Kazuhiro Tsuruta**
*Kyushu Institute of Technology, Kitakyushu City, Japan
**Kyushu Sangyo University, Fukuoka City, Japan

- We improved control performance of the large-sized gantry-type linear motor slider.
- Mechanical distortion in the slider cause the axes of the slider a unique problem with the mutually repulsive forces, and generated vibration under high feedback gain.
- These problem are suppressed if the distortion compensator and disturbance observer are used, and shortens the settling time.



Dynamics of the Gantry-Type Slider



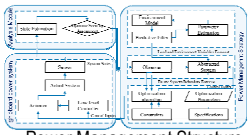
Comparison of the Work-point Position

TP1-3(3) 14:00-14:15

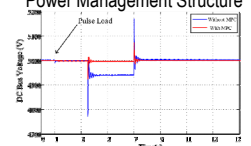
System-Level Dynamic Power Management for Islanded DC Microgrid with Pulse Load

Wanlu Zhu[1]; Wugui Wang[2]; Lijun Fu[1]
1. National key laboratory of Science and Technology on Vessel Integrated Power System, Naval University of Engineering, Wuhan, Hubei
2. China Ship Development and Design Center Wuhan, Hubei, China

- A novel system-level dynamic power management strategy for islanded DC microgrid to reduce the adverse impact of pulse load.
- The power management problem is formulated as an optimization problem based on the concept of Model Predictive Control.
- Simulation results show that the system DC bus voltage response is greatly improved after pulse load disturbance by using this strategy.



Power Management Structure



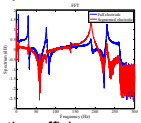
DC Bus Voltage Simulation Result

TP1-3(4) 14:15-14:30

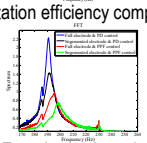
Lateral Vibration Modal Control of a Smart Cantilever Beam by Electrode Configuration of Piezoelectric Actuator

Chi-Ying Lin*, Wei-Ting Chen and Yu-Hsi Huang
Advanced Systems and Controls Lab., National Taiwan University of Science and Technology
Taipei, Taiwan

- Active vibration control based on electrode configuration of piezoelectric actuator.
- Comparison with PD and PPF control.
- Effective suppression of first lateral mode vibrations in a smart cantilever beam.



Excitation efficiency comparison



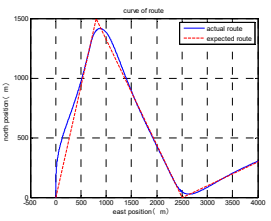
Experimental results

TP1-3(5) 14:30-14:45

Way-point Tracking Control for Air Cushion Vehicle

Yuanhui Wang, Ran Ge
Department of Automation, Harbin Engineering University
Harbin, China

- Build motion mathematical model of ACV.
- Design way-point tracking strategy.
- Design ADRC controller whose parameters are tuned by genetic algorithm.

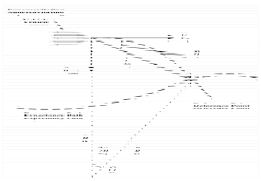


TP1-3(6) 14:45-15:00

An Optimal Nonlinear Guidance Logic for the Trajectory Tracking of Supercavitating Vehicles

Jia Song, Ke Gao, and Erfu Yang
School of Astronautics, Beihang University
Beijing, China

- An optimal nonlinear midcourse guidance logic is proposed by considering the wake terminal guidance and the remote target attack tasks.
- It is optimized by using an efficient genetic algorithm to obtain its optimal parameters.
- The simulation results suggest that the guidance logic can meet both the motion requirements and navigation constraints.



The Design of Guidance Law

TP1-4: Modeling, Simulation Techniques and Methodologies (III)

Session Chairs: Wei Guo, University of Electronic Science and Technology of China
Zixu Wang, Kagawa University

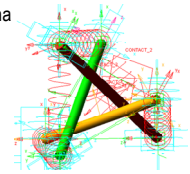
Conference Room 64 on 6th floor, 13:30-15:00, Tuesday, 8 August 2017

TP1-4(1) 13:30-13:45

Three-bar tensegrity structure analysis of the axial folded way

Heping Liu, Xiaohui Yang and Ani Luo
Mechanical and Electrical Engineering., Harbin Engineering University
Harbin, China

- This paper studies a kind of three-bar tensegrity cable-driven axial folded structure.
- Establishing the mathematical model of three-bar tensegrity structure.
- Analysis of the program of the folding structure.
- Verify the feasibility of the folding program by ADAMS simulation



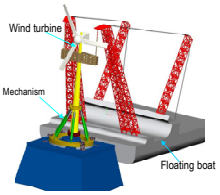
Three-bar tensegrity

TP1-4(2) 13:45-14:00

Design and Research of a New of Installation Equipment for Offshore Wind Power Turbine

Chunxiang Ma, Miaoqi Zheng, Rui Liang
School of Mechanical and power Engineering
Shanghai Jiao Tong University
Shanghai, China

- It consists of lower platform, six hydraulic cylinders, and the upper platform.
- The upper platform and lower one are connected by six hydraulic cylinders.
- These three groups are installed uniformly on a circle of 5000mm. In the groups on the upper platform, the angel between spherical hinges is 30 degree.



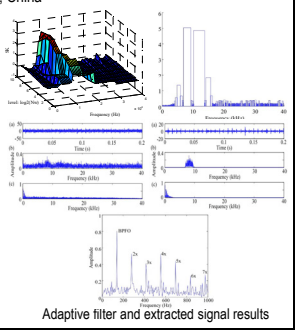
A new type of installation equipment

TP1-4(3) 14:00-14:15

Extraction of Weak Transient Signals based on Adaptive Window Merging for Rolling Bearing Fault Diagnosis

Wei Guo, Lingjian Huang, Ming J Zuo
School of Mechatronics Engineering, University of Electronic Science and Technology of China, Chengdu, China

- Problem of local and weak defect detection in rotating machinery.
- Adaptively select the filter parameters, i.e. the center frequency and the band width.
- Optimal center frequency: identify the frequency with the maximal energy.
- Optimal band width: compare the energy changes of two adjacent windows and merging these windows.
- Extraction of weak transient signals and comparison with kurtogram.



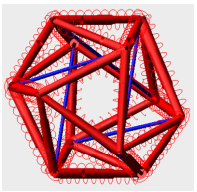
Adaptive filter and extracted signal results

TP1-4(4) 14:15-14:30

Compression Process Research of 6-bars Tensegrity Structure

Ani Luo,Haoyu Yang,Heping Liu,Yuxuan Liu
College of Mechanical and Electrical Engineering., Harbin Engineering University
Harbin, Heilongjiang, China

- Make a compression test of a 6-bars ball-shaped tensegrity structure.
- The motion laws of each component and node in the compressed process have symmetry.
- The self-constriction and extension of the structure can be achieved only by reducing the length of 6 cables by 46.73%.



6-bars ball-shaped tensegrity structure

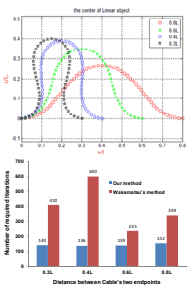
TP1-4(5) 14:30-14:45

Static Modelling and Simulation of Linear Object Based on Differential Geometry and Discrete Cosine Transform

Chen Luo, Zhijie Mo , Mengliang Kuang and Yijun Zhou
School of Mechanical Engineering, Southeast University, Nanjing, China

Due to Discrete Cosine Transform (DCT)'s strong "energy compaction" property, the proposed model has following benefits:

- Reduce the involved number of unknown parameters (~40% reduction compare with existing model).
- Maintained modelling accuracy.
- Improve model calculation efficiency (see right panel).
- Insensitive to initial model inputs and Increase the model reliability.



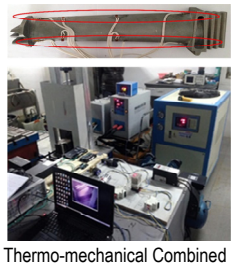
Method comparison

TP1-4(6) 14:45-15:00

Effects of Thermal and Mechanical Combined Load on Blade Stress and Fatigue Life Characteristic

Hao Lin, Haipeng Geng, Hao Li, Xiangming Xu, Tingchen Du, Hao Lv, Lie Yu
Mechatronics State Key Laboratory for Strength and Vibration of Mechanical Structures
Xi'an Jiaotong University
Xi'an, China

- Thermo-mechanical finite element simulation results based on the stress and fatigue life have been obtained.
- The thermo-mechanical fatigue experiment is carried out in the experiment system with the real full scale blade.
- A nonlinear Gauss fitting expression between the fatigue life cycle number and the vibration frequency of the high cycle load is given.



Thermo-mechanical Combined Fatigue Experiment System

TP1-5: Mobile Robot System (I)

Session Chairs: Shuxiang Guo, Kagawa University
Huiming Xing, Beijing Institute of Technology
Conference Room 65 on 6th floor, 13:30-15:00, Tuesday, 8 August 2017

TP1-5(1) 13:30-13:45

Design of a Compact and Dexterous Quadruped Robot

Jiang Yang, Wenchuan Jia*, Yi Sun, Huayan Pu,
Shugen Ma, Li Chen and Bin Han
Shanghai Key Laboratory of Intelligent Manufacturing and Robotics, Shanghai University
Shanghai, China

- Using ball screw transmission and four-bar linkages mechanism as the knee driving setup of a quadruped robot.
- The greater the degree of the knee stretch is, the smaller the driving force of the knee motor is.
- when a foot is under a load of about 200N, similar to the weight of the robot, the structural strength of the leg is still enough.

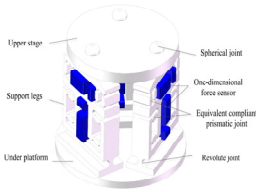
ProGo

TP1-5(2) 13:45-14:00

Stiffness Analysis and Verification of One 3 - RPS Parallel Sensor

Liangyu Bi, Wenchuan Jia, Yi Sun, Shugen Ma, Handi Liu
School of Mechatronic Engineering and Automation
Shanghai Key Laboratory of Intelligent Manufacturing and Robotics
Shanghai University

- Theoretical calculation of stiffness of six - dimensional force sensor.
- Finite element simulation analysis of six - dimensional force sensor stiffness.
- Experimental verification of stiffness of six - dimensional force sensor.



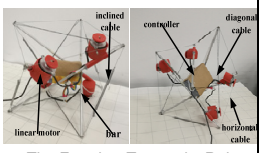
The 3 - RPS Parallel Sensor

TP1-5(3) 14:00-14:15

Four-bar tensegrity robot based on ADAMS simulation

Ani Luo, Jiandong Wang and Heping Liu
College of Mechanical and Electrical Engineering ,Harbin Engineering University
Harbin, Heilongjiang,China

- The four-bar tensegrity robot consists of 4 bars , 12 cables and 4 diagonal cables added to the two end face.
- It's through the length change of diagonal cables to drive the overall shape of the structure to change, so as to realize the rolling of the robot.
- Through simulation analysis, find the robot's problem of motion deviation and its rolling performance under the double end face's deformation is better than that under the single end face's deformation.



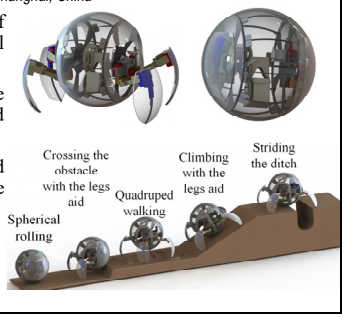
The Four-bar Tensegrity Robot

P1-5(4) 14:15-14:30

Design and analysis of a transformable spherical robot for multi-mode locomotion

Zhongshu Huang, Wenchuan Jia*, Yi Sun, Shugen Ma, Zhiwei Wang, Huayan Pu, Yingzhong Tian
School of Mechatronic Engineering and Automation, Shanghai University
Shanghai, China

- The mechanical structure of a transformable spherical robot is proposed.
- The robot moves in the spherical rolling mode and quadruped walking mode.
- The robot moving in hybrid driving mode shows the better mobile performance.

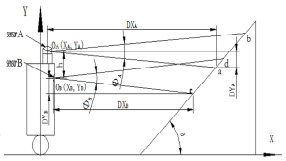


TP1-5(5) 14:30-14:45

A Rapid Impassable Terrain Recognition Algorithm for Mobile Robot Based on Hypotheses Testing theory

Yang Gao, Xueyi Wu, Yu Liu and Laijun Wang
School of Automobile,Chang'an University,
Xi'an, Shaanxi Province,China

Different type of cheap range finders with different diffusion angle and inaccurate measuring could be used in the slope recognition task. Historical recognition result is used to decrease the influence of inaccurate recognition according to the Hypothesis testing theory.

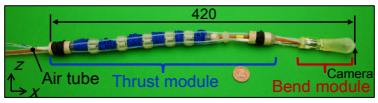


Impassable Terrain Recognition

TP1-5(6) 14:45-15:00

Development of In-pipe Robot with Extension Hose and Balloons

Koki Nomura, Mamoru Sato, Hiromi Takeuchi, Konno Minoru, Toriumi ryoichi,
Hiroyuki Ishii, and Atsuo Takanishi
Robotics Research Lab., Waseda University
Tokyo, Japan



WATER-1

- A novel in-pipe robot that moves like an inchworm by using an extension hose and variable diameter balloons was developed.
- The robot can move horizontally and vertically in pipes having an inner diameter of both 28 mm and 53 mm.

TP1-6: Humanoid Robot System

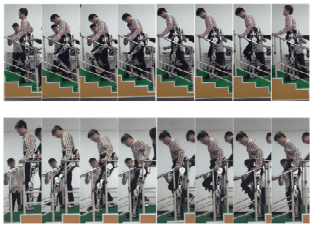
Session Chairs: Yili Fu, Harbin Institute of Technology
Songyuan Zhang, Harbin Institute of Technology
Conference Room 66 on 6th floor, 13:30-15:00, Tuesday, 8 August 2017

TP1-6(1) 13:30-13:45

Adaptive Stair-Ascending and Stair-Descending Strategies for Powered Lower Limb Exoskeleton

Fashu Xu, Xichuan Lin, Hong Cheng, Rui Huang, Qiming Chen
Machine Intelligence Institute, University of Electronic Science and Technology of China
ChengDu, China

- Sizes of stairs are perceived automatically;
- Trajectories are programed according to the stair adaptively;
- ZMP is calculated to ensure safety;
- The practicability and universality are testified by the SCIs patients

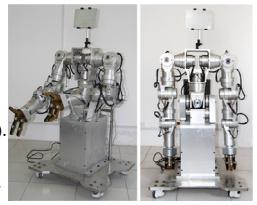


TP1-6(2) 13:45-14:00

Tradeoff between Safety and Performance for Humanoid Rehabilitation Robot Based on Stiffness

Jian Li, Shuai Li, Siqi Li and Xuefei Mao
Key Laboratory for Intelligent Control and Decision on Complex Systems,
School of Automation, Beijing Institute of Technology, Beijing, China

- A humanoid rehabilitation robot is developed with compliant joints.
- Propose a method to describe the nonlinear model of human-robot collision with effective mass and stiffness at robot's end-effecter(EE).
- The safety can be guaranteed by passive mechanical compliance and compromising performance.
- The design criteria and stiffness selection method of spring in the joint are proposed.



