POWER ELECTRONICS SOCIETY NEWSLETTER

First Quarter 2008
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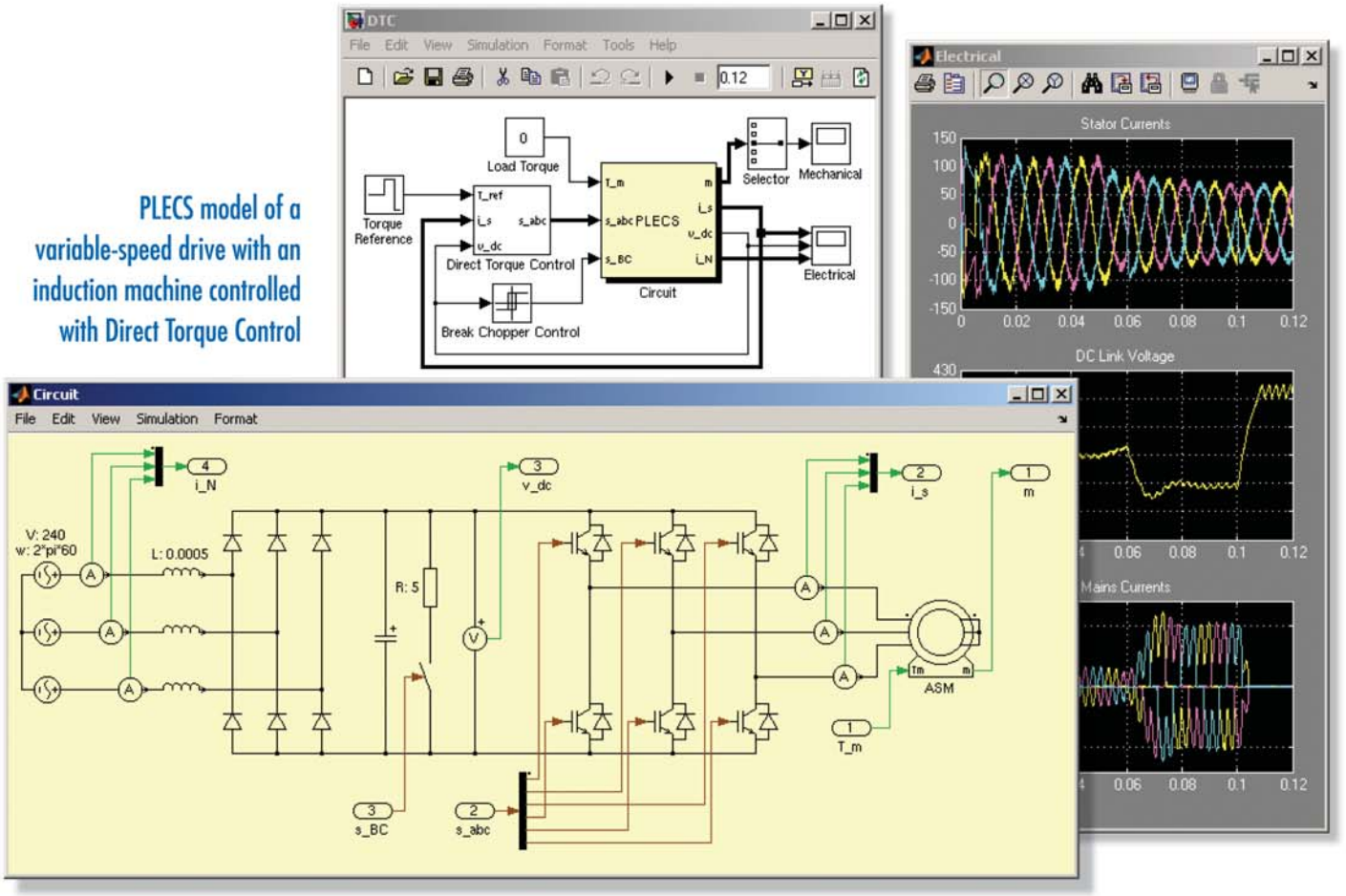

PLECS model of a variable-speed drive with an induction machine controlled with Direct Torque Control

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From The Editor

John M. Miller

Happy New Year to all our PEL's members! Power Electronics Society is now in its 20th year, two decades of very exciting times, changing times, accomplishments and service to society. This past year was witness to progress and to change. The newsletter is growing, we've moved to not only color front and back covers, but to inside color which has contributed greatly to reader appeal. In 2007 Prof. Akagi assumed leadership as PEL's president and our society leaders represented PEL's at the June Society Review meeting in Philadelphia, PA. More detail on this can be found in the President's message inside. There was also change in the form of reducing proliferation of professional conferences as exemplified by PEL's and IAS forming a merged conference the Energy Conversion Conference and Exposition that will make its debut in September 2009 thanks to the dedication and efforts of many individuals including our past president, Prof. Rik DeDoncker. The article by Ralph Kennel, PEL's VP Meetings, describes in detail the behind the scenes activities leading to this merger. The interested reader is also referred to a related article by Dr. Tomy Sebastian in the PEL's newsletter Vol. 19, Nr. 3, July 2007. Speaking of anniversaries, 2007 marked the 10th year anniversary for our German chapter that you can read about in Dr. Omid Forati Kashani's summary of their Hannover-Hameln meeting. It was ten years ago, 1998 that Prof. Rik DeDoncker helped initiate and institute this very active chapter. Congratulations to our fellow members in Germany!

This is also a very packed issue and the editorial staff offers a batch of meeting and event announcements for 2008 to our members. For 2008 we have our premier conference announcements for APEC® at the end of February in Austin, TX, PESC® at the Greek Island of Rhodes during June and our sponsorship of even numbered year meeting of the IEMDC in Miami, FL at the beginning of May. Plus advance notice of ECCE2009 to be held September 2009 in San Jose, CA. This meeting combines for the first time the prior separate meetings of PESC, of which 2008 will be the last conference, and IAS IPCSD sessions into a single energy conversion conference. Also during the third quarter of 2008 PEL's is co-sponsor of the European Power Electronics

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CVD growth chamber with ultra-dense vertically-aligned carbon nanotube electrode structure (see article on pp 32-36). Courtesy of Laboratory for Electromagnetic and Electronic Systems, MIT.

From The Editor continued from page 3

and Power Electronics Motion Control, EPE-PEMC meeting to be held in Poznan, Poland in Sept. Exciting times indeed.

Finally, we are pleased to offer excellent updates on the IEEE Fellow grade nomination process from Mr. Frank Romano of the IEEE Fellow Committee and a listing of the 2008 IEEE PEL's Fellows. Congratulations to all of the recipients. Dr. B.K. Bose provides us with an outline and process flow for the procedures to be used to nominate colleagues as IEEE medalists. Also, our technical article to kick-off 2008 focuses on energy storage technology from a very respected researcher and industrial practitioner, Mr. Michio Okamura. Over the past four years Mr. Okamura has worked diligently to overcome considerable technical barriers to commercializing his Nanogate-capacitor product that we last reported on in the January 2004 issue, Vol. 16, Nr. 1. Technology development takes time, considerable effort and devotion in the face of many setbacks. Kudo's to Mr. Okamura and our congratulations!

John M. Miller, EIC
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President's Message

Dear PELS members:

Did you enjoy the 2007 Christmas, 2007 End-Year, and/or 2008 New-Year holidays with your family, parents and/or relatives, recalling and appreciating your own culture and tradition? A New-Year home celebration in the morning on January 1st inspires me to renewed effort every year, eating a traditional meal, drinking a special rice wine (the Japanese "sake"), and talking with my family. More than 6,000 PELS members spreading all over the world may hold their individual New-Year celebrations. Each of the PELS members belongs to one of regions 1 to 10 to encourage area activities such as the IEEE Distinguished Lecturer program, as well as regional conferences and workshops.

Looking back on the year 2007, I would like to emphasize that the silicon-controlled rectifier (SCR) was born at General Electric in 1957, just 50 years ago. Later, the SCR was renamed as the "thyristor" that stemmed from a short combination of a "thyratron" with a "transistor." The birth of the SCR was really the dawn of power electronics. (Exactly speaking, the term "power electronics" was not used at that time. Dr. William E. Newell used it with its lucid definition in his paper entitled "Power Electronics--Emerging from Limbo" in IEEE Trans. on Industry Applications, vol. IA-10, no. 1, pp. 7-11, 1974.) As for my relation to the thyristor, I did research on a phase-controlled cycloconverter based on line commutation for five years when I was a graduate student in the 1970s. Stable and soft line commutation from a thyristor to another one with current overlapping impressed me with the essentials of power conversion. The emergence of both gate-turn-off (GTO) thyristors in the early 1970s and IGBTs in the mid 1980s has made the thyristor (the SCR) out of date. However, the latest light-triggered thyristors are still used in high-power line-commutated converters for high-voltage direct-current (HVDC) transmission systems and back-to-back (BTB) frequency changers and asynchronous ac-link systems.

During the year 2007, I had various and valuable experiences as the PELS President. I attended three IEEE Technical Activity Board (TAB) Meetings in February, June and November, where not only all the society/council presidents and division directors but also the IEEE TAB Director and his staff joined together, discussed common issues, and ironed differences of opinion among more than 40 societies and councils. The so-called "society review" was one of the most important events for the PELS in the June IEEE TAB Meeting. The TAB society-review committee reviews each society every five years for the purpose of keeping it healthy in its mission, purpose and vision, governance and organization, finance, technical committees, publications, conferences and workshops, and membership from various aspects of view.

Prior to the society review on June 14, 2007, we submitted to the committee a 37-page report, together with the PELS Constitution, Bylaws and Operations Handbook. A team effort by all the PELS AdCom members and the executive officer, Lee Myer resulted in completing the fine report. On behalf of the PELS, I deeply thank all of them for their sincere contributions. The PELS representatives present were Rik De Doncker, Ron Harley, Grahame Holmes, Dean Patterson and Hiro Akagi. The presentation and discussion lasted two hours, keeping a good relation to the committee members. Later, the committee sent a 9-page society-review report with the following general observation: "The Society is well managed and well run. It is financially sound, with good reserves, a successful conference program and a prestigious publication." In addition to this welcome observation, the committee has made some constructive comments and suggestions, as well as encouragements. According to the suggestions, we are reorganizing the governance including the PELS AdCom meeting, and are planning to convert this Newsletter into a Magazine.

This year 2008, our Society is due to hold several conferences and workshops such as APEC in February, PESC in June, COMPEL in August, and INTELEC in September, along with many technically-cosponsored conferences and workshops. I am convinced that one of the most important activities and services to the PELS members is to organize conferences and workshops, as well as to publish our Transactions and Newsletter. Therefore, I encourage you to participate in your favorite conference and/or workshop, to enjoy it, to exchange the latest information on power electronics, to meet old friends, and to find new friends. After presenting a paper at a PELS-sponsored /cosponsored conference or workshop, you are stimulated to submit the improved paper considering discussions and comments at the conference or workshop to the IEEE Transactions on Power Electronics. It would be the most prestigious to have your paper published in the Transactions.

The 39th PESC will be held at the International Convention Center Sofitel, Capsis Hotel, Rhodes, Greece from June 15 to 19 in 2008. I have heard from the Technical Program Chair, Vassilios G. Agelidis that this PESC has received over 1400 digests (an all-time record) from a record number of over 70 countries and areas. This is great but the 39th PESC will be the last one. It will be followed by the inaugural IEEE Energy Conversion Congress and Exposition (ECCE) that will be held in San Jose, California, USA, September 20-24, 2009. This new conference combines the IEEE PESC with the Industrial Power Conversion Systems Department (Electrical Machines Committee, Industrial Drives Committee, Industrial Power Converter Committee, and the Power Electronics Devices and Components Committee) of the IEEE Industry Applications Society Annual Meeting.

Power electronics continues to be one of

key technologies to overcome urgent global warming and climate change on the planet, Earth. It is a good time, in a broad sense, to actively promote research on power electronics leading to reducing CO2 emissions, for example, research on energy savings and renewable energy. Our Transactions is timely planning to publish "a Special Issue on Power Electronics for Wind Energy Conservation" in May 2008.

The IEEE Power Electronics Society is a dynamic professional organization that values cooperation, diversity, innovation, enthusiasm and globalization! I am proud of being a PELS member for many years, as well as serving as the President in 2008.

Hirofumi (Hiro) Akagi
IEEE PELS President
Professor, Tokyo Institute of Technology
E-mail: akagi@ee.titech.ac.jp

Hirofumi Akagi 赤木泰文

INTELEC® Fellowship

The INTELEC® Advisory and Conference Executive Committees sponsor the Joseph J. Suozzi INTELEC Fellowship in Power Electronics. This fellowship is named in honor of the late Dr. Joseph Suozzi, a founder and long-time leader of INTELEC. This grant, increased to $15,000 starting in 2008, is made annually to an electrical engineering graduate student studying in an area of power electronics applicable to communications systems. Such systems include wireline, optical, wireless or combinations of such systems such as the Internet or embedded telecommunications infrastructures. Alternative energy systems for communications networks or network elements is also a suitable area.

This fellowship is international and is therefore open to electrical engineering graduate students in all countries. It is a one-time grant to an individual and is not renewable.

Interested electrical engineering graduate students should submit:

- an essay not exceeding one page in length that explains how his/her proposed project can be applied to powering of communications systems
- a transcript of his/her grades
- a letter of support from his/her Faculty Advisor.

These materials should be sent by 1 February 2008 to the Chair of the IEEE Power Electronics Society Education Activities Committee:

Dr. Hui Li
Electrical and Computer Engineering Dept.
2525 Pottsdamer Street
Tallahassee, Florida 32310-6046

The recipient of the 2005 INTELEC fellowship will be notified by 21 April 2008.

Rhodes the city of knights

PESC08

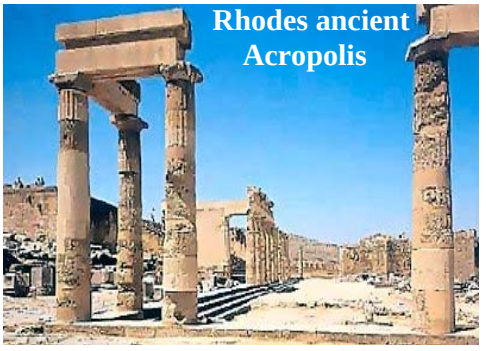
39th Power Electronics Specialists Conference

June 15-19, 2008

Island of Rhodes, Greece

PESC is an annual international conference providing a forum for research results, which advance fundamentals and principles of power electronics technologies. PESC includes: technical sessions, tutorials, and informal discussion sessions. Topics cover design, control, analysis, modeling, and simulation of power electronics systems, power converters, motor drive systems, power semiconductor devices and technologies, magnetic devices and materials, energy storage systems, emerging power electronic topologies, and all other aspects of the field. A highlight of this conference would be specially planed sessions showcasing state-of-the-art industrial applications including energy efficiency technologies.

The IEEE Power Electronics Specialist Conference for the year 2008 will take place in the island of Rhodes in Greece and will be co-sponsored by the National Technical University of Athens chaired by Dr. Stefanos Manias and Dr Vassilios Agelidis.



Rhodes ancient Acropolis

The island of Rhodes is considered to be one of the most popular summer resorts of Europe. Rhodes is gifted with unprecedented natural beauty, blessed with innumerable archaeological sites of unique value and pulsing with numerous non-identical settlements. The island of Rhodes is situated at the cross roads of two major sea routes of the Mediterranean between the Aegean Sea and the coast of the Middle East. The meeting point of three continents, it has known many civilizations.

Enjoy the Aegean sea and sky

The conference will be held at the Sofitel Capsis Hotel & Convention Center, a 5-star deluxe fully equipped resort hotel, located at the beachfront of the Ixia Bay, 5 minutes from the Medieval City of Rhodes and 15 minutes from the Rhodes International Airport.

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IEEE Joint IAS/PELS/IES German Chapter celebrates its one decade founding anniversary

Dr. Omid Forati Kashani

It was in May 1998 as Prof. Rik W. De Doncker, later IEEE PELS President, informed the members of the IEEE IAS in Germany about the approval of the petition to form the IEEE IAS German Chapter with effective founding date of December 18th, 1997. As Interim Chapter Chairman he invited the members to meet at the RWTH Aachen University in Aachen, Germany, to elect the first Chapter Board and to start the Chapter activities. Founded in 1997 the IEEE IAS German Chapter has been merged with IEEE PELS in 1999 and IEEE IES in 2001 to become the IEEE Joint IAS/PELS/IES German Chapter. With more than 300 members and organizing of at least three technical meetings per year the IEEE Joint IAS/PELS/IES German Chapter is one of the most active chapters within the IEEE Germany Section. Besides meetings the IEEE Joint IAS/PELS/IES German Chapter has been the main organizer of the IEEE Power Electronics Specialists Conference (PESC) in 2004 in Aachen, Germany. Honoring these activities the IEEE Joint IAS/PELS/IES German Chapter got many awards such as "IEEE PELS Best Chapter Award for 2001", "IEEE Industry Applications Society's 2002 Outstanding Large Joint Chapter", "IEEE Region 8 The Chapter of the Year 2003" and "IAS Continued Outstanding Performing Chapter 2005". Therefore the last meeting of the Chapter in 2007 on 15th and 16th of November at the Leibniz Universität Hannover and the Lenze AG had a special meaning for the Chapter celebrating its one decade honorable existence.

The host of the first day of the meeting was the Leibniz Universität Hannover in Hannover, Germany. After a short welcome speech by the Chapter Chairman Prof. Heinz van der Broeck and Prof. Axel Mertens, the head of the Power Electronics and Drive Control group of the Institute for Drive Systems and Power Electronics at the Universität Hannover, the president of the university Prof. Erich Barke gave some information about the history and the activities of the Universität Hannover in his presentation. Founded in 1831 the Leibniz Universität Hannover is today with more than 23,000 students in the fields of natural sciences and engineering, the humanities and social sciences as well as in law and economics, one of the largest institutions of higher education in Lower Saxony, Germany.

In the next part of the presentations Prof. Mertens and Prof. Bernd Ponick, the head of Electrical Machines and Drive Systems group, introduced the history and the activities of the Faculty of Electrical Engineering and Computer Science and the Institute for Drive Systems and Power Electronics of the Leibniz Universität Hannover. As two examples of the projects at the institute Mr. Sven Demmig and Mr. Andreas Averberg presented their projects about active Microsystems and DC-DC Converters with power ratings between 1 kW and 5 kW for Fuel Cells respectively. In his presentation Mr. Demmig explained his research results about various Micro Actuators and their applications. Mr. Averberg presented his DC-DC Converter for Fuel Cells and his analytical investigations considering various parameters which influence this circuit.