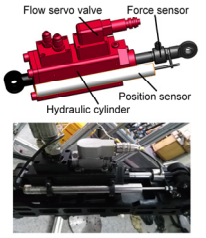
Humanoid Rehabilitation Robot

TP1-6(3) 14:00-14:15

Research on Impedance Control Based on Force Servo for Single Leg of Hydraulic Legged Robot

Yili Fu, Jianwen Luo, Danmei Ren, Haitao Zhou, Xu Li, Songyuan Zhang
The State Lab of Robotics and Systems, Harbin Institute of Technology
Harbin, China

- A force servo based impedance controller for the hydraulic legged robot has been presented.
- A novel velocity compensation algorithm which makes for elimination of the redundant forces is also included.
- A double hydraulic cylinders experiment platform was implemented.
- Experimental results have shown a good performance of the impedance controller which allows arbitrary virtual stiffness and dampingof the leg.



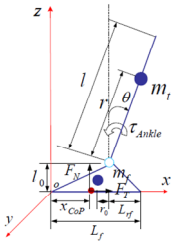
The hydraulic servo unit and its model

TP1-6(4) 14:15-14:30

Balance Recovery Analysis with Constraints of Feet-ground for Biped Robot

Wei Yu[1, 2], Rong Zhuang[2], Zhijiang Shao[1]
1. College of Control Science and Engineering, Zhejiang University, HangZhou , China
2. Department of Control Engineering HuaDian Electric Research Institute, HangZhou , China

- Analyze the relationship between feet-ground, the friction and the CoP constraints with balance recovery.
- Investigate the satisfaction of these constraints imposed bounds on the control torque.
- Put forward the friction coefficient and foot length/height affect the joint torques to balance recovery.
- Provide theoretical guidance for robot mechanism design.



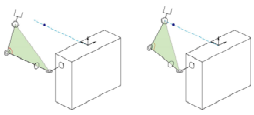
Model of a planar humanoid robot

TP1-6(5) 14:30-14:45

Direction Consistent Approach for Telepresence System with Miniature Humanoid Robot

Sho Owada and Yuichi Tsumaki
Department of Mechanical Systems Engineering, Yamagata University
Yamagata, Japan

- A telepresence system that aims to provide a tactile sense by Rubber Hand Illusion (RHI) is introduced.
- A direction consistent approach is proposed to provide a natural feeling for the operator and correct gesture perception by the remote person even if the robot avatar has different kinematic parameters.



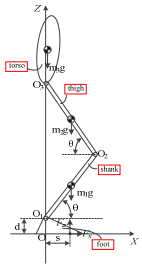
Direction Consistent Approach

TP1-6(6) 14:45-15:00

Trajectory Planning and Control for Hopping Robot at the Stance Phase

Qiang Wei[1], Minzhou Luo[1], Jianghai Zhao[2] and Fayong Guo[2]
1.Department of Automation,University of Science and Technology of China, Hefei China
2.Institute of Advanced Manufacturing Technology Hefei Institutes of Physical Science, Chinese Academy of sciences, Changzhou , China

1. A planar robot model with articulated legs is presented, and corresponding dynamics are derived.
2. We discuss a ZMP (Zero moment point)-based trajectory planning for hopping robots at the stance phase.
3. A fuzzy control system is developed to track the generated ZMP trajectory and realize stable hopping motion.
4. The effectiveness of the proposed model and control scheme is verified through the simulation and experiments.



TP2-1: Intelligent Mechatronics and Application (IV)

Session Chairs: Tanaka Yoshiyuki, Nagasaki University
Qiang Fu, Tianjin University of Technology

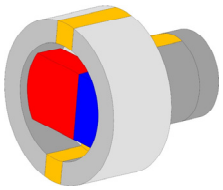
Conference Room 61 on 6th floor, 15:20-16:50, Tuesday, 8 August 2017

TP2-1(1) 15:20-15:35

Analysis of a Novel Pressure-resistant Permanent Magnetic Coupler

Benchun Yao, Qingxin Ding, Lei Jing, Huan Liu, and Shimin Zhang
College of Mechanical and Transportation Engineering, China University of Petroleum-Beijing
Beijing, China

- A novel magnetic coupler (PMC) with high-pressure resistance, is proposed and analyzed.
- The PMC transforms rotation into translation.
- In single-shot application, the PMC has constant latching force without continuous power supply.
- In multi-shot application, the PMC could be used to operate small-stroke valve working in hazardous medium.



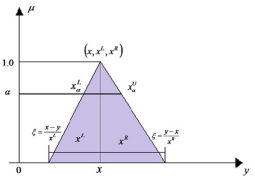
The Permanent Magnetic Coupler

TP2-1(2) 15:35-15:50

Robust Design for Robustness of Design Variables

Takahisa KOBAYASHI, Masao ARAKAWA
Kagawa University of Enginerring
Takamatsu, Japan

- We need solution which are unchanged even with small perturbation in design conditions.
- Use fuzzy theory to be able to treat uncertainties of the decision theory as a model was natural.
- Propose a new method through comparing a traditional method.



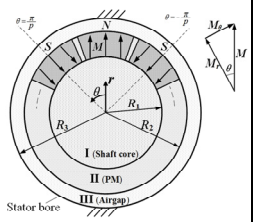
LR fuzzy numbers

TP2-1(3) 15:50-16:05

Analytical Solution of Air-gap Field in Motors with Parallel Magnetized Permanent Magnets

Xiangming Xu, Haipeng Geng, Baisong Yang, Hao Lin, Feixiang Tang and Lie Yu
Mechatronics State Key Laboratory for Strength and Vibration of Mechanical Structures
Xi'an Jiaotong University, Xi'an, China

- An analytical method to predict the open-circuit air-gap flux density distribution of motors with parallel magnetized magnets is proposed.
- The analytical formulas of airgap flux density in motors equipped with surface-mounted magnets, cylindrical or ring-type PMs are obtained.
- This analytical method is compared with finite element method to verify the validity.



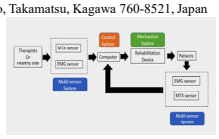
Motor model with surface-mounted PMs in parallel magnetization

TP2-1(4) 16:05-16:20

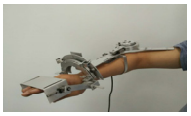
Characteristics Evaluation of a Rehabilitation Robot for Upper Limbs

Nan Xiao[1] , Hao Xu[1], Baofeng Gao[1], Shuxiang Guo[1,2*] , Hongdao Ma[1], Fozhi Zhou[1]
1 Key Laboratory of Convergence Biomedical Engineering System and Healthcare Technology,
The Ministry of Industry and Information Technology, School of Life Science, Beijing Institute of Technology,
No.5, Zhongguancun South Street, Haidian District, Beijing 100081, China
2 Faculty of Engineering, Kagawa University, 2217-20 Hayashi-cho, Takamatsu, Kagawa 760-8521, Japan

- A new exoskeleton rehabilitation robot system for upper limbs, which can achieve 3 degree-of-freedom (DOF) movements including elbows and wrists.
- Lacking of cooperation of master side and slave side, a new system with multi-sensors has been designed to control the device. By using this control system, it makes it easy to implement the motion and information collection.
- The control system using Gyros to detect the moving status is accurately feasible for rehabilitation of upper limbs.



Control system of master and slave side.



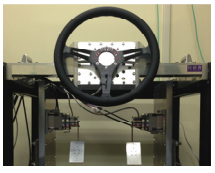
Experiments in characteristics evaluation.

TP2-1(5) 16:20-16:35

Analysis of Haptic Interaction between Limbs in Operations of Vehicular Driving Interfaces

Yoshiyuki Tanaka, Hideki Okano and Shunei Tanabe
Graduate School of Engineering, Nagasaki University
Nagasaki, Japan

- Haptic factors in driving operations by the limbs were analyzed using the developed laboratory driving simulator.
- Perceived force magnitudes in steering by the limbs (limb) were equivalent to approximately 80% (50%) of those in pedaling by the foot.
- Force perception properties for two pedals with different operational properties influenced each other in change-pedal operations.



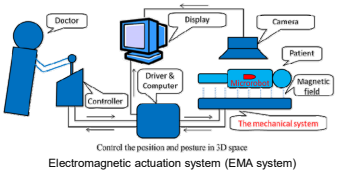
Developed driving simulator

TP2-1(6) 16:35-16:50

Conceptual Design of a Novel Magnetically Actuated Hybrid Microrobot

Qiang Fu[*1*2], Shuxiang Guo[*1*3], Jian Guo[*1],
[*1]Tianjin Key Laboratory for Control Theory & Application in Complicated Systems and Biomedical Robot Laboratory, Tianjin University of Technology,
[*2]Graduate School of Engineering, Kagawa University
[*3]Department of Intelligent Mechanical Systems Engineering, Kagawa University

In this paper, to deal with the performance of the medical microrobot in fluid condition, we proposed a novel type of magnetically actuated hybrid microrobot. The magnetically actuated hybrid microrobot has characteristics of controllability and multi-function. It has a simple structure, a simple control strategy with a rotational magnetic field and good dynamic in fluid.



Electromagnetic actuation system (EMA system)

TP2-2: Signal and Image Processing (IV)

Session Chairs: Yinlin Li, Institute of Automation Chinese Academy of Sciences
Chaonan Zhang, Beijing Institute of Technology

Conference Room 62 on 6th floor, 15:20-16:50, Tuesday, 8 August 2017

TP2-2(1) 15:20-15:35

Phonological Processing of Japanese Kanji and Chinese Characters in Bilingual Japanese : An fMRI study

Jingjing Yang[1] , Xiujun Li[1], Qi Li[1] ,Xinwei Xiao[1],Dan Tong[2], Qiong Wu[3] and Jinglong Wu[3]

1 School of Computer Science and Technology, Changchun University of Science and Technology, China
2 Department of Radiology, No.1 Hospital of Jilin University , China
3 Graduate School of Natural Science and Technology, Okayama University, Japan

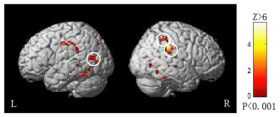


Fig. Functional brain maps during the healthy native Japanese speakers. Mean normalized brain maps overlaid on the corresponding T1-weighted images showing significant activation (in color; p<0.001, cluster size>20voxels Uncorrected) with Chinese characters rhyme judgment task-Japanese words rhyme judgment task.

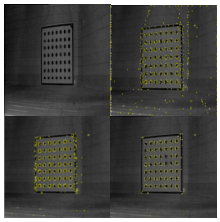
- The result showed that our bilingual Japanese subjects have large overlaps in the neural substrates for phonological processing of Chinese (L2) and Japanese(L1) language.
- Despite of radical difference in their phonologies, the two logographic languages engage a very similar neural network for the rhyme judgment.
- The scale of the network, however, is mediated by the proficiency expertise in that language.

TP2-2(2) 15:35-15:50

Multi-Scale Adaptive Corner Detection and Feature Matching Algorithm for UUV Task Target Image

Jian Xu , Xingyu Zhou, Xiaoyuan Chen and Mingze Xu
Department of Automation ,Harbin Engineering University
Harbin, Heilongjiang Province, China

- The principle of Harris Algorithm
- The Principle of FAST Algorithm
- The Improved Harris-FAST Algorithm
- UUV Task Target Image Matching Algorithm



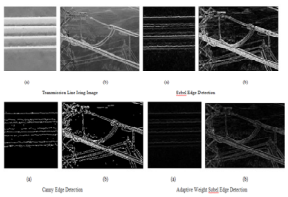
Corner detection results by three algorithms

TP2-2(3) 15:50-16:05

Research on the Application of the Edge Detection Method for the UAVs Icing Monitoring of Transmission Lines

Yongsai Zhai1, Guangyuan Wang2, Hong Yu3, and Genyuan Wei4
North China Electric Power University, Kunming University of Science and Technology
Information and Automation Academy, Electrical Research Institute of Yunnan Electric Power Research Institute (Group) Co., Ltd.
Kunming, China

- The adaptive weighted Sobel operator compared with sobel and canny.
- Strong anti-interference ability.
- Accurate and continuous positioning boundary.
- Rich image detail information.



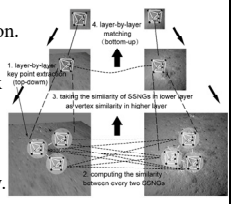
Edge detection results of transmission line image

TP2-2(4) 16:05-16:20

A Hierarchical Graph Matching Based Key Point Correspondence Method for Large Distance Rover Localization

Yinlin Li[1], Yuren Zhang[2], Chuankai Liu[3], Xu Yang[1] and Hong Qiao[1]
1. Institute of Automation, CAS, Beijing, China; 2. Meituan, Beijing, China;
3. Beijing Aerospace Control Center, Beijing, China

- Key point correspondence plays a critical role in large distance lunar rover localization.
- The proposed matching method takes the smaller scale neighborhood graph as vertex label, and processes in the framework of image pyramid recursively.
- The proposed key point detection method can extract key points stably and uniformly.
- Experiments conducted on lunar surface images witnessed the effectiveness.



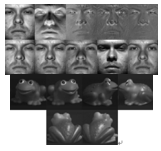
Hierarchical Matching Strategy

TP2-2(5) 16:20-16:35

Image representation based PCA feature for image classification

Ma Zhongli, Li Qianqian ,Li Huixin and Li Zuoyong
College of Automation, Harbin Engineering University
Harbin, Heilongjiang, China

- In this paper, we propose a novel representation method for image classification.
- The proposed method firstly used the PCA method to obtain the first numbers of eigenvectors with the largest contribution rate for the samples of each subject as the training samples.
- These training samples are used to represent the test sample.



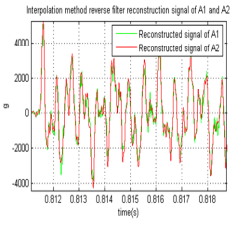
Yale B database and COIL-100 database

TP2-2(6) 16:35-16:50

Three Modelling and Simulation Methods for Shock Acceleration Signal Reconstruction

Zhang Rong, Zhou Jikun and Zhang Yi
Institute of Systems Engineering China Academy Engineering of Physics
Mianyang, China

- Acceleration sensor installation system identification research based on Levy fitting model, frequency interpolation and time domain model
- Shock acceleration signal reconstruction simulation analysis with three inverse-filtering methods.
- The experiment research on signal reconstruction with three inverse-filtering methods and conclusions.