After presentations the participants had the opportunity to visit the laboratories of the institute, where more explanations about the projects and test benches were given. The laboratory tour ended with celebrating of the 10th Chapter birthday with drinks and three birthday cakes decorated with the emblems of the three Societies, namely IAS, PELS and IES.

The last part of the meeting on the first day was the get-together party at Hotel Stadt Hameln sponsored by Lenze AG. In that party the Chapter Chairman Prof. van der Broeck and the Senior Past Chapter Chairman Dr. Peter Magyar gave the participants information about the history and awards of the IEEE Joint IAS/PELS/IES German Chapter in their humorous presentations. Recording the ten years history of the Chapter it is planned to produce DVD-records from presentations and pictures of the meetings in the past and to give them to the participants at the first meeting in 2008.

The second day of meeting was hosted by Lenze AG near the city of Hameln, Germany. Founded in 1947 near Hameln today Lenze AG is with more than 3000 employees worldwide one of the leading innovative electrical drives manufacturers in Germany. Therefore it was not only a good opportunity for the meeting participants to visit an active manufacturer in electrical drives but also to celebrate the 10th Chapter birthday together with 60th birthday of Lenze AG.

The meeting at Lenze AG began with the welcome speech and presentation by Dr. Edwin Kiel, director of the innovation department of Lenze AG. In his presentation he introduced the Lenze AG and its production spectrum alongside its aims and goals. Before the IEEE Business part of the meeting Mr. Josef Lackhove of Lenze presented some drive and automation systems with their characteristics and components.

Meeting participants in front of the main entrance to the Hauptgebäude of the Leibnitz Universität Hannover.

IEEE Joint IAS/PELS/IES German Chapter board members cut the birthday cakes decorated with emblems of all three Societies.

Birthday cakes decorated with IAS, PELS and IES emblems.

Participants on the second day of meeting at Lenze AG.

In the IEEE Business part of the meeting Chapter Chairman Prof. van der Broeck reported about the participation of a student team from RWTH Aachen University and University of Applied Sciences Cologne, Germany, in the IEEE International Future Energy Challenge 2007 of PELS awarded with 2500 U.S. $. Another award was the Anthony J. Hornfeck Service Award of IEEE IES to Prof. Joachim Holtz from University of Wuppertal, Germany, which was handed over by Prof. van der Broeck. In the next part Prof. van der Broeck and Junior Past Chapter Chairman Prof. Andreas Lindemann presented the invitations for the Chapter meetings in 2008.

After IEEE Business part of the meeting the participants had the opportunity to visit the production lines for converters. Before the production line tour Mr. Christian-M. Popa and Mr. Uwe Behme of Lenze gave an introduction to the production line and test procedures at Lenze AG. During visiting the steps for the production of converters and test benches were explained. For example it was shown how the Surface Mounted Devices (SMD) were mounted on circuit boards or in the testing part how a robot took the assembled converters from line, put them in to the test boxes and brought them back on the line after tests.

The audience listening to the lecturers at Lenze AG

After lunch the meeting continued with two presentations. As the first lecturer Dr. Carsten Fräger of Lenze presented a high dynamic

servo drive system produced by Lenze AG. He explained the components, control and sensor system techniques which were applied in this servo drive system. As the last lecturer Mr. Hans-Joachim Wendt of Lenze presented some application fields in production and logistic centers. In his presentation he explained the market analysis of installed electrical drives and volume of sale in these fields.

There are three meetings in 2008 planed. The first one will be on 6th and 7th of March in Heidelberg, Germany. For more details please visit our website at: http://www.ewh.ieee.org/r8/germany/ias-pels/index.html.

Dr. Omid FORATI KASHANI is with Siemens AG in Nuremberg and Public Relations Chair of the IEEE Joint IAS/PELS/IES German Chapter.

Energy Conversion Conference & Exposition Update

Dear Members of the Power Electronics Society,

Increasing benefits for PELS members is one of the main goals of our society, especially for our president, Hiro Akagi and past–president, Rik De Doncker, and myself. Of course, it is sometimes difficult to define what a benefit really is and what is not. One aspect, which occurs very often in respective discussions, is the number of highly ranked conferences and the impossibility for each of us to take part in all of them. Of course, conferences are one of the main "products" of IEEE societies like PELS – the purpose is to keep the members up to date and to support intersociety collaboration. The question is, how can we keep ourselves up to date without spending too much time visiting a tremendous number of conferences (in a certain year I have attended more than 10 myself)?

The problem increases when considering the fact, that many universities merge departments and institutes with low numbers of students. In former times it was usual to have a professor for power electronics, another one of electric machines and even another one for electrical drives at the same faculty. Today only large universities can afford this – it is much more common, that all three subjects mentioned above are taught by a single colleague. As each of the subjects has its own main conferences within IEEE – and in addition to that some more conferences outside IEEE – the problem seems to turn into a non solvable one.

Our past-president has started some far view initiative to find a profitable solution for all our members – academics as well as colleagues from industry. It is my intention to inform you about the goals and ideas of this initiative and to gain your support for it. Furthermore, I like to keep you informed about the developments and activities with respect to that matter.

When discussing about conferences and their intentions it becomes clear that there are different demands/requirements/wishes amongst industry and academics. Of course, both want to be updated with respect to latest developments in their respective subjects. Industrial colleagues, however, usually have the possibility to attend only a very limited number of conferences per year (usually only a single one), whereas academics often have the means – and maybe even the obligation – to attend several ones.

Fairly and frankly speaking, the main problem for colleagues from industry is not the travel cost or participation fees – it is the time they are not available for their company. With respect to that situation a lot of well-known conferences supported significantly from industry are limited in duration to 3 days. It is hard for many industrial colleagues to attend conferences outside their own continent or even their own country – travelling time, not travelling cost, in most cases leads to a decision not to attend the conference, even if it is highly recommended. Another aspect is the location of a conference – it is definitely harder for industrial colleagues to get the permission for attending a conference, when the conference takes place in a holiday resort or a comparable region instead of an area with strong industrial character or without any doubt, that the main reason for doing this trip is really the conference – and not entertainment.

With respect to academics the situation is a different one. Of course, academics appreciate the links to colleagues from other parts of the world for exchanging experiences and keeping up to date with respect to their teaching activities. In many countries academics are ranked according their number of publications – conference contributions are usually a first step to a journal paper which is essential for the ranking. (In some countries – like Germany – academics are not (yet) ranked as described above. We should – however – be aware that the developments even in these countries will also lead to the situation that the number of highly ranked publications gets more important). Therefore, some academics feel there should be even more possibilities for publishing. A reduction of the number of conferences does not seem to meet the interest of academics. The initiative of our Past-President takes care for both aspects. The idea is to perform only one main conference in each of the three industrial parts of the world (America, Asia and Europe).

Industrial people are encouraged to attend the conference in their own part of the world. For the most industrial companies it should be possible to send their power electronics specialist to that important conference in their neighbourhood. Academics who need the possibility to publish more papers than on a single conference per year can attend the conferences in other parts of the world. This enables them to present their research results to more addressees all over the globe.

With respect to America, PELS and some IAS committees have decided to install a new main conference covering – besides others – the areas of Power Electronics and Electrical Drives. This conference is called ECCE (Energy Conversion Conference and Exposition) and will take place the first time from September 20 to September 24, 2009, at San José, California, USA. In the same year, there will be no PESC. The IAS committees of the IPCSD Department (IPCC, IDC, PECC and EMC) have decided to hold their committee meetings and sessions at ECCE instead of the IAS Annual Meeting (which will take place with the remaining committees of IAS). The intention is to organize an ECCE annually in America.

In Asia, discussions have started to realize a similar concept with a single main conference for Power Electronics. China, Japan and Korea want to circulate this conference on an annual basis between their countries.

In Europe the situation is unfortunately even more complex – nevertheless the issue of a single main conference and EXPO is discussed with European colleagues and engineering organizations.

In each part of the world there are a couple of international, but more regionally oriented conferences – there is no intention from our side (PELS) to impact these conferences. Even after installing the concept of 3 main conferences as described above, PELS will collaborate with other conferences and sponsor or co-sponsor them.

I am very sure that these few explanations cannot clarify all issues and aspects of the conference with expo concept. We would appreciate if our members would start discussions and reasoning and give us a feedback about their opinions. This would help to consider our members' needs and wishes when proceeding with the activities described above.

Ralph M. Kennel
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IEEE MEDAL – The Most Covetable Award

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1. INTRODUCTION

Do you know what is an IEEE Medal? Have you ever looked into the Spectrum and The Institute that announce the IEEE Medalists every year with their photos and citations ?

As a professional in EE, you might have already received prize paper awards, Society awards, IEEE Fellowship, or Technical Field Awards (such as Newell Award or Tesla Award), but the IEEE Medal is by far the highest and most prestigious award you can ever get from the IEEE. These Medals are like Nobel Prizes in Electrical Engineering (there is no Nobel Prize in engineering). Again, the crown jewel of all the Medals is the Medal of Honor. Some persons who will remain immortal in the history for their contributions, such as Guglielmo Marconi, EFW Alexanderson, William Shockley, Lotfi Zadeh, Charles Concordia, Gordon Moore, etc. are the recipients of the Medal of Honor. As you know, the IEEE (The Institute of Electrical and Electronic Engineers) is the largest professional organization in the world, and therefore, the prestige and competition of these Medals are very high. Each year, the IEEE holds the Honors Ceremony [2], where the Medals are awarded by the IEEE President in highly ceremonial environment. As a researcher in EE, you might have spent long and dedicated hours of your life in the solitary corner of a laboratory, possibly sacrificing a lot of your earthly pleasures. If you have made significant contributions that have a lasting impact on technology, society and the engineering profession, and that makes you an outstanding individual, you need to be recognized by the IEEE Medal. Your close professional colleagues are possibly watching you all the time with their admiring eyes, and one of them will be willing to nominate you for the Medal with your close cooperation.