Signal Reconstruction Effect

TP2-3: Control Theory and Application(IV)

Session Chairs: Juntao Fei, Hohai University
Xinhua Zhao, Harbin Engineering University

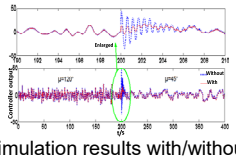
Conference Room 63 on 6th floor, 15:20-16:50, Tuesday, 8 August 2017

TP2-3(1) 15:20-15:35

Design of Multi-mode Switch Controller for Fin Stabilizer

Ming Ji, Hualin Miao, Peng Zhao
Harbin Engineering University
Harbin, Heilongjiang, China

- Propose a method to control fin stabilizer indirectly according to ship's roll to improve the timeliness of fin's works.
- The power spectrum density (PSD) of ship roll angle at different sea conditions are established.
- The controller parameters at different sea states are design in advance.



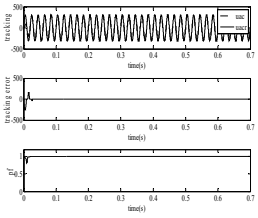
Simulation results with/without slow-fast decomposition

TP2-3(2) 15:35-15:50

Adaptive Fuzzy Sliding Control of Single-Phase PV Grid-Connected Inverter

Juntao Fei, Yunkai Zhu
College of IoT Engineering, Hohai University, China

- An AFSMC is proposed to control a two-stage single-phase PV grid-connected inverter.
- An INC method with an adaptive step size is adopted to track the MPP by controlling the duty cycle.
- An AFSMC with an integral sliding surface is developed, a fuzzy system is used to approach the upper bound of the system nonlinearities .
- Simulations show good performance: reduced THD, small current tracking error, improved robustness .



Performance of the inverter using AFSMC

TP2-3(3) 15:50-16:05

Research on New Intelligent Pump Control Based on Sliding Mode Variable Structure Control

Haitao Qi
Engineering Training Center
Beihang University
Beijing 100191, China
qihaitao@buaa.edu.cn

Shicheng Liu and Rongrong Yang
School of Mechanical Engineering and Automation
Beihang University
Beijing 100191, China
823842603@qq.com

Yongping Yu
Aviation Key Laboratory of Science and Technology on Aero Electromechanical System Integration
Nanjing Engineering Institute of Aircraft Systems
Nanjing 211106, Jiangsu Province, China
sohufgh@163.com

- This paper focuses on control design of a new intelligent pump.
- The structure and working principle of the intelligent pump system were analyzed, and then the mathematical model of the brushless DC motor driving the swashplate was established.
- The sliding mode variable structure control method was adopted for the position control of the intelligent pump swashplate. The whole controller of intelligent pump consisted of sliding mode variable structure position control loop and PID pressure/power control loop.
- The co-simulation model of intelligent pump system, aileron load system and controller were built in LMS-AMESim and MATLAB/Simulink.

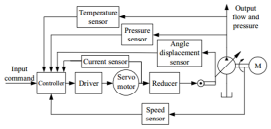


Fig. 1 Principle block diagram of control-on-demand

TP2-3(4) 16:05-16:20

Boundary Sliding Mode Controller Design for Supercavitating Vehicles

Xinhua Zhao and Xiufen Ye
Department of Automation, Harbin Engineering University
Harbin, Heilongjiang, China

- Sliding mode controller is anti-interference and robust. To improve the stability of the system, the robust sliding mode controller based on upper-lower boundary is designed.
- Meanwhile, the planing force is estimated as disturbance. The stability of the system is verificated by Lyapunov theory.

The Supercavitating Vehicle

TP2-3(5) 16:20-16:35

Sliding-mode Control of Four Wheel Steering Systems

Lei Tan, Shuyou Yu, Yang Guo, Hong Chen
State Key Laboratory of Automotive Simulation and Control, Department of Control Science and Engineering, Jilin University, Jilin, China

- A sliding mode control of active four-wheel steering systems improve vehicle handling stability.
- An integral time-variant sliding surfaceis adopted to eliminate steady state errors.
- A smooth function is used to alleviate the chattering effect.
- The sliding mode control can track the ideal reference model and resist external disturbances.

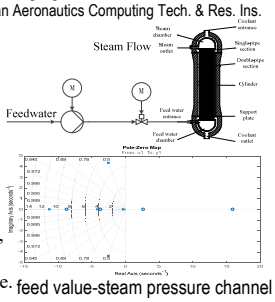
The 4WS vehicle

TP2-3(6) 16:35-16:50

System Identification and Model-free Adaptive Control of Once-Through Steam Generator in Nuclear Power

Mo Tao,Zhiwu Ke and Yagang Yu
Sci. & Tech. on Thermal Energy & Power Lab., Xi'an Aeronautics Computing Tech. & Res. Ins.

- The model of 'feed value-steam pressure' channel is established by system identification method.
- Both of control theory and thermal theory, there are four stages changing of the steam pressure by driving the feed valve with a step.
- MFAC has evident merits in tracking capacity, adaptive capacity, the ability of anti-interference and overcoming the non-minimum phase.



feed value-steam pressure channel

TP2-4: Modeling, Simulation Techniques and Methodologies (IV)

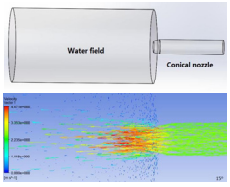
Session Chairs: Xiufen Ye, Harbin Engineering University
Gurenko Boris, Southern Federal University
Conference Room 64 on 6th floor, 15:20-16:50, Tuesday, 8 August 2017

TP2-4(1) 15:20-15:35

Hydrodynamic Analysis of Water-jet Thrusters for the Spherical Underwater Robot(SUR III)

Hongbiao Yang, Xiufen Ye, Shuxiang Guo, Shuoxin Gu and Shangze Chen
Laboratory of Biomimetic Micro Robot and System, Harbin Engineering University, Harbin, China

- Describe the design principle of conical nozzle in detail.
- Establish 3D models of conical nozzles with different control angles.
- Get a series of simulation results for hydrodynamic analysis, mainly including the velocity vectors, pressure and velocity contours.
- Results show that we can achieve a higher reaction thrust by controlling the control angle.



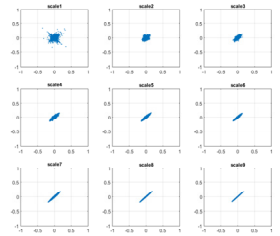
3D model and velocity vector

TP2-4(2) 15:35-15:50

A Review of Multiscale Science: Materials, Biology, Multiscale Data Analysis and Examples from Complex Physiological Systems

Jiaqi Liang
Institute of Automation, Chinese Academy of Sciences
Beijing, China

- Multiscale science is an emerging scientific field that spans many disciplines.
- The general developmental situation, especially scales and relevance in multiscale science.
- Some progress in materials, biology, and data analysis.
- Multiscale analysis of complex physiological systems based on poincaré plots and EMD.

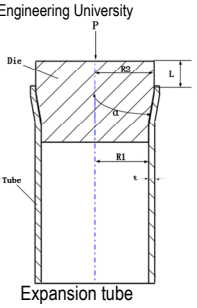

Scales from normal subject RR intervals

TP2-4(3) 15:50-16:05

Tubes as Impact Energy Absorbers: Experimental Investigations and Numerical Simulations

Heping Liu, Xiaolong Zhang and Ani Luo
Mechanical and Electrical Engineering., Harbin Engineering University
Harbin, China

- The expansion tubes achieve the energy dissipation by means of plastic deformation and friction.
- The structural parameters of the expansion tube absorber .
- ANSYS/LS-DYNA finite element code.
- Corresponding tests were conducted to serve as comparison purpose.
- Optimized design idea is put forward to improve the energy absorption efficiency.



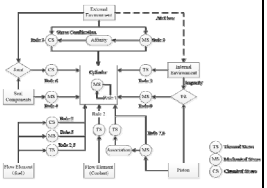
Expansion tube

TP2-4(4) 16:05-16:20

A Failure Analysis Method for Failure Modes and Effects Analysis Based on Stress Environmental Mode

Long Wang, Yue Li, Yanling Qian, Zezhong Li, Tengfei Xu
Laboratory of Science and Technology on Integrated Logistics Support, National University of Defense Technology, Changsha, China

- To establishe a failure analyse method with formal structure for computer integration
- Stress identification rules is put forward according to operating conditions of product.
- Stress environmental model is established based on the relations and constraints between stresses.
- An analysis method is proposed with a case of engine cylinder.

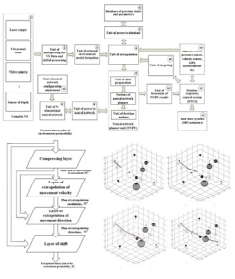

Stress Analyse of Diesel Engine Cylinder

TP2-4(5) 16:20-16:35

Design Method for an Multidimensional Neuronet Based Extrapolating Path Planner

B. Gurenko, V. Guzik, V. Pereverzev, A. Pyavchenko and R. Saprykin
Southern Federal University
Rostov-on-Don, Russia

- The structure of the neural-network planner of intellectual position-trajectory control system for roboti mobile objects.
- The structure of complex extrapolating network.
- Experimental study of the modified method taking into account the dynamics of a number of obstacles.
- Experimental study of the method 3D dynamic environment.

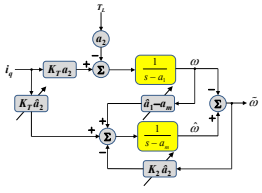


TP2-4(6) 16:35-16:50

Adaptive on-line parameters identification for vector-controlled permanent magnet synchronous motors

Chia-Min Ting[1,2], Hsin-Hung Chou[1,2], and Stone Cheng[2]
[1]MSL/ITRI., [2]Dept. of Mechanical Eng. National Chiao Tung University
Hsinchu, Taiwan

- Identifying the PMSM mechanical dynamics parameters nonlinear behavior in on-line mode.
- Chattering problem was solved using sigmoid function as switch function.
- The results of stationary load torque, load disturbance, and switching vs sigmoid function illustrate the validity of analytical study.


Parameters identification structure

TP2-5: Mobile Robot System (II)

Session Chairs: Hongbin Chang, Kochi University of Technology
Lijun Yu, Harbin Engineering University

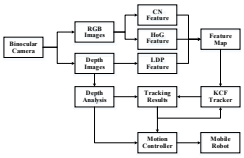
Conference Room 65 on 6th floor, 15:20-16:50, Tuesday, 8 August 2017

TP2-5(1) 15:20-15:35

A Human-Following Approach Using Binocular Camera

Lei Pang, Leijie Zhang, Yingying Yu, Junzhi Yu, Zhiqiang Cao, Chao Zhou
State Key Laboratory of Management and Control for Complex Systems,
Institute of Automation, Chinese Academy of Sciences,
University of Chinese Academy of Sciences, Beijing, China.

- This paper presents a tracker using binocular camera based on the kernelized correlation filter (KCF), which detects the target in multiple scales with the integration features.
- The depth analysis method is introduced to effectively overcome the problem of template drift.
- Experiments are implemented to verified the effectiveness of the tracker.



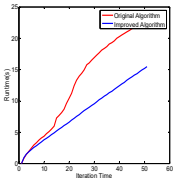
The schematic block diagram of the proposed human tracker.

TP2-5(2) 15:35-15:50

Path Planning for Mobile Robot Based on Fast Convergence Ant Colony Algorithm

Yu Lijun, Wei Zhihong, Wang Hui, Ding Ying, Wang Zhengan
College of Automation, Harbin Engineering University, Harbin 150001, China

- The proposed algorithm improved heuristic factor to make ants seeking towards goals instead of seeking blindly .
- Building an adaptive model, pheromone coefficient adjust self-adaptive is achieved, it avoided ants from trapping into local minimum, improves the pheromone updating rule.
- Reducing searching time by removing redundant path.
- The improved algorithm improved the search effectiveness and practicability.



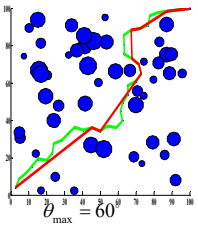
The algorithm running time comparison chart

TP2-5(3) 15:50-16:05

Path Optimization of AUV Based on Smooth-RRT Algorithm

Yu Lijun, Wei Zhihong, Wang Zhengan, Hu Yukun, Wang Hui
College of Automation, Harbin Engineering University, Harbin 150001, China

- The convergence and angle factor are added to improve the growth point and the exploration point of the expansion tree.
- Compared with original algorithm, the improved algorithm used the greedy algorithm to smooth the path.
- The improved algorithm improved the search efficiency and shortened the planning distance.



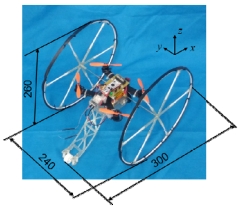
When Smooth-RRT path planning

TP2-5(4) 16:05-16:20

A design of a small mobile robot with a hybrid locomotion mechanism of wheels and multi-rotors

[1]K. Tanaka, [1]D. Zhang, [1]S Inoue, [1]R. Kasai, [1]H. Yokoyama,
[1]K. Shindo, [1]K. Matsuhiro, [1]S. Marumoto, [1,2]H. Ishii, and [1,2]A. Takanishi
[1]Waseda University, Japan, [2]Humanoid Robotics Institute (HRI), Waseda University, Japan

- We developed a small mobile robot in response to the demands in the disaster area.
- A hybrid locomotion mechanism of wheels and multi-rotors are proposed to realize both high locomotion performance and long-term operation.
- The details of the locomotion mechanism and some experimental results using the developed platform are shown.



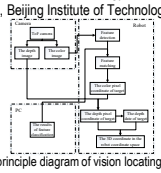
WAseda MOnitoring dRoNe (WAMORN)

TP2-5(5) 16:20-16:35

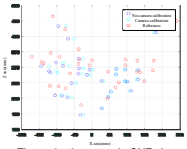
Vision Locating Method Based RGB-D Camera for Amphibious Spherical Robots

Kun Tang, Liwei Shi, Shuxiang Guo, Shaowu Pan, Huiming Xin, Shuxiang Su, Ping Guo, Zhan Chen
Key Laboratory of Convergence Medical Engineering System and Healthcare Technology, the Ministry of Industry and Information Technology, School of Life Science, Beijing Institute of Technology

- To increase the autonomous ability of amphibious spherical robots in underwater environment, an underwater vision locating system was designed .
- The visual locating method was adopted to realize getting the position between robots.
- The experiments demonstrated that visual locating method can be used for the underwater positioning of the amphibious spherical robot effectively.