2. DESCRIPTION OF MEDALS

There are altogether 16 IEEE Medals [1] that are distributed in the different areas of electrical engineering. These can be briefly described as follows:

1. Medal of Honor
"For an exceptional contribution or an extraordinary career in the IEEE fields of interest"
(Gold medal + Bronze replica + Certificate + $50,000)

2. Edison Medal
"For a career of meritorious achievement in electrical science or electrical engineering or the electrical arts"
(Gold medal + Small gold replica + Certificate + $10,000)

3. Founders Medal
"For outstanding contributions in the leadership, planning, and administration of affairs of great value to the electrical and electronics engineering profession"
(Gold medal + Bronze medal + Certificate + $10,000)

4. James H. Mulligan, Jr. Education Medal
"For a career of outstanding contributions to education in the fields of interest of IEEE"
(Gold medal + Bronze medal + Certificate + $20,000)

5. Alexander Graham Bell Medal
"For exceptional contributions to the advancement of communications sciences and engineering"
(Gold medal + Bronze replica + Certificate + $20,000)

6. Simon Ramo Medal
"For exceptional achievement in systems engineering and systems science"
(Gold medal + Bronze medal + Certificate + $20,000)

7. Richard W. Hamming Medal
"For exceptional contributions to information sciences, systems and technology"
(Gold medal + Bronze replica + Certificate + $20,000)

8. Jack S. Kilby Signal Processing Medal
"For outstanding achievements in signal processing"
(Gold medal + Bronze replica + Certificate + $10,000)

9. John von Neumann Medal
"For outstanding achievements in computer-related science and technology"
(Gold medal + Bronze medal + Certificate + $10,000)

10. Jun-ichi Nishizawa Medal
"For outstanding contributions to material and device science and technology, including practical application"
(Gold medal + Bronze replica + Certificate + $20,000)

11. Robert N. Noyce Medal
"For exceptional contributions to the microelectronics industry"
(Gold medal + Bronze medal + Certificate + $20,000)

12. Dennis J. Pickard Medal
"For outstanding accomplishments in advancing the fields of radar technologies"
(Gold medal + Bronze medal + Certificate + $20,000)

13. Wolfson James Clerk Maxwell Award
"For groundbreaking contributions that have had an exceptional impact on the development of electronics and electrical engineering or related fields"
(Gold medal + Bronze replica + Certificate + $20,000)

14. Lamme Medal*
"For meritorious achievement in the development of electrical or electronic power apparatus or systems"
(Gold medal + Bronze replica + Certificate + $10,000) Currently

* The author is currently the Vice-Chair of the Medals Council. He is the recipient of 1996 Lamme Medal.

not awarded due to lack of funding

15. Medal for Engineering Excellence*
"For exceptional achievements in application engineering in the technical disciplines of the IEEE, or the benefit of the public and the engineering profession"
(Gold medal + Bronze medal + Certificate + $10,000) Currently not awarded due to lack of funding

16. Heinrich Hertz Medal*
"For outstanding achievements in electromagnetic waves"
(Gold medal + Bronze replica + Certificate + $10,000) Currently not awarded due to lack of funding

A candidate can get more than one medal (not in the same year and not for the same contribution), but the Medal of Honor recipient is not eligible for any other medal. If you receive a Medal, you are not eligible for any Technical Field Award. The Lamme Medal is meant for power engineers (including power electronics), but unfortunately, it is discontinued temporarily because currently there is no sponsor for it. Historically, the Edison Medal was awarded to a number of power engineers [such as Peter Lawrenson (2005), Nikola Tesla (1916), George Westinghouse (1911), etc.], but mostly, it goes to non-power engineers because of severe competition. The power engineers are also eligible for Education and Engineering Excellence Medals, but again the competition is high. Some of these medals can be shared by multiple recipients (two or three). Historically, majority of the Medalists have been from USA (like Nobel Prize winners), but currently, the international competition is high.

3. HOW TO NOMINATE?

Anybody (IEEE Member or Non-Member) can nominate a Medalist, but it is desirable that he is an IEEE Fellow and well-known in the field. The flowchart for nomination and selection is given in Fig.1. The procedure is

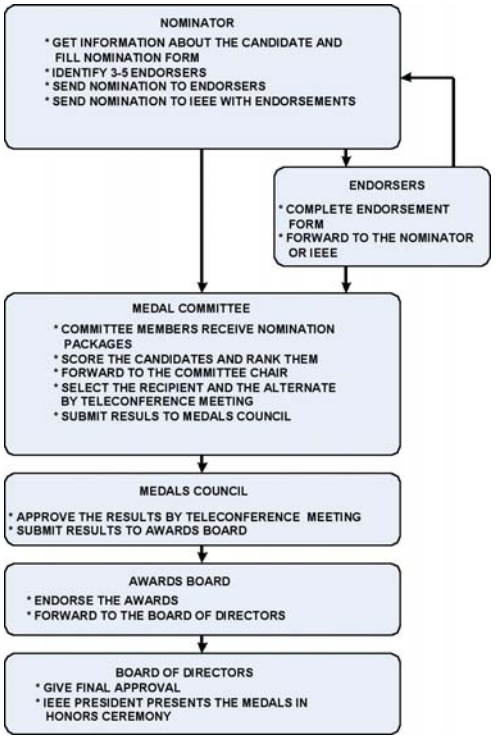

Fig.1. Flowchart for nomination and selection of Medalist

somewhat similar to IEEE Fellowship nomination [3]. If you think that you have a professional colleague who deserves a Medal, please come forward and nominate him. The Nomination Form and the Guidelines can be downloaded from the IEEE website [1]. There is a short one page "Potential Nominee Form" that probes eligibility of the candidate. However, you can ignore it, if you want. Please watch the nomination announcement every year in The Institute. The deadline is typically the early July of every year.

Interact with the candidate heavily and identify the strong points which are to be emphasized in the form. Also, with the help of the nominee, identify 3-5 endorsers who will be willing to make strong recommendation about the candidate. They should all better be IEEE Fellows and heavy-weights in the field. The endorsement from the relevant society President is optional. Organize the text with carefully selected words, and rewrite it several times until it comes to perfection. All the strong points should be highlighted to catch the eyes of Medal Committee members. Of course, the committee members possibly know the candidates well by their contributions. The endorsers have the option of sending the endorsement letter directly to the IEEE, or to the nominator, but the former is desirable. In summary, follow all the guidelines carefully without exceeding the text space boundary.

4. SELECTION PROCESS

For every Medal, there is a Selection Committee that normally consists of eight members (excluding the Chair). The decision is taken by a majority vote, but if there is a tie, the Chair overrules the selection. The committee selects the recipient and an alternate with appropriate citations. From the remaining candidates, a few are listed for consideration next year, and the rest are rejected (politely termed "withdrawn"). If contributions do not match, one or two candidates can be transferred to other Medal Committees for consideration. There is no harm for simultaneous nomination of a person in several committees, but an individual can not get more than one medal in a year, as mentioned before. The Committee Chair prepares the biography of the recipient (and the alternate) highlighting their achievements for future publication.

After the Medal Committees have made selection, the Chairs submit the report to the Chair of Medals Council for approval. The Medals Council (with the Medal Committee Chairs as members) meets in a teleconference meeting and approves the Medals. The list is then forwarded to the IEEE Awards Board for endorsement. It is then forwarded to the Board of Directors for final approval.

5. HONORS CEREMONY

Finally, the day comes for celebration typically in the month of June every year. It is a ceremonious occasion of high publicity and grandeur, when not only the Medals but other awards, such as Service Awards, Honorary Membership, Corporate Recognition, Prize Papers, Fellowship & Scholarship, External and IEEE Staff Awards are also presented. The Technical Field Awards are presented by the respective Societies. All the prominent persons of IEEE hierarchy (Awards Board, Board of Directors, Fellow Committee, IEEE volunteer invitees and media people) along with the President and President-Elect assemble on this occasion. The Medalists meet early in a private reception (see Fig.2) where they are given the Award checks and certificates, and briefed for formalities of the

Fig.2. IEEE Medalists for the year 1996 (IEEE President – middle in back row, Medal of Honor – middle in front row, Author – third from right in front row)

Honors Ceremony is normally held in the evening with a gala dinner. The President presents the Medals with introduction of each recipient which is then followed by acceptance response of the Medalists. The Medalists are also recognized formally in a later date by the respective Societies. The Medalists are publicized heavily in the Spectrum, The Institute, Society Magazines/Newsletters, websites and local newspapers. Best luck for your nominations.

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IEEE Fellow Nomination Process

By Frank Romano

The Fellow Committee, in concert with Staff, has developed a PowerPoint presentation that describes the Fellow program and the process for submitting a nomination. As the nomination period is open at present, but will close 1 March, 2008, this is a good time to remind members and volunteers of the program that acknowledges those individuals who have contributed significantly to the advancement of engineering, science, and technology and represents the highest grade of IEEE membership. In addition, we are particularly interested in reaching out to the industrial community to offer a better understanding of the Fellow program and the benefits derived by those enterprises. Three years ago, we introduced the Fellow program category of Application Engineer/Practitioner to identify those members who take an idea for a product or service that was designed by someone else and bring it to the marketplace to benefit of society.

A slide presentation describing the process is available from IEEE at the Fellow web site at: http://www.ieee.org/fellows

Frank Romano
Administrator, Fellow Activities
445 Hoes Lane
Piscataway, NJ 08854

Bose Biography

Dr. Bose has held the Condra Chair of Excellence (Endowed Chair) in Power Electronics in the University of Tennessee, Knoxville since 1987. Concurrently, he was the Distinguished Scientist (1989-2000) and Chief Scientist (1987-1989) of EPRI-Power Electronics Applications Center, Knoxville. Prior to this, he was a research engineer at GE Global Research Center in Schenectady, NY for 11 years (1976-1987), a faculty member at Rensselaer Polytechnic Institute, Troy, NY for 5 years (1971-1976), and a faculty member of Bengal Engineering and Science University (BESU) for 11 years (1960-1971). He is specialized in power electronics and motor drives area. He has authored or edited seven books in power electronics, published more than 200 papers, and holds 21 U.S. patents. He has given invited presentations, tutorials, and keynote addresses extensively throughout the world. He is a recipient of a number of awards and honors that include the IEEE Power Electronics Society William E. Newell Award (2005), IEEE Millennium Medal (2000), IEEE Meritorious Achievement Award in Continuing Education (1997), IEEE Lamme Medal (1996), IEEE Life Fellow (1996) (Fellow in 1989), IEEE Industrial Electronics Society Eugene Mittelmann Award (for lifetime achievement in power electronics) (1994), IEEE Region 3 Outstanding Engineer Award (1994), IEEE Industry Applications Society Outstanding Achievement Award (1993), BESU Distinguished Alumnus Award (2005), GE Silver Patent Medal (1986), GE Publication Award (1987), Calcutta University Mouat Gold Medal (1970), Honorary Professor of Shanghai University (1991), China University of Mining and Technology (1995), Xian Mining University (also Honorary Director of Elec. Engg. Inst.(1998), Huazhong University of Science and Technology (2002), and Honorary Adviser of Beijing Power Electronics D&D Center (1990). Dr. Bose had B.E. in 1956, M.S. in 1960, and Ph.D. in 1966.

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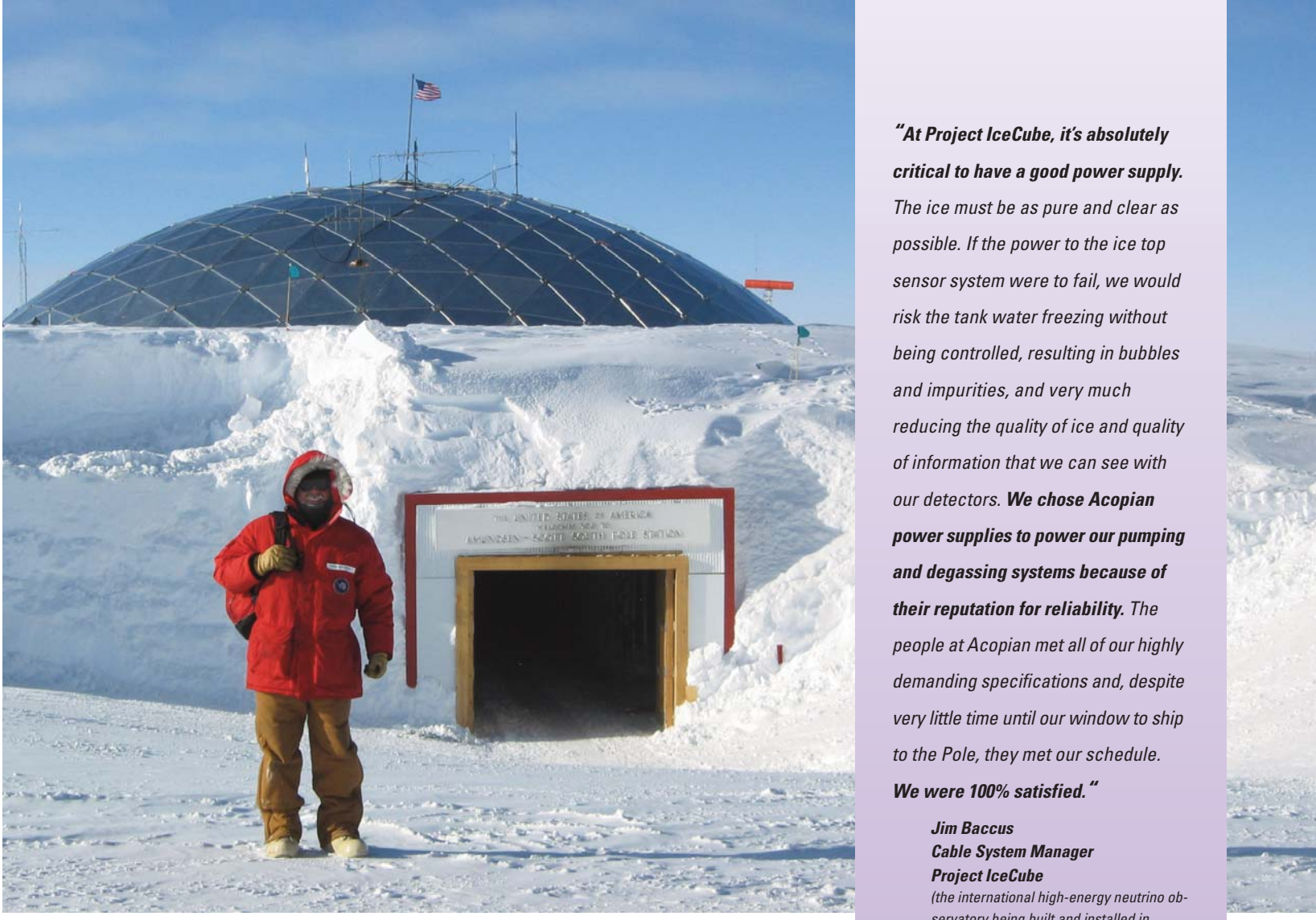

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Updating the "Nanogate" Capacitor

Michio Okamura

1. Introduction

There have been considerable changes in the situation surrounding the Nanogate-capacitor since its debut October 2, 2003, at JEOL, Ltd [1]. In Japan lithium-ion batteries have expanded into the market with their high energy densities. Nickel metal hydride (NiMH) batteries also succeeded in hybrid vehicles manufactured by Toyota.

On the contrary, capacitor hybrids have not experienced big growth after the Honda fuel cell vehicle FCV in 2002 and capacitor hybrid trucks manufactured by Nissan Diesel.

2. Status of the Nanogate-capacitor

In September of 2007, the first stage of the development of the Nanogate-capacitor [1-2] was completed, moving it closer to mass production.

The Nanogate-capacitor targets are shown in Figure 1, the high-powered upper left region will be covered easily by conventional activated carbon-carbon capacitors. Power density, for example, 27 kW/kg by the U2 Nanogate cell, will be satisfactory for non-acetonitrile electrolyte capacitors.

To expand ultracapacitor energy storage into the right-side region, that is, by increasing energy density without losing the features of carbon-carbon capacitors, we set several targets using the Nanogate principle.

Why Nanogate moved from JEOL to Power Systems, Inc.

The Nanogate phenomenon was originally discovered during research on electric double layer capacitor (EDLC) by Mr. Okamura and others, then developed and publicized by JEOL and Okamura Laboratory [2]. There were early hopes for this new device, which presumably could reverse the present shares of batteries and capacitors in energy storage applications. With its long life and high efficiency, the Nanogate-capacitor could dominate a new technical world of capacitive electrical energy storage.

However, things were not developing so well, and in 2004 Okamura Laboratory absorbed Power Systems, then the renamed Power Systems accepted an investment of approximately 23 million USD and built its own EDLC and Nanogate-carbon factories. This means now there are two Nanogate technologies, the original one by JEOL and the recently improved Nanogate from Power Systems.

In previous papers, I carefully defined JEOL's data to distinguish one Nanogate from the other. Formerly, and as the president of my own laboratory, I am now the chairperson of Power Systems. Therefore, all of my papers and information should now be fully devoted to Power Systems, not to JEOL, since they are different companies.

No significant developments have been announced recently on the Nanogate by JEOL, and this article concentrates only on the activities of Power Systems.

The L6 is the first product of the Nanogate-capacitors. This 2 _F (ohms for a farad of capacitance) cell for a 1 minute-charge, provides the highest specific power (W/kg) but the lowest specific energy)Wh/kg) for the Nanogate, at about 10 Wh/kg. The A5 cell is a 20 _F cell intended for a 10 minute-charge. The B5 is a 200 _F cell intended for a 100 minute-charge for the highest energy density, 38 Wh/kg [3]. Dark marks in Figure 1 indicate cells now in production or available in the near future, and light marks indicate development is currently underway.

These energy densities are lower than expectation at the beginning but still much higher than the attainable level by conventional carbon-carbon EDLC.