The principle diagram of vision locating method



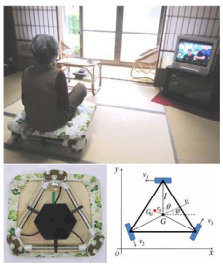
The projection result in OXZ plan

TP2-5(6) 16:35-16:50

Fault Diagnosis and Control of a Cushion Robot Considering Actuator Degradation

Hongbin Chang, Shuoyu Wang, and Ping Sun
Department of Intelligent Mechanical Systems Engineering, Kochi University of Technology
Kochi, Japan

- The problem of actuator degradation is considered on a cushion robot.
- A fault diagnostic observer was designed to observe the value of loss of effect on the actuators, which will be used to the tracking controller.
- The asymptotic stability of the tracking error system is proved based on Lyapunov stability theory and LaSalle's invariance principle.
- Simulation results demonstrate the feasibility of the proposed method.



Cushion Robot

TP2-6: Intelligent Biomedical Instrument Technology

Session Chairs: Guancheng Li, Beijing Institute of Technology
Shuoxin Gu, Kagawa University

Conference Room 66 on 6th floor, 15:20-16:50, Tuesday, 8 August 2017

TP2-6(1) 15:20-15:35

An Innovative Bio-Robot Imitating the Cervical Spine Behaviors During the Rotation-Traction Manipulation

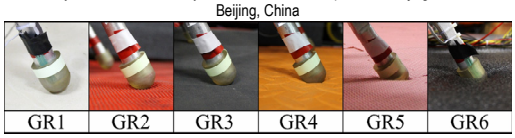
Jian Li, Guancheng Li,Zhen Chen,Xuefei Mao,Minshan Feng,Liguo Zhu,Liwei Shao
School of Automation, Beijing Insititue of Technology
Beijing, China

- Biomechanical behaviors of cervical spine are imitated
- Adaptive force tracking impedance is applied
- The accuracy of RT manipulation process is valuated

TP2-6(2) 15:35-15:50

Multi-Sensor Fusion Based on BPNN in Quadruped Ground Classification

Zhuhui Huang and Wei Wang
Institute of Automation, Chinese Academy of Sciences
University of Chinese Academy of Sciences, 19 A Yuquan Rd, Shijingshan District
Beijing, China



Six different kinds of ground substrate GR1 (vitrified tiles), GR2(plastic carpet), GR3(anti-static rubber slab), GR4, GR5(EVA), and GR6(EPE).

- Fuse data from multi-sensor to achieve classification of the different ground substrates using BPNN.
- Present the COG adjustment method with 6-axis motion sensor feedback.

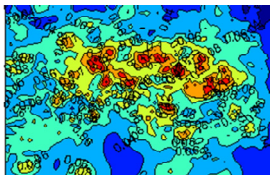
TP2-6(3) 15:50-16:05

A Three Dimensional Ultrasound Image-guided Navigation System for Muscle Injection

Kuan Luan and Jin Li
Automation college, Harbin Engineering University
Harbin, Heilongjiang, China

Jinglong Liu
Neurological Rehabilitation Department
Heilongjiang Province Rehabilitation Hospital
Harbin, Heilongjiang, China

- A changing region produced by pulling concerned limbs is recognized in a transverse section ultrasound image.
- The transverse section of the muscle is transformed into three-dimensional space.
- A center line connecting center points from two or more transformed transverse sections indicates the position of a segment of the target muscle for injection.



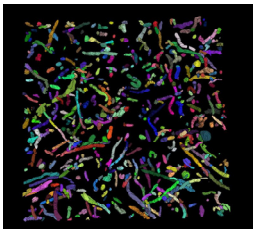
Example of estimated optical flow field of a US image.

TP2-6(4) 16:05-16:20

Automatical Detecting and Connecting the Mitochondria From the Serial EM Images

Jie Hu, Chi Xiao, Lijun Shen, Qiwei Xie, Xi Chen and Hua Han
Institute of Automation, Chinese Academy of Sciences, Beijing, China

- The key role of mitochondria in in neural function
- Faster R-CNN algorithm is put forward to detect mitochondria
- Fusing the multi-layer information to obtain the connected relationship
- Showing the 3D reconstruction results of mitochondria

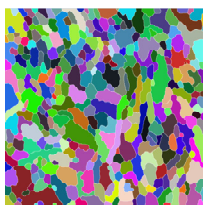


TP2-6(5) 16:20-16:35

Watershed Learning Merge Tree used for Segmenting Neurons in SEM Images

Zhenpeng Xiao, Xia Liu, Hua Han, Qiwei Xie, and Lijun Shen
Automation School, Harbin University of Science and Technology, Harbin, China
Institute of Automation, Chinese Academy of Sciences,Beijing, China

- Recognizing Membranes in SEM Images with DCNN Algorithm.
- Acquiring super-pixel patches through watershed algorithm.
- Building watershed learning merge tree.
- Resolving the tree to get final results.



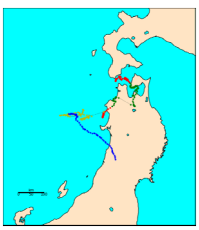
Segmented Neurons

TP2-6(6) 16:35-16:50

Encoding Bird's Trajectory using Recurrent Neural Networks

Ilya S. Ardakani and Koichi Hashimoto
Department of System Information Sciences Tohoku University
Sendai, Japan

- Birds' trajectory data auto-encoding using Long-Short Term Memory networks
- Embedding of the encoded state vectors
- Visualization of the embeddings' clusters



Trajectory segments labeled by embeddings Clusters

Wednesday
August 9, 2017

Morning Sessions

WA1-1	OS: Signal measurement and Process in Automatic Control (I)
WA1-2	Signal and Image Processing (V)
WA1-3	Fuzzy Control
WA1-4	Modeling, Simulation Techniques and Methodologies (V)
WA1-5	Mobile Robot System (III)
WA1-6	Micro and Nano Systems
WA2-1	OS: Signal measurement and Process in Automatic Control (II)
WA2-2	Robotic Vision
WA2-3	Intelligent Control
WA2-4	Actuator Design, and Novel Actuator Systems
WA2-5	Rescue Robots and Field Robot Systems
WA2-6	CAD/CAM/CAE and Manufacturing Systems

WA1-1: OS: Signal measurement and Process in Automatic Control (I)

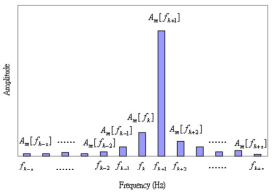
Session Chairs: Hsiung-Cheng Lin, National Chin-Yi University of Technology
Guo-Shing Huang, National Chin-Yi University of Technology
Conference Room 61 on 6th floor, 8:30-10:00, Wednesday, 9 August 2017

WA1-1(1) 8:30-8:45

Measurement of Harmonics and Interharmonics using FFT-based Algorithm

Hsiung-Cheng Lin
Department of Electronic Engineering National Chin-Yi University of Technology
Taiping Dist., Taichung 41170, Taiwan

- This paper aims to develop the FFT-based algorithm to measure harmonics/interharmonics more accurately based on simple algebra equations.
- All dispersed power occurred from FFT can be restored to recover the amplitude, and the individual frequency component can be obtained effectively.



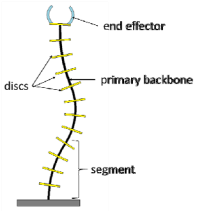
Relation between harmonic frequency and dispersed Energy

WA1-1(2) 8:45-9:00

1segment continuum manipulator for automatic harvesting robot ~ Prototype and modeling ~

Takaaki Tokunaga, Koichi Oka, and Akinori Harada
Machine Aviation Control System Lab., Kochi University of Technology, Kochi, Japan

- We made mechanism to solve problem of 1segment continuum manipulator motion.
- We made the model of 1segment continuum manipulator.
- We verified the model by comparison between the motion of prototype and the model.



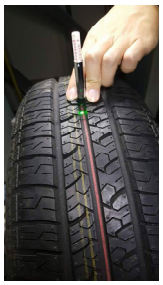
Continuum manipulator

WA1-1(3) 9:00-9:15

Measuring Tread Depth with Light-spot Analysis

Jih Kai, Wang* and Shih Yen, Huang
Department of Computer Science and Information Engineering
National Chin-Yi University of Technology
Taiping, Taichung 41170, Taiwan (R.O.C.)

- The depth of the tread must be greater than 1.6 mm.
- A non-contact measuring depth method.
- Based on light-spot analysis.
- Determine the effectiveness of laser light-spots.
- Accurately measure tire tread depth.



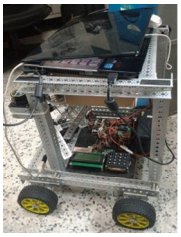
Light-spot measuring environment

WA1-1(4) 9:15-9:30

Map Construction and Exploration with Measurements of Laser Rangefinders

Guo-Shing Huang and Shun-Yu Pan
Department of Electronic Engineering
National Chin-Yi University of Technology
Taichung 41101, Taiwan, ROC

- This research proposes the Gmapping algorithm based on the Rao-Blackwellized Particle Filters.
- The proposed SLAM algorithms adopting orthogonality only to construct accurate maps can not only align the initial map automatically, but also reduce the complexity.
- It can effectively enhance the accuracy for the exploration of low-end laser rangefinders.
- it achieves the functions of real-time localization, mapping, and indoor navigation, and supports higher exploration efficiency than traditional SLAM algorithms.



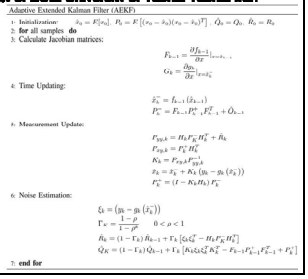
Blue-tooth Remote-controlled Car

WA1-1(5) 9:30-9:45

Adaptive Extended Kalman Filter Designing Based on Non-Singular Fast Terminal Sliding Mode Control for Robotic Manipulators

Reza Mohammadi Asl [1], Yasher Shabbouei Hagh [2], and Heikki Handroos [1]
[1]Intelligent Machines Lab., Lappeenranta University of Technology, Lappeenranta, Finland
[2]Control Engineering Department, Faculty of ECE, University of Tabriz, Tabriz, Iran

- A new method for position estimation of the robotic manipulators, based on the principles of the Extended Kalman Filter (EKF) is introduced.
- Non-singular Fast Terminal Sliding Mode (NFTSM) controller is used to control the estimated system.
- The proposed approach is applied on a robotic manipulator.

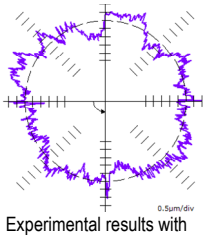


WA1-1(6) 9:45-10:00

Application of Taguchi Method for Determining the Best-Fitted Control Parameters of CNC Machine Tools

Li-Wei Lee, Syh-Shiuh Yeh, and Jien-I Lee
Institute of Mechatronic Engineering, National Taipei University of Technology
Taipei, Taiwan

- Parameter-tuning technology based on Taguchi method is developed in this study.
- It makes easy for CNC machine operators and manufacturers to tune the settings of control parameters.
- For circular tests, the best rate of improvement in the reversal spikes and roundness were 60.87% and 35.00%, respectively.



Experimental results with optimal circular parameters

WA1-2: Signal and Image Processing (V)

Session Chairs: Shuxiang Guo, Kagawa University
Jinglong Wu, Okayama University

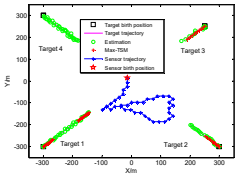
Conference Room 62 on 6th floor, 8:30-10:00, Wednesday, 9 August 2017

WA1-2(1) 8:30-8:45

Threat Assessment and Sensor Control for Multi-target Tracking via PHD Filter

Hui Chen, Zhongliang He, and Bei Liu
School of Electrical and Information Engineering, Lanzhou University of Technology
Lanzhou, China

- This paper uses the approximate multi-target filter to estimate multi-target states, and determine the target with the maximum threat degree at the different times based on the Tactical Significance Map (TSM) function.
- The Rényi divergence is used as the objective function for sensor control, and the final control policy is solved through the maximum information gain criterion.



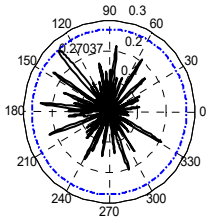
TSM based multi target tracking

WA1-2(2) 8:45-9:00

Study on the Online Test of Spindle's Dynamic Radial Error of Machine Tool

ZHOU JIKUN, ZHANG RONG, LING MINGXIANG
Institute of Systems Engineering China Academy Engineering of Physics,
Mianyang, China

- Floating sample frequency data acquisition method is proposed to collect the spindle profile.
- The ensemble averaging method is used to eliminate the white noise mixed in the measurement data.
- An experiment system is set up to verify the proposed method.



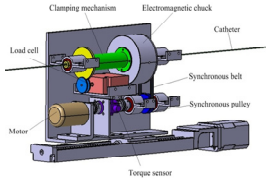
Spindle's Radial Error

WA1-2(3) 9:00-9:15

Electromagnetic Braking-based Collision Protection of a Novel Catheter Manipulator

Linshuai Zhang *1 , *4 , Shuxiang Guo *2, *3 , Huadong Yu *4, Shuoxin Gu *1,Yu Song *1 ,Miao Yu *1
*1 Graduate School of Engineering, Kagawa University, Takamatsu, Kagawa, Japan
*2 Key Laboratory of Convergence Medical Engineering System and Healthcare Technology, The Ministry of Industry and Information Technology, School of Life Science, Beijing Institute of Technology, Haidian District, Beijing 100081, China
*3 Department of Intelligent Mechanical Systems Engineering, Kagawa University, Takamatsu, Kagawa 761-0396, Japan
*4 School of Mechatronical Engineering, Changchun University of Science and Technology, Changchun, Jilin, China

- Design a novel catheter manipulator with collision protection.
- Use the electromagnetic device to control the clamping force by adjusting the input current.
- The simulation is carried out to verify the feasibility of the collision protection.



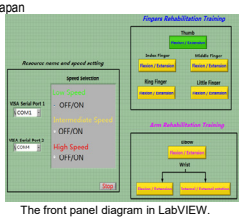
The structure diagram of the novel catheter manipulator

WA1-2(4) 9:15-9:30

The LabVIEW- Based Control System for the Upper Limb Rehabilitation Robot

Shuxiang Guo*1*2*3, Jiange Gao*1*2, Jian Guo*2 and Nan Li*2
*1 Tianjin Key Laboratory of the Design and Intelligent Control of the Advanced Mechatronical System, Tianjin, China
*2 Tianjin Key Laboratory for Control Theory & Applications in Complicated Systems and Biomedical Robot Laboratory, Tianjin University of Technology,Tianjin, Binshui Xidao 391, China
*3 Intelligent Mechanical Systems Engineering Department ,Faculty of Engineering, Kagawa University, Takamatsu, Kagawa, Japan

- The control system of the upper limb rehabilitation robot based on LabVIEW was proposed to assist patients in rehabilitation training of upper limb.
- The system can realize the real-time transmission of control signal and control character analysis, and then select the corresponding function to achieve rehabilitation training of upper limb rehabilitation robot control.
- The system can be extremely convenient to control the robot's rehabilitation training, moreover, the man-machine interface was friendly and easy for the operator to use.

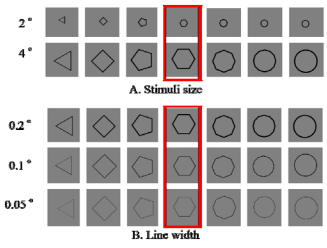


The front panel diagram in LabVIEW.

WA1-2(5) 9:30-9:45

A Basic Study on Regular Polygons Recognition of Central and Peripheral Vision field for VR

Yang Feng , Qiong Wu, Keisuke Okamoto, Jiajia Yang, Yoshimichi Ejima , Jinglong Wu
The Graduate School of Natural Science and Technology, Okayama University, Japan.



In this research, we used the simplest stimuli to investigate the dependency of regular polygons recognition on retinal eccentricity.

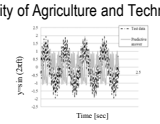
It was confirmed that the stimulus size and the line width of the stimuli affect the recognition in the peripheral visual field, and it can be processed quickly regardless of the presentation time.

WA1-2(6) 9:45-10:00

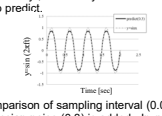
A Study on Statistical Modeling with Gaussian Process Prediction

Fumie Ogawa* **, Hiroki Kawano*, Ryo Shimizu*, Masayoshi Wada**
PT Control System Development Dept., Mazda Motor Corporation*, Hiroshima, Japan
Mechanical System Engineering WADA Lab., Tokyo University of Agriculture and Technology**
Tokyo, Japan

- One of a tool for statistic modeling precision was found.
- We were able to obtain some precautions for practicability of statistical model based on the Gaussian process.
- Not to using for all Data of modeling, we can get to create accurate models.



Simulation of input random value: We have to use carefully , how many enter data for input and to predict.



Comparison of sampling interval (0.001) when Gaussian noise (0.3) is added: In general ,statistical models are made of random values. However in vertical direction is not able to predict totally.

WA1-3: Fuzzy Control

Session Chairs: Rui Yang, Shandong University of Science and Technology
Chunfeng Yue, University of Electronic Science and Technology of China

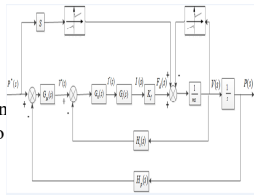
Conference Room 63 on 6th floor, 8:30-10:00, Wednesday, 9 August 2017

WA1-3(1) 8:30-8:45

Cable-driven Interventional Operation Robot with Stribeck Friction Feedforward Compensation

Shuxiang Guo, Changqi Xu, Nan Xiao, Xianqiang Bao, Yan Zhao, Cheng Yang, Rui Shen
Key Laboratory of Convergence Medical Engineering System and Healthcare Technology, Beijing Institute of Technology, Beijing China

- Designed with the remote control between master side and slave side.
- Cable-driven structure.
- Friction model was built and friction feedforward algorithm was added to closed-loop control of the robot.
- Bandwidth and dynamic tracking performance of the system error is improved.



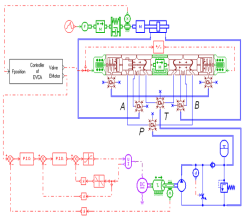
The control algorithm block diagram of the robot system

WA1-3(2) 8:45-9:00

Fuzzy CMAC Compound Control of Hydraulic Servo Actuation for Ship Steering System

Jiang'ao Zhao, Yongling Fu, Jian Fu and Guancheng Liu
School of Mechanical Engineering & Automation, Beihang University, Beijing, China; Capital Aerospace Machinery Company, Beijing, China

- A fuzzy cerebellar model articulation algorithm controller for ship steering system is proposed.
- The robustness of resisting to external disturbance and changing of internal parameters is greatly enhanced.
- The dynamic and static characteristic of the steering system is effectively ameliorated.
- The model of Fuzzy CMAC was established in Matlab/Simulink



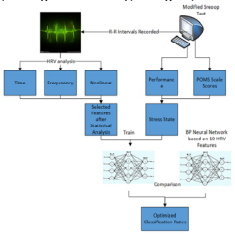
Co-simulation model of FCMAC and EVCA in AMESim.

WA1-3(3) 9:00-9:15

Stress Level Evaluation using BP Neural Network Based on Time-Frequency Analysis of HRV

Zhaoyi Qin, Min Li,Longping Huang and Yihan Zhao
School of Mechatronic and Engineering and Automation., Shanghai University,Shanghai,China

- Record R-R intervals and stress levels under modified Stroop test.
- Extract HRV features through time-frequency analysis.
- Select input data through Anova one-way analysis and t-test.
- Comparison between BP neural network and optimized BP neural network leads to best classification rates.



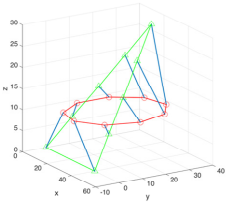
Research Process

WA1-3(4) 9:15-9:30

Optimal UAVs Formation Transformation Strategy based on Task Assignment and Particle Swarm Optimization

Zezhi Sui, Zhiqiang Pu, and Jianqiang Yi
Institute of Automation, Chinese Academy of Sciences, Beijing, China

- Focusing on the process of multi-UAV formation transformation.
- The Hungarian algorithm is used to rapidly solve the assignment problem.
- PSO is adopted to compute the optimal relative position relationship iteratively.
- The simulation results show that the process of the formation transformation is optimized and the generated paths is collision-free.



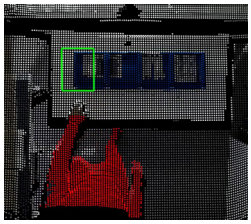
Simulation result

WA1-3(5) 9:30-9:45

Learning Human Motion Intention with 3D Convolutional Neural Network

Joshua Owoyemi and Koichi Hashimoto
Graduate School of Information Sciences, Tohoku University
Sendai, Japan

- We present an End-to-end model to learn human motion intentions from point cloud data.
- Sequences of human motion paired with target action intentions are used as training examples for the learning model.
- The 3D CNN spatiotemporal features learned by the model helps to predict human motion intention with an accuracy of 83% within 60% of the motion performed.



Human Motion Intention Prediction

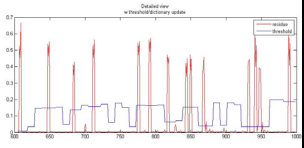
WA1-3(6) 9:45-10:00

An Online Data Driven Fault Detection Method in Dynamic Process based on Sparse Representation

Rui Yang
College of Electrical Engineering and Automation
Shandong University of Science and Technology

Mengjie Huang
College of Mechanical and Electronic Engineering
China University of Petroleum

- An intermittent fault detection method based on sparse representation is proposed.
- Both dictionary and threshold value can be updated online.
- Future work will be conducted on hardware testing including three tank system.



Fault Detection Result

WA1-4: Modeling, Simulation Techniques and Methodologies (V)

Session Chairs: Xianqiang Bao, Beijing Institute of Technology
Jiayu Liu, Beijing Institute of Technology

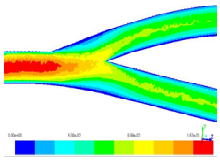
Conference Room 64 on 6th floor, 8:30-10:00, Wednesday, 9 August 2017

WA1-4(1) 8:30-8:45

Analysis of the Elastic Stress for the Bifurcated Region of Blood Vessel

Shuxiang Guo*1*2, Wenxuan Du*1 ,Jian Guo*1,Yuhang Cheng*1 and Xiaoliang Jin*1
*1 Tianjin Key Laboratory for Control Theory & Application in Complicated Systems and Biomedical Robot Laboratory, Tianjin University of Technology, Binshui Xidao 391, Tianjin, China
*2 Intelligent Mechanical Systems Engineering Department, Faculty of Engineering Kagawa University, Takamatsu, Kagawa, Japan

- This paper rebuilt a 3D blood vessel model and performed the fluid solid interaction analysis of the vascular model.
- We analyzed the correlation between blood flow velocity and vascular stress from the perspective of hemodynamics.
- Experimental results showed that the stress and pressure at the bifurcation and the scope of their mutation are gradually increased with the increase of blood velocity.



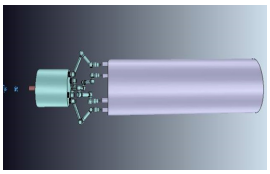
The velocity distribution at the inlet velocity of 0.1m/s.

WA1-4(2) 8:45-9:00

Compliant Control of a Space Robot with Multi Arms for Capturing Large Tumbling Target

Jiayu Liu, Qiang Huang, Tao Yang and Tao Deng
Intelligent Robotics Institute, Beijing Institute of Technology
Beijing, China

- Chaser with four same arms.
- Mass of chaser: ≈600kg.
- Mass of target: ≈4000kg.
- Distributer of minimum L2 norm.
- Regulator based on the dissipation vectors.



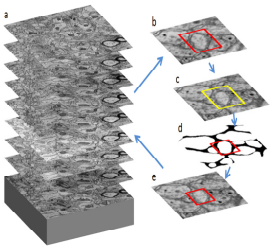
Chaser with multi arms and target

WA1-4(3) 9:00-9:15

An Efficient Method for Neuronal Tracking in Electron Microscopy Images

Lei Yin, Chi Xiao, Qiwei Xie, Xi Chen, Lijun Shen and Hua Han
Institute of Automation, Chinese Academy of Sciences Beijing, China

- An neuronal tracking acts an important role in neuronal reconstruction.
- An efficient method is proposed to track a neuron, which is based on kernelized correlation filter and Contour correction.
- It has a good performance on a public electron microscopy dataset, even though contour segmentation has some



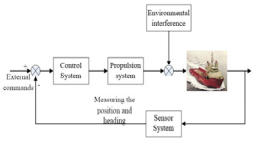
The Tracking Process

WA1-4(4) 9:15-9:30

Dynamic positioning particle filtering method based on the EnKF

Xiaogong Lin , Hanyu Sun and Yuanhui Wang
Automation department of *Harbin Engineering University*,
Harbin, *Heilongjiang Province*, China

- Build a three degrees of freedom ship model.
- Combine EnKF and particle filter to help the importance density function integrate into the latest observation imformation
- Through simulation, we obtain the expected results.



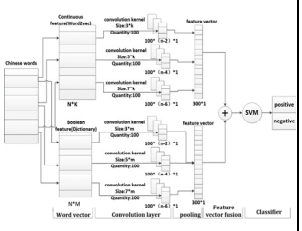
Block diagram of DP system

WA1-4(5) 9:30-9:45

Convolutional neural networks for Chinese sentiment classification of social network

Jia He, MaoYang Zou, and Ping Liu
School of Computer Science, Chengdu University of Information Technology
ChengDu, China

- MixCnn is used to extract the features of the word embedding and sequence features of word vectors based on lexicon.
- Two kinds of features are fused as the input of Support Vector Machine, then sentiment tendency of Chinese text is judged.
- Experimental result shows it is better than the traditional Convolutional Neural Network on precision and Fscore for Chinese sentiment classification



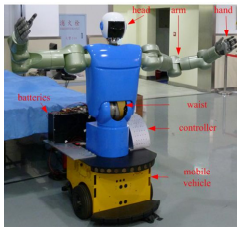
MixCnn Structure

WA1-4(6) 9:45-10:00

Design of an Upper-body Humanoid Robot Platform

Fenglei Ni, Chuangqiang Guo, Yiwei Liu, Minghe Jin and Hong Liu
State Key Laboratory of Robotics and System, Harbin Institute of Technology,Harbin, China
Zijian Zhang
College of astronautics, Nanjing university of aeronautics and astronautics, Nanjing, China

- An upper-body humanoid robot with 52 DOF is introduced.
- A control system with three hierarchical levels is used.
- An experiment of box grasping have completed.



The Humanoid Robot

WA1-5: Mobile Robot System (III)

Session Chairs: Yan Zhao, Beijing Institute of Technology
Yu Song, Kagawa University

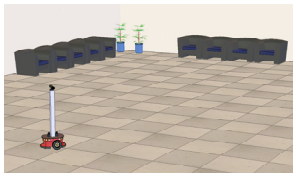
Conference Room 65 on 6th floor, 8:30-10:00, Wednesday, 9 August 2017

WA1-5(1) 8:30-8:45

An Integrated Exploration and Observation Planning for an Efficient Indoor 3D Mapping

Diar Fahruddin Sasongko and Jun Miura
Toyohashi University of Technology
Toyohashi, Japan

- The task of the robot is to make a 3D description of informative regions in an unknown environment.
- For an efficient mapping, we propose a method which integrates exploration and observation planning.
- Our proposed method is more efficient than the one which deals with exploration and observation separately.

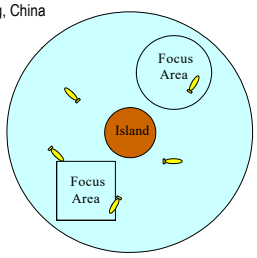


WA1-5(2) 8:45-9:00

An Improved Multi-AUV Patrol Path Planning Method

Zheping Yan, Jingwen He, and Juan Li
College of Automation, Harbin Engineering University
Harbin, Heilongjiang, China

- A multi-AUV cooperative path planning optimization algorithm for complex environments is proposed.
- Combine the predictive control with the particle swarm optimization algorithm.
- Consider the adaptability of AUV to the nearshore flow field based on the typical ocean current model.
- It has different patrol frequency for different areas.



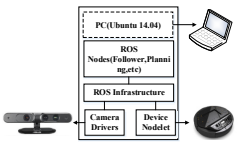
The Patrol Task Model

WA1-5(3) 9:00-9:15

Real-Time RGB-D based People Detection and Tracking System for Mobile Robots

FANG Fang, QIAN Kun, Zhou Bo, MA Xudong,
Key Laboratory of Measurement and Control of CSE
(School of Automation, Southeast University)
Nanjing, China

- A real-time RGB-D based person detection and tracking system suitable is presented for mobile robots.
- Combines RGB-D visual odometry estimation, target feature extraction, nearest point position information into a robust vision system that runs on open source robot operating system.