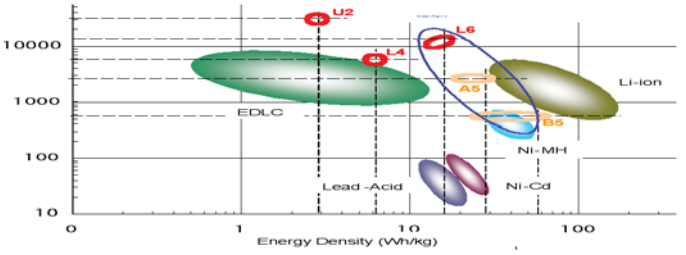

Figure 1: A rough comparison of our capacitors and batteries [4,5]

3. Chasing energy density

To overcome the limitation on specific energy, we thought to remove the catalytic action that comes with activated carbon. If we could get rid of these unwanted catalysts from the capacitor electrodes, a higher operating voltage and hence higher energy density should be obtainable.

However, that belief was only partially correct. By replacing activated carbon with various carbons available at that date, the results amounted to nothing more than a loss in specific energy and energy density. To be a record-breaking electrode, it must have both higher operating voltage and larger capacitance.

While pursuing this research direction, the carbon was heat-treated at various temperatures, including the use of modifications of several processes known as carbon activation methods. During some trials with similar processes such as potassium hydroxide (KOH) activation, we hit upon a strange material behavior, which was afterward called Nanogate-carbon. Details of this finding have been described elsewhere [1].

4. Behavior of the electrodes

The activation of the Nanogate electrodes was carried out not in the furnace but within the capacitor cell on its first charging cycle. Initially, a non-porous carbon electrode indicates nearly zero capacitance, as shown in the left-bottom portion in Figure 2. The plot in Figure 2 traces the voltage between the plus and the minus terminals of the cell, while it is being charged at a constant current.

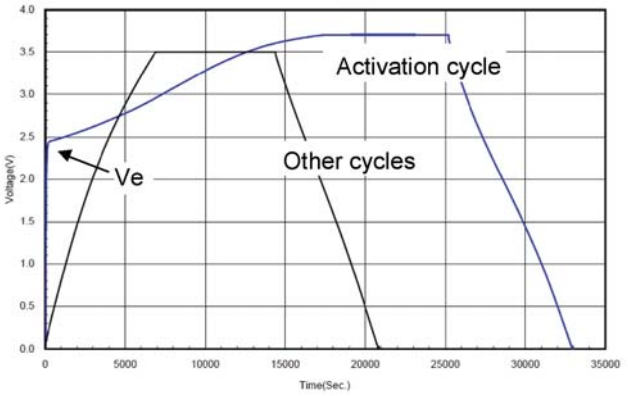

Figure 2: The first (activation) and the second cycles

At the very beginning of the first charging cycle, charged cell voltage went up quickly and stopped at Ve, changing to a much slower rise above this threshold. Since 1/(dv/dt) of the trace was proportional to the capacitance, the curvature of the trace indicated very small capacitance existed from the beginning (0 volts up to Ve). When charging potential exceeded Ve, the capacitance suddenly started increasing thereafter. We named this phenomenon "electric field activation".

After the first electric field activation cycle, large capacitance appeared on both plus and minus electrodes. By this method, a catalytic property did not appear and large capacitance was obtainable, together with high operating voltage.

Unlike common activated carbon, beautiful charge-discharge traces from zero to 3.9 volts were obtained, as shown in Figure 3, although regular operating specifications will be 3.2 volts or so. The Nanogate-capacitor can be charged or discharged all the way down to zero with no harm. All the voltage traces are almost linear with no abrupt changes in the curvature. Judging from such behavior, we consider that there is no ion intercalation but only adsorption of ions taking place, at regular charge/discharge cycles, just as in a pure EDLC.

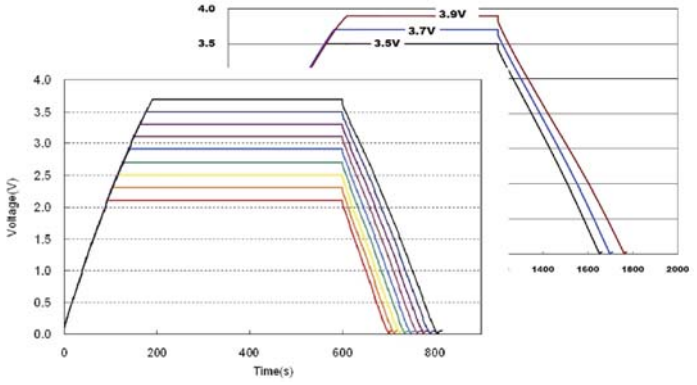

Figure 3: Charge/discharge of the Nanogate-capacitor 2.1~3.9 V

5. Scale production of the Nanogate-capacitor

Although the research described above was successful, there was one big issue left. It was not known if the same result could be obtained in the next trial. What's more, there was no vendor available from whom we could purchase the Nanogate-carbon. This might not have been a problem for the former Okamura Lab., Inc., or for academic purposes, but it was not good enough for Power Systems, Co., or for the production line of the Nanogate-capacitor.

Finally, we came up with building a carbon factory by ourselves. The carbon for the Nanogate-capacitor is not activated but requires special treatment similar to KOH activation, which is notoriously explosive.

Our carbon factory is composed of furnace lines designed as to be expandable to a maximum of ten lines. Each line has a linear transmission system, and moves material to a temperature-controlled furnace area. The yield of the system is about 1 ton/month for each line, which corresponds to 10k-cell/month for a line.

Since the Nanogate-carbon is non-porous and heavy, much better yield is obtainable than activated carbon. Processing and handling are easy.

5. Conclusion

Supported by successful operation of original carbon factory, The Nanogate-capacitor has finally been launched by our factory. Increasing specific energy and energy density by the Nanogate-capacitor method progressing with type "L" to "A", then to "B", will expand the ranges of EDLC. These developments, together with large-scale production, suggest lower costs are possible and should open up a wider area of applications.

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Biography

Mr. Michio Okamura is chairman of Power Systems Co., Ltd. and inventor of the Nanogate-capacitor. He can be reached at 81-45-931-2202, or by Fax 81-45-931-2180 and via email at okamura@powersystems.co.jp

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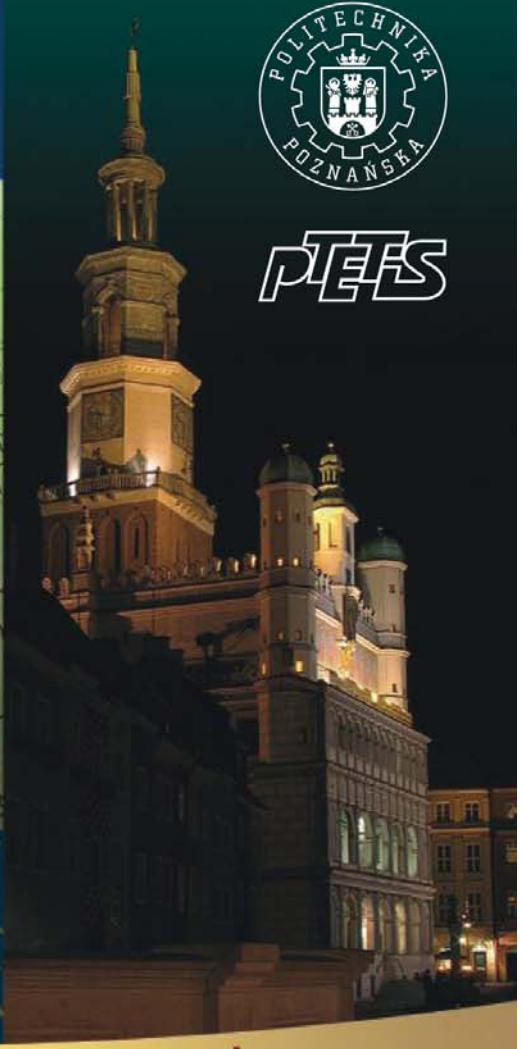

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The IEEE Power Electronics Society announces the **Eleventh IEEE Workshop on Control and Modeling for Power Electronics (COMPEL'08)**. This workshop brings together industrial, government, and academic researchers for interactive discussions on the latest advances in modeling, analysis, and control of power electronic devices, circuits, and systems. Special emphasis at COMPEL'08 will be on multi-domain, multi-scale modeling, simulation and abstraction. The workshop also includes hands-on software and hardware demonstrations presented by participants.

Topics: The COMPEL'08 Technical Committee will consider all submissions relevant to the areas of interest of the workshop. Topics suitable for the workshop include (but are not limited to):

- *Digital Control*: fully digital & hybrid methods; low-power, low-cost; DSP, microcontroller, FPGA, ASIC; control algorithms, design methods, implementation issues, applications.
- *Modeling & Simulation*: devices, circuits, and systems; multilevel modeling; model fidelity & compatibility; electro-thermal, EMI, reliability, failure mechanisms; hardware-in-loop.
- *System Power Management*: data centers, processors, renewable energies & co-generation, micro grids, hybrid/electric vehicles, all-electric aircraft, electric ships, space applications.
- *Design & Operation*: synthesis, visualization, and verification tools; monitoring, built-in test, diagnosis, and prognosis; adaptation and reconfiguration; virtual prototyping.
- *Education*: virtual laboratories, multimedia tools, interactive simulation, symbolic tools.

Deadlines:

Digest submissions due:	14 April 2008
Author notification of acceptance by:	2 June, 2008
Final paper versions due:	4 August 2008

Tentative Workshop Schedule:

17 August (Sunday): Tutorial & Welcome
18-20 August: Technical Sessions & Demos
Social events include reception and banquet

Preparation of Submissions:

Prospective authors should submit a cover page and a separate digest, not exceeding 4 pages, of their intended submission. The cover page should include the title, author names and complete mailing addresses, telephone and fax number, e-mail addresses of the corresponding author, and a 100-word abstract. The digest should not identify any author. All submissions must be sent as electronic mail attachments, ***in PDF format***, to **compel2008@lem.ee.ethz.ch**.