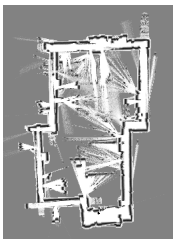
The System Platform

WA1-5(4) 9:15-9:30

Adaptive Square-Root CKF based SLAM Algorithm for Indoor UGVs

Jianzhong Xia[1], Umar Iqbal[2], Aboelmagd Noureldin[2], Mahamed Maher Atia[2], Feng Sun[1]
[1]College of Automation, Harbin Engineering University, Harbin, Heilongjiang, China
[2]Department of ECE, Queen's University, Kingston, Ontario, Canada

- Introduce a SLAM algorithm for UGVs.
- Use square-root version of CKF to reduce the computation complexity and to improve the numerical stability.
- Use adaptive factors to make the estimated square-root of the covariance more accurate.
- Use the Husky UGV to evaluate the performance of the proposed algorithm.



SLAM Results

WA1-5(5) 9:30-9:45

The field terrain recognition based on extreme learning machine using wavelet features

Caixia Liu, Jianjun Fang, Yanxia Liu, and Yujiao Lu
School of Automation, Beijing Union University
Beijing, China

- Legged robots.
- Terrain recognition algorithm.
- Wavelet feature.
- Extreme learning machine.

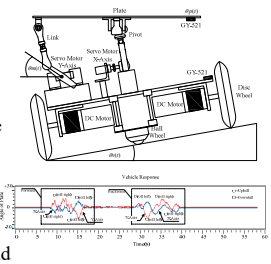
The Legged Dog

WA1-5(6) 9:45-10:00

Fuzzy-Tuned PI Controller for Plate Balancing on Mobile Vehicle System

Yongyut Pattanapong and Chirdpong Deelertpaiboon
Department of Instrumentation and Control Engineering,
Pathumwan of Technology, Bangkok, Thailand

- 2D balancing plate system driving on unstructured surface which causes dynamic of the system to change.
- No need to derive mathematical equation to describe dynamic of the system.
- Response comparison between constant gain and fuzzy-tuned gain for PI controller.
- Results show better settling time and smaller steady state error.



WA1-6: Micro and Nano Systems

Session Chairs: Huadong Yu, University of Changchun of Science and Technology
Kojima Masaru, Osaka University

Conference Room 66 on 6th floor, 8:30-10:00, Wednesday, 9 August 2017

WA1-6(1) 8:30-8:45

A Charge-Amplifier Based Self-Sensing Method for Measurement of Piezoelectric Displacement

Zhangming Du[1], Tianlu Zhang[1], Chao Zhou[1], Lu Deng[2], Zhiqiang Cao[1] and Shuo Wang[1]
1.Institute of Automation,Chinese Academy of Sciences
2. School of Statistics and Mathematics, Central University of Finance and Economics
Beijing, China

- Based on charge-displacement relationship derived from piezoelectric constitutive equations.
- A charge-amplifier circuit was developed for measurements.
- The method provides true sensor-actuator collocation.
- A series of experiments evaluated the performance of our method.

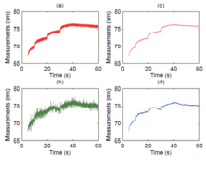


Fig. 7. Resolution comparison between self-sensing method and eddy-current sensor: (a)resolution of self-sensing method (b)resolution of eddy-current sensor (c)filtered output of self-sensing method (d)filtered output of eddy-current sensor

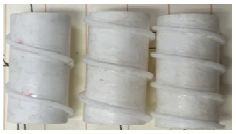
Resolution Comparison

WA1-6(2) 8:45-9:00

Motion Performance Evaluation of a Magnetic Actuated Screw Jet Microrobot

Shuxiang Guo ,Zixu Wang and Qiang Fu
School of Life Science Beijing Institute of Technology
Beijing, China

- Series of experiments and evaluation Motion Performance for a New Type Magnetic Actuated Screw Jet Microrobot
- Keeping the other conditions unchanged, to evaluate the influence of changing the pitch of the screw of the speed.
- The effect of viscosity coefficient of different liquids on the velocity.



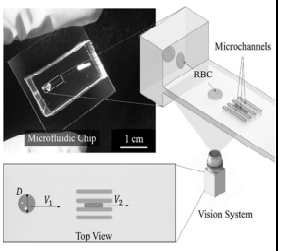
Different pitch screw device

WA1-6(3) 9:00-9:15

On-Chip RBC Deformability Checker Embedded with Vision Analyzer

M. Kaneko[1], T. Ishida[1], C. Tsai[1], H. Ito[1], M. Chimura[2], T. Taniguchi[2], T. Ohtani[2] and Y. Sakata[2]
[1]Dept. of Mechanical Engineering, Osaka University, Suita, japan
[2]Dept. of Cardiovascular Medicine, Osaka University, Suita, japan

- This paper challenged to obtain RBC deformability by automatic visual recognition techniques.
- By cell orientation converter we can rotate RBCs into a 2D view.
- Parameter α is introduced for determining the boundary of RBCs.
- We showed that the results between the automatic and manual approaches are with an average error of 4.77 %.



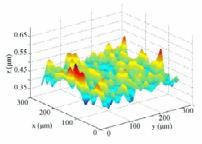
Overview of the system.

WA1-6(4) 9:15-9:30

The Reference Plane by BEMD for 3D Roughness Evaluation of Micro-milling Surface

Yun Qi, Jinkai Xu, Zhanjiang Yu and Huadong Yu
National and Local Joint Engineering Laboratory for Precision Manufacturing and Detection Technology.,
Changchun University of Science and Technology
Changchun, China

- The numerical surface of micro-milling was simulated by the method of Tonder.
- Using bidimensional empirical mode decomposition algorithm (BEMD) to process the numerical surface data to get the 3D roughness reference plane.
- The 3D roughness parameters which were calculated using the reference plane were selected from the standard of ISO 25178-2 to characterize the micro-milling surface topography.



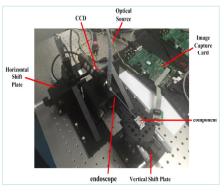
The reference plane by BEMD

WA1-6(5) 9:30-9:45

Vision-based Quality Inspection for Components with Small Diameter and Deep Hole

Xinyi Gong, Hu Su, Zhengtao Zhang, and De Xu
Institute of Automation, Chinese Academy of Sciences
Beijing, China

- We present an internal structure inspection method based on micro vision.
- A search strategy based on Kalman filter is proposed to detect the internal structure of the component.
- The quality of the component is inspected according to the extracted curves.



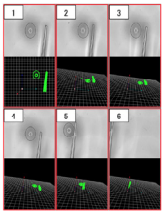
The Hardware Platform

WA1-6(6) 9:45-10:00

Development of the 3D measurement system in real-time for micro-manipulation

Kenichi Ohara[4], Masaru Kojima[1], Shota Takagi[1],
Yasushi Mae[1] and Tatsuo Arai[2,3],
1. Osaka University, Japan, 2. Beijing Institute of Technology , China,
3. The Univ. of Electro-Communications, Japan, 4. Meijo University, Japan

- We reported a speedup method for an All-In-Focus image creation process using GPU.
- Our method can be used for supporting micro-operation with a microscope.
- The manipulation experiment using the measurement result by this system was done.



Manipulation experiment

WA2-1: OS: Signal measurement and Process in Automatic Control (II)

Session Chairs: Hsiung-Cheng Lin, National Chin-Yi University of Technology
Hongjun Wang, Tianjin University of Technology

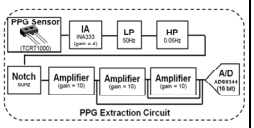
Conference Room 61 on 6th floor, 10:20-11:50, Wednesday, 9 August 2017

WA2-1(1) 10:20-10:35

Noninvasive Photoplethysmography Monitoring in Free-Moving Rats

Chi-Chun Chen, Shi-Cheng Su, and Wen-Ying Chang
Department of Electronic Engineering, National Chin-Yi University of Technology
Taichung, Taiwan

- Propose a noninvasive dynamic physiological monitoring system to assess animal disease prevention models.
- Use three stages (front end) in conjunction with an adaptive filter (back end) to offset the signal distortion.
- Provide a convenient and effective tool for physiologists of basic clinical studies.



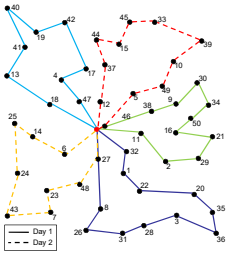
PPG extraction circuit

WA2-1(2) 10:35-10:50

A Novel Two-Dimensional Particle Encoding for Vehicle Routing Control

Ruey-Maw Chen, Wei-Zhi Hong and Ching-Te Wang
Computer Science and Information Engineering, National Chin-Yi University of Technology
Taichung, Taiwan, R.O.C.

- A novel two-dimensional discrete PSO (TDPSO) is designed to find optimal solutions to periodic vehicle routing problems (PVRPs).
- A sweep heuristic algorithm is applied to generate diverse initial solutions.
- An advanced savings method is designed in combination with local search to improve algorithm performance.



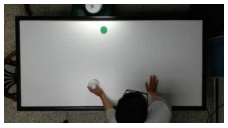
optimal vehicle routings

WA2-1(3) 10:50-11:05

Fast-Moving Object Tracking in Air Hockey

Shih-Yen Huang 1, You-Cheng Li 2*
Department of Computer Science and Information Engineering , National Chin-Yi University of Technology ,Taiwan

Object tracking is a frequent research topic in the field of computer vision. This paper developed an experimental method as follows: Puck images and environmental parameters were studied offline, and the position of the puck was then quickly extracted online. Through modify color space and divided tabletop into multiple blocks to obtain center-of-mass positions, then detects the type of noise and quickly predict the direction of movement of objects.



WA2-1(4) 11:05-11:20

The Establishment of Human-Computer Interaction Based on Word2Vec

Bo-Sheng Lin, Chuin-Mu Wang and Cheng-Ning Yu
Department of Computer Science and Information Engineering, National Chin-Yi University of Technology, Taiwan

- A novel method was proposed a interactive chat robot on Chinese text base on Word2vec.
- This paper use Jieba to segment the sentence entered by the user.
- The users can not only limit the input of one or two words, but can input in accordance with the user's own meaning.
- You can also calculate the similarity between two words.

Similarity	Concept	Matching elements
0.4521	Alarm clock	Get up
0.3904	Weather	Morning
0.3067	Stay	Get up
0.1747	Disease	Get up
0.1580	Buy	Morning

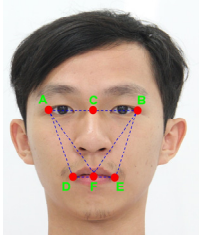
INPUTS 'CALL ME UP TOMORROW MORNING'

WA2-1(5) 11:20-11:35

Image-projection-based Facial Feature Vector Design

Jyun-Siang Yang, Wen-Yuan Chen and Shih-Yen Huang
National Chin-Yi University of Technology
Taichung, Taiwan

- The upper and lower halves of the image are projected horizontally and vertically based on edges and skin color.
- The left and right corners of the eyes and mouth were used as endpoints to obtain facial eigenvectors.
- Using the LIBSVM tool, real-time face recognition was performed.



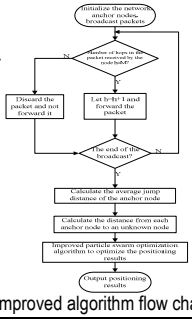
Schematic representation of facial feature vectors

WA2-1(6) 11:35-11:50

Study on DV-HOP Node Location Algorithm for Wireless Sensor Networks

Youjun Yue*1,Lanting Ding*1,Hui Zhao*1*2 ,Hongjun Wang*1
*1Tianjin Key laboratory for Control Theory and Applications in Complicated System, Tianjin University of Technology,Tianjin, China;*2Tianjin Agricultural University,Tianjin, China

- The minimum number of hops of the unknown node to the anchor node is corrected by introducing limit the number of hops mechanism.
- The improved particle swarm optimization algorithm(PSO) is used to calculate the node coordinates instead of the maximum likelihood estimation method .
- Verified by matlab simulation software, compare with traditional DV-HOP and PSO-DVhop, the results of the improved algorithm are superior and feasible.



Improved algorithm flow chart

WA2-2: Robotic Vision

Session Chairs: Jinglong Wu, Okayama University
Yusheng Yan, Harbin Engineering University
Conference Room 62 on 6th floor, 10:20-11:50, Wednesday, 9 August 2017

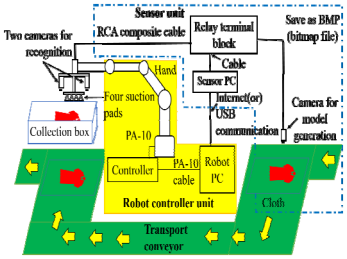
WA2-2(1) 10:20-10:35

Verification of Recognition Performance of Cloth Handling Robot with Photo-model-based Matching

Khaing Win Phyu, Ryuki Funakubo, Ikegawa Fumiya, Yasutake Shinichiro, and Mamoru Minami
Graduate School of Natural Science and Technology, Okayama University, Japan

- Model generation method from cloth photograph
- Model-based matching method
- Utilizing GA
- Experiment of No.3 cloth

(a) recognition without disturbance
(b) recognition of partly hidden cloth
(c) identification of two clothes



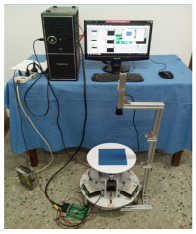
System Configuration

WA2-2(2) 10:35-10:50

Vision-Based Method of Kinematic Calibration and Image Tracking of Position and Posture for 3-RPS Parallel Robot

Lingtao Yu 1, Yusheng Yan 1, Sixu Ren 1 and Jiliang Zhao 2
1. College of Mechanical and Electrical Engineering, Harbin Engineering University, Harbin, Heilongjiang, China
2. Aerospace System Engineering Shanghai, Shanghai, China

- A non-contact measuring method to realize the kinematic calibration and image tracking of position and posture based on computer vision for the developed 3-RPS parallel robot is proposed.
- A method of pre-distinguishing feature points region is proposed to combine with PNP algorithm for realizing three-degree-of-freedom measurement of position and posture under monocular vision.
- The synthesis of the traditional Pyramid-LK algorithm and feature points region prediction method is performed to realize the image tracking.



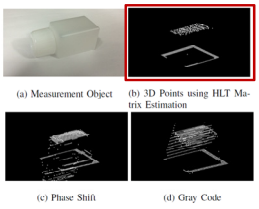
Kinematic Calibration and Image Tracking of Position and Posture for 3-RPS Parallel Robot

WA2-2(3) 10:50-11:05

3D Measurement by Estimating Homogeneous Light Transport (HLT) Matrix

Naoya Chiba and Koichi Hashimoto
Graduate School of Information Sciences, Tohoku University, Japan

- We show that 3D points can be measured by using HLT Matrix for targets which are difficult to measure by traditional methods.
- We introduce HLT Matrix for efficient 3D measurements.
- This is an extension of the Light Transport (LT) matrix which is a model of light transportation between a projector and a camera.
- By using the HLT Matrix, we can estimate LT Matrix without backgrounds measurement.



Comparison between our method and traditional methods

WA2-2(4) 11:05-11:20

Fusion of Vision and IMU to Track the Racket Trajectory in Real Time

Kun Zhang, Zaojun Fang, Jianran Liu, Zhengxing Wu and Min Tan
Institute of Automation, Chinese Academy of Sciences, China

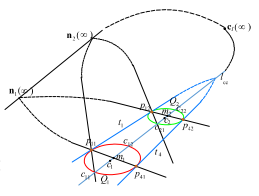
- This paper presents a novel approach on tracking the racket trajectory when human playing table tennis with robot.
- The main idea lies on fusing the vision and IMU data based on the EKF.
- The visual viewable range could be broadened by switching the vision system between the monocular and binocular.
- Experiments and results showed the proposed method is effective and real-time.

WA2-2(5) 11:20-11:35

Recovering Projected Centers of Circle-Pairs with Common Tangents

Qian Chen and Haiyuan Wu
Wakayama University, Wakayama, Japan

- Use only two parallel circles.
- Use common tangents to find the line at infinity.
- Simple and clear algorithm.
- Stable results.
- Compared with other existing algorithms using simulated and real images.



Recovering the centers of two circles.

WA2-2(6) 11:35-11:50

Rotation-Traction Manipulation Bionic Training Robot Based On Visual Servo and Impedance Control

Haiyu He, Ru Lai, Jian Li, Xiangdong Liu — School of Automation, Beijing Institute of Technology, Beijing, China
Liguo Zhu, Minshan Feng — Wangjing Hospital, Chinese Academy of Traditional Chinese Medicine, Beijing, China
Liwei Shao — Research Institute of BIT in Zhongshan, Guangdong, China

- Rotation-Traction Manipulation
- Mechanism design
- Hand tracking.
- Position-based impedance control.

WA2-3: Intelligent Control

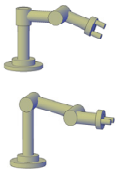
Session Chairs: Zhilin Liu, Harbin Engineering University
Xichuan Lin, University of Electronic Science and Technology of China
Conference Room 63 on 6th floor, 10:20-11:50, Wednesday, 9 August 2017

WA2-3(1) 10:20-10:35

Decentralized Force/Position Control for Reconfigurable modular robot based on the Nonlinear Joint Torque Observer

Wei Zhang, Yanli Du
College of Electrical Information Engineering,BeiHua University
Jilin, China

- A double closed-loop decentralized force controller based on the nonlinear joint torque observer is designed. Compared to the single closed-loop control ,the proposed method can improve control precision and convergence speed of the end contact force and position.
- Do not need to change the control parameters, the designed controller can control different configurations of reconfigurable modular robot .



Configurations manipulator

WA2-3(2) 10:35-10:50

Model Predictive Controller Design with Disturbance Observer for Path Following of Unmanned Surface Vessel

Zhilin Liu1 Chao Geng1 Jun Zhang2
1.College of Automation, Harbin Engineering University Harbin, Heilongjiang, China
2.Department of Electrical and Information Engineering, Jiangsu University, Jiangsu , China

- A model predictive controller with disturbance observer is presented to force an automated unmanned surface vessel (USV) to follow a reference path with environment disturbance.
- A full-scale trials by fully instrumented USV is carried out to identify the dynamic model.
- The constrained control input of the USV is solved by MPC.

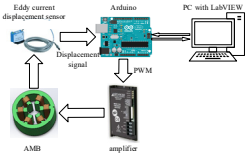
The real-boat marine trial

WA2-3(3) 10:50-11:05

Design and Implement of a Low Cost Control System of Active Magnetic Bearings Using LabVIEW Interface for Arduino

Tingchen Du, Haipeng Geng, Yanhua Sun, Hao Lin, Hao Lv and Lie Yu
State Key Laboratory for Strength and Vibration of Mechanical Structures
Xi'an Jiaotong University
Xi'an, Shaanxi Province, China

- Design and implement a low cost control system of active magnetic bearings using LabVIEW Interface for Arduino.
- Use PID control strategy realized by LabVIEW to make the system operated stability.
- Drive the active magnetic bearings by PWM built in Arduino.



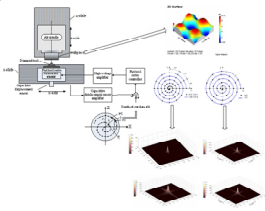
Layout of AMB control system

WA2-3(4) 11:05-11:20

Characterization of Diamond Turned Sinusoidal Grid Surfaces Based on 2D-DFT

Xiaohui Wang, Wenzhen Zhong and Haiyan Shao
Department of Mechanical Engineering, University of Jinan
Jinan, China

- Micro-structured surface was manufactured by DTM based on FTS (fast tool servo).
- A surface characterization method for sinusoidal grid surfaces has been proposed based on 2D-DFT.
- A comparison studies on surface quality of machined surface based on constant-angle and constant arc-length methods have also been conducted.



The characterization of micro-structured surface

WA2-3(5) 11:20-11:35

Time-optimal and Minimum-Jerk Trajectory Planning of 3-DOF PM Spherical Motor

Dengquan Zhang ,Fengying Wu ,Rui Li
Tianjin University of Technology391, Binshui Xidao, Xiqing District, Tianjin, 300384, China

- Introduction
- Description of the minimum jerk trajectory planning problem
- Trajectory Planning Based on Non - uniform Rational B - spline
- Optimization of Kinematic Constraints and Sequential Quadratic Programming
- Simulation
- Conclusion

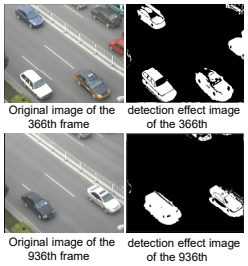
3-DOF PM Spherical Motor

WA2-3(6) 11:35-11:50

Combined improved Frequency-Tuned with GMM algorithm for moving target detection

Wang Hui, Gao Jing, Yu Lijun, Hu Yukun, Wang Zhengan
College of Automation, Harbin Engineering University, Harbin 150001, China

- The proposed algorithm used improved Frequency-Tuned and GMM (Gaussian Mixture Model) algorithm to detect moving target.
- Compared original algorithm ,the proposed method can avoid the random noise and highlight the significance of the moving target.
- The improved algorithm improved the detection rate with good robustness.



Original image of the 366th frame | detection effect image of the 366th
Original image of the 936th frame | detection effect image of the 936th

WA2-4: Actuator Design, and Novel Actuator Systems

Session Chairs: Nishioka Ysautaka, University of Shiga Prefecture
Weijun Huang, Huazhong Agricultural University

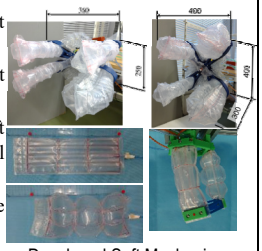
Conference Room 64 on 6th floor, 10:20-11:50, Wednesday, 9 August 2017

WA2-4(1) 10:20-10:35

Development of Soft Mechanisms with a Pleated ELSA for Robots Contacting with Humans

Yasutaka NISHIOKA, Kazuyuki NAGAO, Shun YASUDA,
Toshihiko YASUDA and Mitsuhiro YAMANO
Department of Mechanical Systems Engineering., University of Shiga prefecture
Shiga, Japan

- Pleated ELSA(Extremely Lightweight Soft Actuator) made by Plastic films
- Generation of both large displacement and various motions
- Proposal of two kinds of soft mechanisms: Robot hand and Parallel mechanism
- Realization of high generation force ratio to own weight



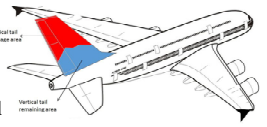
Developed Soft Mechanisms

WA2-4(2) 10:35-10:50

Fault Tolerant Control Strategy Based on Actuation Switch Mechanism for More-electric Aircraft with Vertical Tail Damage

Zhihan Zhou, Shaoping Wang, Xingjian Wang
Department of Automation Science and Electrical Engineering, Beihang University
Beijing, China

- Vertical tail damaged during the flight, all hydraulics lost.
- Dissimilar redundent actuation system(DRAS) provide a way by using EHA to design FTC strategy.
- Using the engine differential thrust to compensate the impact of vertical tail damage
- Designed a actuation switch mechanism to decide the actuation configuration related to damage degree.



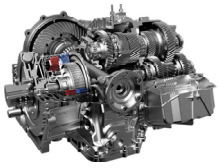
Vertical tail damage

WA2-4(3) 10:50-11:05

Hamilton Jacobi Inequality Based Sliding Mode Robust Control for Optimal Torque Transmissions of Dry Dual Clutch Assembly in Torque Phase of Shift

Mingxiang Wu
College of Engineering, Shanghai Normal University TianHua College, Shanghai, PRC 201815
wumingxiangcq@163.com

- Brief introduction to dry dual clutch transmission. Why in extensive use?
- Imperfections of present investigations into dynamics and control of dry dual clutch assembly.
- Our proposed excellent solutions.
- Verifications of our solutions.
- Research prospects and cooperation intentions.



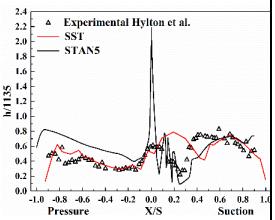
Lamborghini Dual Clutch Assembly

WA2-4(4) 11:05-11:20

Numerical Simulation of Heat Transfer Distribution over the Surface of Internally Cooled Nozzle Guide Vane in an Annular Cascade

DING Yulin, LIU Youhong and NIU Junjie
School of Energy and Power Engineering, Beihang University
Beijing, People's Republic of China

- Heat transfer over the internally cooled nozzle guide vane: MARK II vane and C3X vane .
- Static pressure, static temperature, heat transfer coefficient, velocity and temperature contour are depicted.
- The SST turbulence model is more accurate than the STAN5 code. But calculation speed of the STAN5 code is faster.

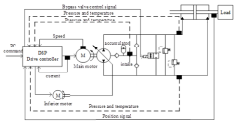


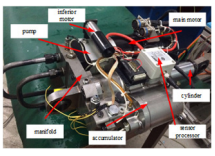
Heat transfer coefficient predicted by SST and STAN5 of MARK II 5411 case vs measured data

WA2-4(5) 11:20-11:35

Design and Performance Analysis of a Dual-Variable Electrohydrostatic Actuator for Aerospace Application

Mingkang Wang, Yongling Fu, Jian Fu, Xu Han and Liming Yu
School of Mechanical Engineering & Automation, Beihang University, Beijing, China;
Flying College Beihang University, Beijing, China





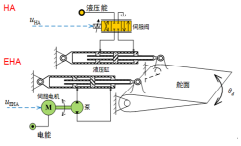
- An independently designed EHA system including mechanical structure design and control algorithm in controller are presented.
- AMESim model and 3D prototype are built.
- Performance experiments are finished.
- Amended constant-frequency switch in hysteresis current control is verified.

WA2-4(6) 11:35-11:50

A Novel Multi-state Reliability Assessment Model for Servo HA/EHA System via Universal Generating Function

Kangle Wang, Shaoping Wang, and Jian Shi
School of Automation Science and Electrical Engineering
Beijing University of Aeronautics and Astronautics
Haidian District, Beijing, China

- HA accomplished with EHA constitutes the dissimilar redundant actuator system
- The performance of component and system expresses multi-stated and controlled
- A multi-state reliability assessment model was established via UGF method



Dissimilar structure of HA/EHA system

WA2-5: Rescue Robots and Field Robot Systems

Session Chairs: Hidenori Ishihara, Kagawa University
Hatano Masatoshi, Nihon University

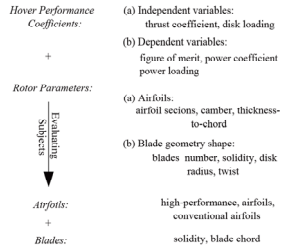
Conference Room 65 on 6th floor, 10:20-11:50, Wednesday, 9 August 2017

WA2-5(1) 10:20-10:35

Experimental Evaluating Approach to a Suitable Martian Coaxial Rotorcraft Blade

Qiquan Quan*, Pengyue Zhao, Shuitian Chen, Dan Wang, He Li, Deen Bai, and Zongquan Deng
School of Mechatronics Engineering, Harbin Institute of Technology

- Hover performance coefficients and rotor parameters are the two main factors used to characterize the rotor hover performance.
- Blade airfoil section and geometry shape are the two factors used to select experimental subjects.
- Experiments are tested by hover stand mounted in the MAS, and the results are used to select a suitable rotor blade for Martian UAV.



WA2-5(2) 10:35-10:50

Basic Study on Wall Climbing Root with Magnetic Passive Wheels

Hidenori Ishihara
Department of Intelligent Mechanical Systems, Kagawa University
Takamatsu, Japan

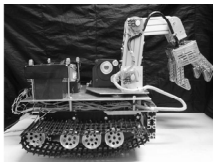
- The wall climbing robot on the steel wall enabled to move flexibilly.
- The developed robot contains the magnetic caster for adsorbing on the steel wall.
- Introducing the suspension system for the magnetic caster realized the raiding over the projection like as the weld line..

WA2-5(3) 10:50-11:05

Estimation of Center of Gravity for Withdrawal Works of Unknown Indefinite Shape Rubbles for Rescue Robots

Masatoshi Hatano
College of Science and Technology, Nihon University, Japan

- In rescue fields, shapes, mass, lying state of rubbles are multifarious and unknown.
- We propose a method to decide a position to grasp on a rubble such as the center of gravity of the rubble using force sensors attached on fingertips of the robot hand and camera images with the Snakes.
- Experiments were performed to verify our proposed method.



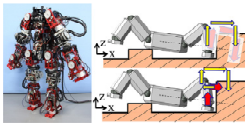
Constructed proto-type rescue robot for withdrawal works

WA2-5(4) 11:05-11:20

Crawling Motion and Foot Trajectory Modification Control for Legged Robot on Rough Terrain

Takashi Matsuzawa, Ayanori Koizumi, Kenji Hashimoto, Xiao Sun, Shinya Hamamoto, Tomotaka Teramachi, Nobuaki Sakai, Shunsuke Kimura and Atsuo Takanishi
Faculty of Science and Engineering, Waseda University
Tokyo, Japan

- Crawling motion has a phase that a body contacts on the ground as a leg.
- Trajectory modification control based on F/T sensor and IMU aims to avoid collision between feet and rough terrain.
- Legged robot performs crawling motion to verify whether there is the difference of locomotion capability.
- It is confirmed that proposed method contributes to improvement of locomotion capability on rough terrain.