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Visit the Workshop website for more information:
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Town & Country Resort & Convention Center, San Diego, California USA
September 14-18, 2008

We would like to formally invite you to attend the **30th International Telecommunications Energy Conference** to be held September 14–18, 2008 at the Town and Country Resort and Convention Center, in San Diego, California, USA.

INTELEC 2008 is an international forum on innovation and power quality that has been growing every year since its inception and is recognized as "The Event" for technical exchange specific to power systems applications in the communications industry. INTELEC brings together the key players in the user and supplier communities of wireline, wireless, cable, satellite and broadband networks and provides the forum for users, system engineers, installers, maintenance personnel, manufacturers and product designers to exchange ideas and review the latest industry innovations.

In 2008, we'll be returning to San Diego, one of America's finest cities. INTELEC was last held in San Diego in 1988. Over 100 technical papers, covering virtually all aspects of telecommunications power will be presented. Several workshops, tutorials and an outstanding exhibition of power equipment used in communications applications are also scheduled at the conference. Over 1,000 representatives from more than three dozen countries are expected to attend.

Please visit our web site at www.intelec.org for additional information. We look forward to your attendance in sunny San Diego in September, 2008.

Sincerely,

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Chairman
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A Technical Forum on Innovation and Power Quality

IEEE

SECOND ANNOUNCEMENT AND CALL FOR PAPERS

11th International Conference on

OPTIMIZATION OF ELECTRICAL AND ELECTRONIC EQUIPMENT OPTIM '08

May 22-24, 2008, Bra_ov, Romania

Organized by: **Faculty of Electrical Engineering and Computer Science, Transilvania University of Brasov**

In cooperation with:

- Faculty of Electrical Engineering, *Politehnica* University of Timisoara
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Technically Sponsored by:

- IEEE-IAS, -PELS, -IES & IEEE Romania Section
- IET The Institution of Engineering and Technology & IET Romania Section
- VDE Association for Electrical, Electronic & Information Technologies

Topics:

Electrotechnics

- Electric Circuits and Networks, Electromagnetic Field, Electrostatic Processes, EMC/EMI,
- Magnetic Materials, Pasive Components and Materials
- Electromagnetic Processing of Materials, Electromagnetic heating
- High Voltage Technique: Discharges, Insulation
- Electric Arc, Electrical Apparatus: Modelling, Simulation, CAD
- Industrial and Commercial Power Systems: Transients, Short Circuits; Rural Electric Power
- Power Quality and Utility Applications, Power System Protection, Earthing, Lightning
- Lighting Applications

Power Electronics, Electrical Machines & Industrial Drives

- Rotary and Linear-Motion Electrical Machines and Drives, Electric Generators and their Control
- Power Electronics in Drives, Control in Power Electronics
- Electric Propulsion on Trains, Vessel, Urban People Movers
- High Power Converters, Low Power Converters, Switching Converters
- Automotive Power Electronics and Motor Drives, Automotive Electrical Equipment
- Mechatronics, Actuators, Robotics, Mobile Autonomous Systems

Industrial Automation and Control

- Control of Linear and Non-linear Systems
- Motion Control, Drive Control, Modelling, Simulation, Signal Processing
- Adaptive and Robust Control, Variable Structure Control, Petri Nets, Neural Networks, Intelligent Systems
- Industrial Informatics, Communication Systems, Process Control
- CAD Tools and Multimedia, Human-Machine Interface Technology
- Safety and Reliability in Automation

Applied Electronics

- Power Electronics Components and Devices: Modelling, Simulation; Discrete and Integrated Semiconductors,
- DSP and Microcontrollers for Power Electronics and Motion Control
- Electronic Circuits and Network Theory, Circuits & Systems, Microsystems
- Symbolic Approaches on Electronics
- Embedded Systems, Hardware & Software Co-Design
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- Audio and Video Signal Processing
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Electrical Engineering Education

- Education in Electrical Technologies
- New Educational Tools including Information and Communication Technologies
- Introducing Information and Communication Technologies in the Laboratories
- Distance Learning, Continuous Learning, New Materials, New Methods
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Special Sessions

- Optimization Algorithms in Power Electrical and Electronics Engineering
- Hybrid Vehicles, Fuel Cell Vehicles, Electric Vehicles, Control Techniques for Electric and Hybrid Vehicles
- Renewable Energy Conversion and Control
- Linear Electric Motor Drives and Maglevs
- Numerical Field Computation Methods in Electromagnetics
- Virtual and Remote Laboratories

Schedule for paper submission:

Full paper deadline:	January 15, 2008
Notification of acceptance:	February 15, 2008
Photo-ready copies and Registration fees:	April 5, 2008

Submission:

Selection will be based upon full length 6 or 8 A4 pages paper in IEEE double column format. Only contribution papers are accepted. Practical (experience based) contributions from industry are mostly welcome. Please make sure that your paper is the best it can be when you send it by Email. You will be invited to make corrections in accordance with reviewers' recommendations.

IEEE Authors Guide may be downloaded from the sites: http://www.ewh.ieee.org/soc/ias/pub-dept/style.html, (styles) and …/two-column.pdf (sample paper) or may be available on request from IEEE Publications Department, P.O. Box 1331, Piscataway, NJ 08855-1331 USA. **Important OPTIM corrections**: paper size A4; 3-3.5 cm top and bottom margins, 2.5 cm left and right margins; 5 mm space between the two equal width columns.

We expect to have again a conference with 170-200 papers or more (OPTIM '06 had 158 papers from 28 countries). The papers are planned to be presented in 3 parallel oral lines of sessions with poster sessions to cover for the rest of the papers. We will have 3-4 keynote addresses from world-renowned personalities and international high tech Companies, to be presented in special plenary sessions. There will be 2 full conference days (Thursday May 22 and Friday May 23) with day 3 (Saturday May 24, 2008) for cultural events for all participants.

Load your submission on the site http://info-optim.ro. Please load blind (anonymized) files in Adobe Acrobat (.pdf). On the site you are invited to complete a form containing the title of the paper, the authors (names, affiliation, E-mail address, mailing address, phone and fax numbers), the corresponding author, and the topic area.

Accepted Papers:

All submitted papers will be reviewed by members of the International Steering Committee and the corresponding author will be notified of acceptance or rejection. Accepted papers must be presented at the conference (an author could present maximum two (2) papers) and will be published in the conference Proceedings.

The best (graded by the reviewers' scores) 20% of papers presented (the session and date will be mentioned) at OPTIM 2008, with the author's approval, will be sent by the organizers of OPTIM-06 and will considered for review for eventual publication in **IEEE Trans. Vol. IA, PEL, and IE**, provided their content falls into the scope of these Journals. More details will be given on site at OPTIM 2008. **This is a result of continuing technical sponsorship from IEEE-IAS, -PELS, and -IES.**

Papers from OPTIM '08. may also be considered, by author's initiative or by invitation, for final review and speedy publication in the new Internet-only international archival journal: "Journal of Electrical Engineering"; please visit: "www.jee.ro".

Conference Language:

The official language of the Conference is English. It will be used for all printed materials, presentations and discussions.

Registration fees (bank transfer taxes not included):

350 EUR (or equivalent in USD) for each participant (author or not author), includes attendance at all scientific programs, invitation to the welcome reception and the banquet, Proceedings in CD form, daily meals (4 days), transport by bus organized from and to the Bucharest International Airport, one trip from the list of the proposed ones.

250 EUR (or equivalent in USD) for each companion (not author or co-author), includes invitation to the welcome reception and the banquet, daily meals (4 days), transport by bus organized from and to the Bucharest International Airport, two trips from the list of the proposed ones.

We will arrange a wide variety of accommodations by request at prices from, approximately 40 Euro/night/room in good quality family hotels to probably up to 90 Euro/night/room in the 4 star Hotel "Cheile Gr_di_tei" where the Conference will take place.

Conference Location:

The OPTIM 2008 Conference will be held in Moeciu (near Bra_ov), 176 km north of Bucharest. Brasov is a famous beautiful, medieval-touch city in the middle of the country. There are many beautiful scenes in Brasov, Bran, and Poiana Bra_ov, which are located in the neighbourhood of the city. Brasov can be reached very well by car and it also by trains from/to most of the big cities in Romania. Bra_ov has no International Airport. The conference period is in the third week of May, which is warm enough, moist, with temperature about from 15 C (night) to 20 C (day). The Conference will take place in the 4 star Hotel "Cheile Gr_di_tei" in Moieciu, 45 minutes by car, from the centre of the old city of Brasov.

For more information contact:

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ANNOUCEMENT AND CALL FOR PAPERS

The IEEE International Electric Machines and Drives Conference provides an international forum for sharing experience, new ideas, and developments in design, operation, analysis, and practical application and optimization of electric drive systems and their components. IEMDC is a venue for users, designers and manufacturers, and analysts of electric machines and drives and their related power electronics and controls. The conference is jointly sponsored by the IEEE Power Engineering, Industrial Electronics, Industry Applications, and Power Electronics Societies.

In addition to the subjects identified above, the conference will have plenary presentations by recognized experts to highlight various aspects of electric machines and drives, such as automotive applications, renewable energy applications, permanent magnet motor drive systems, fault tolerant operation and survivability, sensorless methods, and turbogenerator operation and maintenance. Papers addressing these topics are encouraged.