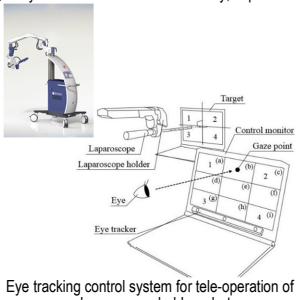
Foot Trajectory Modification Control of legged robot

WA2-5(5) 11:20-11:35

Effect of Robot Operation by a Camera with the Eye Tracking Control

Masahiko Minamoto[a], Yutaro Suzuki[a], Takahiro Kanno[b], Kenji Kawashima[b]
[a] Monozukuri Eng. Dept., Tokyo Metropolitan College of Industrial Technology, Japan
[b] Institute of Biomaterial and Bioengineering, Tokyo Medical and Dental University, Japan

- We develop a control system for tele-operation of robots using an eye tracking control.
- The operation screen is divided into 3x3 grids. The robot stops when the gaze is on the center grid cell and moves to the direction with a pre-defined constant speed when the gaze is on the other cells.
- The effectiveness of the system is confirmed experimentally using a laparoscope holder robot and a crawler-type rescue robot.



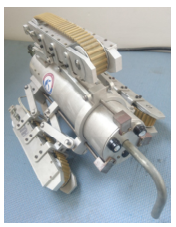
Eye tracking control system for tele-operation of a laparoscope holder robot

WA2-5(6) 11:35-11:50

Design of an Adjustable Pipeline Inspection Robot with Three Belt Driven Mechanical Modules

Chung-Wei Ou, Chin-Jung Chao, Lih-Tyng Hwang, Fa-Shian Chang, Shun-Min Wang, Jeng-Nan Lee, Ren-De Hung, Bin Chiu, and Kai-Yi Cho
Dept. of Electronics, Cheng Shiu University
Kaohsiung, Taiwan

- This article presents an adjustable pipeline inspection robot with three belt driven mechanical modules. The adjustable pipeline robot can be used for 30-45cm diameter pipeline.
- This robot has three powered belt driven chains each of which has a mechanical clutch. The mechanical clutch is used a 3-bars linkage type mechanism. The robot is designed foldable when each chain contacts the ground or wall of pipeline or tunnel.
- The robot can be operated in various sizes of pipeline, and can utilize the belt driven walking model to conquer the irregular barriers of pipeline.



Pipeline Inspection Robot

WA2-6: CAD/CAM/CAE and Manufacturing Systems

Session Chairs: Banwait Sukhwant Singh,
National Institute of Technical Teachers Training & Research
Haipeng Geng, Xi'an Jiaotong University

Conference Room 66 on 6th floor, 10:20-11:50, Wednesday, 9 August 2017

WA2-6(1) 10:20-10:35

Development of Low Cost Programmable Indexing Head for Horizontal Milling Machine

Sanjiv Kumar*, Deepam Goyal** and SS Banwait**
*Department of Mechanical Engineering, Govt. Polytechnic College, Ambala, Haryana, India
**Department of Mechanical Engineering, National Institute of Technical Teachers Training and Research, Chandigarh, India

- A microcontroller based programmable indexing head for horizontal milling machine has been developed.
- The developed indexing head comprises of three main parts i.e. mechanical system, electronics system and application software. It has the capability of self-locking.
- The developed indexing head reduces by 62.03% the cost of indexing head and provided a saving of 93.67% time wasted in changing the indexing plates in traditional indexing head.

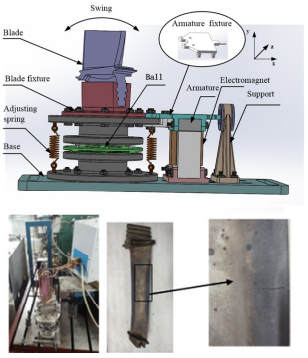
Programmable Indexing Head

WA2-6(2) 10:35-10:50

Design and Simulation of High Cycle Fatigue Testing Rig Driven by Electric Magnet

Geng Haipeng

(1) The electromagnetic resonant device was designed to test HCF and TMF using the sine resonance search method
(2) The testing device can also be integrated into a high-frequency heating load frame, which enables thermal-mechanical fatigue cycle testing.
(3) This study demonstrates the capabilities of the apparatus by performing interaction tests.
(4) The initial results of the full-scale blade testing results prove the feasibility of this method and the device.

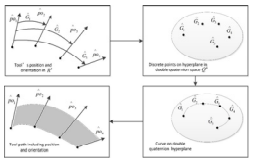


WA2-6(3) 10:50-11:05

Research on algorithm of tool-path planning for 5-axis NC machining based on double quaternion

Jian Wang , Qiang Liu , Shiwei Pi , Qitong Liu and Yao Li
School of Mechanical Engineering and Automation, Beihang University
Beijing, China

- In this paper, double quaternion was applied to describe the tool tip position and tool axis orientation in Cartesian space.
- Based on spherical linear interpolation theory and Bezier recursive algorithm, a Bezier curve of double quaternion was designed, which is also the tool path including positions and orientations.



Process of tool-path planning

WA2-6(4) 11:05-11:20

The Simulation Analysis of Fluid Internal Characteristics of Wet Clutch During the Engaging Process

Liying Miao, Xuesong Li*, Xiusheng Cheng Author2, and Rong Chen
State Key Laboratory of Automotive Simulation and Control
Changchun, China

- According to the work state, the automobile clutch can be divided into dry type and wet type. In recent years, because of its excellent performance and the growing maturity of the technology, then gradually making wet clutch widely used in the modern vehicle automatic transmission system.

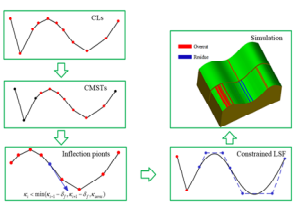
The Schematic Diagram of Wet Clutch Assembly

WA2-6(5) 11:20-11:35

B-spline Smooth Compression of Consecutive Micro Segment Trajectories in Free-form Surface NC Machining

Qitong Liu, Qiang Liu, Shiwei Pi, Jian Wang, and Pengpeng Sun
School of Mechanical Engineering and Automation, Beihang University
Beijing, China

- CMSTs identification according to geometric features.
- Inflection points estimation and the corresponding tangential vectors calculation.
- B-spline smooth compression by constrained least squares fitting method



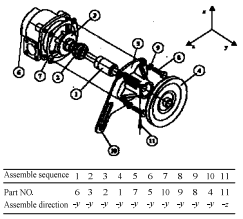
Process of B-spline Smooth Compression

WA2-6(6) 11:35-11:50

Automatic generation and optimization of stable assembly sequence based on ACO algorithm

Weijun Huang, Qinchao Xu
College of Engineering, Huazhong Agricultural University
Wuhan, China

- A methodology based on ant colony optimization algorithm to generate the optimal assembly sequence.
- The assembly sequence planning problem was translated into an optimal path searching in a graph.
- The stability of assembly process is considered to make it more applicable to production.
- A more reasonable geometric constraint model for ASP is be set up.



Assemble sequence	1	2	3	4	5	6	7	8	9	10	11
Part NO.	6	3	2	1	7	5	10	9	8	4	11
Assemble direction	-Y	-Y	-Y	-Y	-Y	-Y	-Y	-Y	-Y	-Y	-Z

Example of a product

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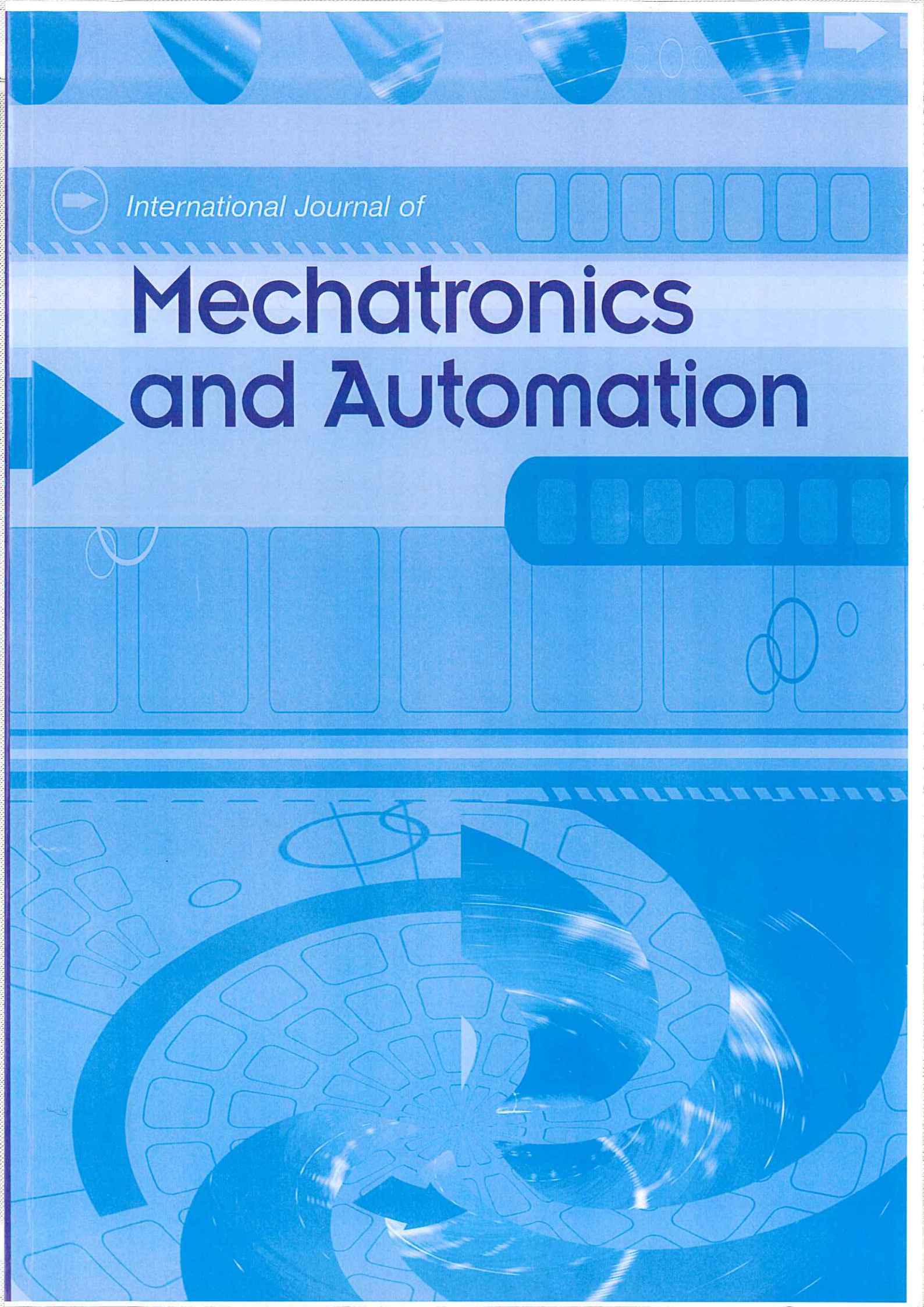
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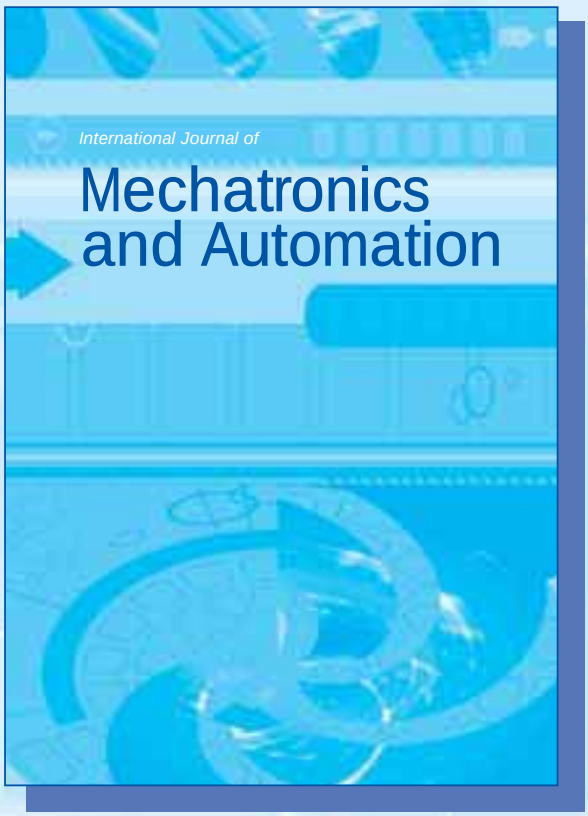

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IEEE ICMA 2017 Program at a Glance

Sunport Takamatsu Symbol Tower, Takamatsu, Kagawa, Japan August 6-9, 2017

Sunday, August 6, 2017	
13:30 - 18:30	Registration Desk Open on 6th floor
14:00 - 17:00	Workshop at Conference Room 61
17:00 - 18:00	Keynote Speech #1 (Prof. Toshio Fukuda)
18:30 - 19:30	Reception at Conference Room 54 on 5th floor
Monday, August 7, 2017	
8:20 - 8:30	Opening Ceremony (Kagawa International Conference Hall)
8:30 - 9:30	Plenary Talk #1 (Dr. James Kuffner)
9:30 - 10:30	Plenary Talk #2 (Prof. Fumihito Arai)
10:30 - 11:00	Morning Break
11:00 - 12:00	Technical Sessions MA1 (Kagawa International Conference Hall)
12:00 - 13:00	Lunch Hour Keynote Speech #2 (Mr. Peichao Liu)
13:30 - 15:00	Technical Sessions MP1 (Conference Room on 6th floor)
15:00 - 15:20	Afternoon Break
15:20 - 16:50	Technical Sessions MP2 (Conference Room on 6th floor)
17:00 - 18:00	Technical Sessions MP3 (Conference Room on 6th floor)
Tuesday, August 8, 2017	
8:30 - 9:20	Plenary Talk #3 (Prof. Max Q.-H. Meng)
9:30 - 10:30	Technical Sessions TA1 (Conference Room on 6th floor)
10:30 - 10:40	Morning Break
10:40 - 12:10	Technical Sessions TA2 (Conference Room on 6th floor)
12:10 - 13:30	Lunch Break
13:30 - 15:00	Technical Sessions TP1 (Conference Room on 6th floor)
15:00 - 15:20	Afternoon Break
15:20 - 16:50	Technical Sessions TP2 (Conference Room on 6th floor)
18:00 - 20:30	Award Banquet, Hiten Hall, 3F in JR Hotel Clement
Wednesday, August 9, 2017	
8:30 - 10:00	Technical Sessions WA1 (Conference Room on 6th floor)
10:00- 10:20	Morning Break
10:20 - 11:50	Technical Sessions WA2 (Conference Room on 6th floor)
12:00 - 13:00	Farewell Party at Communication Plaza on 1st floor