Information for Authors

Authors wishing to submit papers are invited to submit an abstract of 200 words single spaced and a digest of five pages, including text, tables, and figures, at the conference website: http://www.iemdc2009.org. The style for the abstract, digest and the final version will be posted on the website. The Abstract and Digest should be in a single-column pdf format in 12 point serif text, such at Times New Roman and double spaced on either A4 or US letter-size pages. These format requirements are necessary for the peer review stage. Contact information for the corresponding author should be indicated on the abstract. No author information should appear on the Digest. Submissions should indicate a preference for oral or poster presentation in case of acceptance however, the final decision on the presentation format will be decided by the technical program committee. All submissions will be made through a web-based system

Acceptance notification will contain instructions for final paper preparation.

Registration and payment of fees by at least one author is required for inclusion in the conference proceedings.

Contact Information

Contact information is posted on the conference website: http://www.iemdc2009.org. The preferred mode of contact is e-mail. For general conference information, please address comments and questions to:

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IEEE IEMDC-2009 Conference Secretariat
Department of Electrical & Computer Engineering
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Florida International University
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Conference Record

The papers presented during the conference will be posted on IEEE Xplore and be cited in EI (Engineering Index).

Important Dates

Submission of Abstracts and Digests November 30, 2008
Notification of Acceptance January 16, 2009
Submission of Final Papers March 2, 2009

Double Layer Capacitor Electrolyte Kinetics

John M. Miller and Porter Mitchell

Maxwell Technologies, Inc.

Introduction

Double layer capacitors deliver exceptional energy storage performance in terms of pulse power, efficiency, cold temperature and high number of energy cycles. In fact, in any application requiring continuous energy shuttling these capacitors offer better performance than battery systems. Where battery systems excel in terms of energy storage, both gravimetrically and volumetrically, the double layer capacitor proves to be a very compatible mate by offering fast, high rate charge and discharge capacity. This paper examines the fundamentals of electrochemical energy storage within the double layer capacitor and why these components can compliment advanced chemistry batteries.

Double layer capacitance is a phenomenon found in all energy storage and conversion systems such as electrochemical batteries, battery-capacitor hybrids, electrochemical capacitors and fuel cells. The DLC effect may only account for 5% to 10% of the storage capacity in electrochemical batteries and fuel cells but accounts for nearly 100% of the storage capacity in electrochemical capacitors (EC). Figure 1 illustrates the taxonomy for EC's in terms of electrode kinetics. Symmetric DLC's, or more commonly ultracapacitors, represent a fast growing industry with application in every system that requires fast energy delivery and recuperation ranging from standby storage units in wind turbine pitch adjustors and hybrid vehicles to their being the main energy storage system in hybrid transit buses, trains and most recently, announcements for use as automobile energy recuperator and in micro-hybrids.

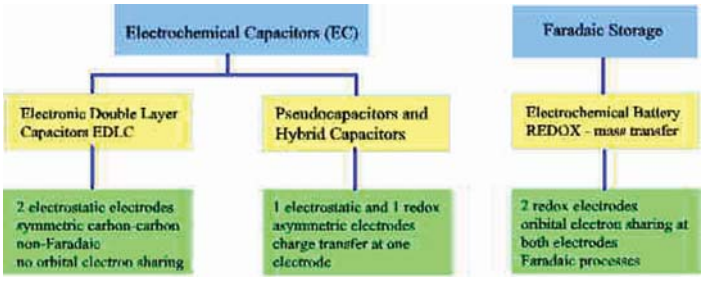

Fig. 1 Electrochemical capacitor and battery electrode kinetics

The DLC has undergone considerable development during the past decade but never so much as during the past three years owing to a high level of interest in energy storage technologies. This interest is fueled to a large degree from the public's increased awareness in renewable energy and the need to reduce global greenhouse gas emissions from all sources. The technical community has engaged in energy storage system refinements over the long term with the fruits of these efforts now appearing as innovations in not only improved energy densities but novel types of energy storage systems. Numerous researchers have sought to improve system performance through materials research approaches of activated carbon, the principal active material in these systems. Such approaches include reducing the reactivity or catalytic activity of the carbon and electrolyte in order to extend operational voltages. Okamura [1] describes a novel method for substantially improving DLC energy density by processing carbon in a manner that reduces or eliminates the catalytic action present in all activated carbons. His Nanogate capacitor achieves higher operating voltage through a first cycle formation process referred to as "electric field activation". Other researchers have developed novel hybrid capacitor concepts consisting of one lithium-ion electrode and a complimentary, lithium pre-doped graphite electrode referred to as the Li-Cap. But electrochemical energy storage is really about storing ions, as many ions as possible. Schindall [2] discusses the mechanisms of ion storage in a context free dissertation that proposes batteries and ultracapacitors share the same operating principles at the most fundamental level – that current is the result of ion transfer in each. In this paper we examine the role of ion transfer in more detail.

What is a DLC?

An excellent discussion on double layer capacitors can be found in the work of Conway [3], a pre-eminent authority on EC's, who notes that it was the work of von Helmholtz in 1853 that inspired this field. Quoting Conway, "DLC arises at all electrode interfaces with electrolyte solutions or ionic melts." All subsequent models for DLC's are based on this concept of ion adsorption to a material surface under the influence of an electric field. To illustrate this fact, consider the sketch of the carbon-carbon ultracapacitor electrode pair shown in figure 2. The left side of figure 2 is a sketch of the ultracapacitor cell showing exaggerated surface irregularities to dispel any notion of smooth, clean, blemish free surface morphology at the scale of ions in solution. The highly porous paper separator serves two roles, one to prevent the two electrodes from shorting out should any asperity of one reach through to the other electrode as happened in recent lithium-ion cell events and second it provides a salt-bridge or ionic conductive pathway allowing operation of the cell. On the right hand side is another highly stylized view of activated carbon pore structure. The point here is that solvated ions in solution are actually rather large in comparison to micro-pores (<2nm diameters) which begs the question of what role micro-pores play in ultracapacitors [4]. But that topic is beyond the intent of this short article. Suffice to say that even the rather small, unsolvated, tetraflouroboride anions (~3.25Angstrom dia.) will have difficulty squeezing into a micro pore when solvated (i.e., sheathed with solvent molecules, AN ~ 2 Angstrom dia.). The electrodes are symmetric with similar pore size distributions in both which means the solvated cations, tetraethylammonium molecules (~6.5 Angstrom) most likely won't fit, or will fit with difficulty into a mirco-pore.

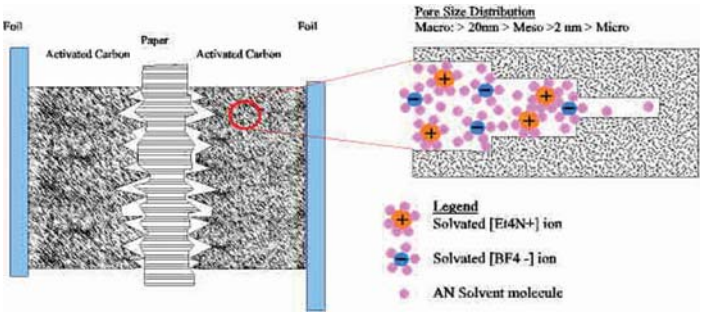

Fig. 2 DLC effect at carbon-electrolyte surfaces

The graphic in figure 2 serves another useful purpose and that is to point out that symmetric ultracapacitors maintain the ionic distribution in the electrolyte under charge balance at all times. When in the uncharged state the cations and anions are more or less randomly distributed in the solvent bath but should be viewed as weakly paired due to their electrostatic attraction, which is why the polar solvent molecules end up sheathing them in the first place. View the solvent sheath as a dielectric layer since these are neutral molecules. The question now is what happens when a potential is applied at the terminals of an ultracapacitor? In figure 3 a voltage is applied across the metal foils of the two electrodes.

The Helmholtz Layer

The DLC effect at first was viewed in the context of the compact layer of ions adsorbed to carbon surfaces at their surface state sites. This Helmholtz layer view explained the DLC effect in terms of classical electrostatic capacitance as that due to high surface area activated carbon hosting electronic charge at the interface to the electrolyte ionic layer. The charge separation distance in the Helmholtz model is simply the thin molecular diameter layer of the solvent sheath. Figure 3 presents the three electrochemical models that came into vogue following the pioneering work of von Helmholtz.

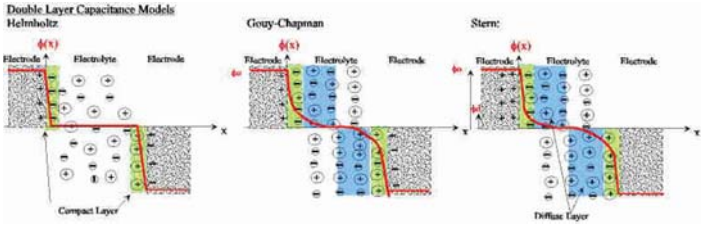

Fig. 3 Electrochemical models of the DLC electrode kinetics

These models are shown from left to right in figure 3. The Helmholtz model of the compact layer presents the DLC as strictly an electrostatic capacitor (static electric field and linear potential as shown) existing across the thin compact layer. The electrolyte is viewed as a highly conductive medium with zero potential loss. Therefore, the potential supported by each electrode is roughly half the terminal potential. In this model the capacitance is constant and not voltage dependent as it is in reality. To rectify this shortcoming, Gouy-Chapman devised a diffuse model that viewed ions as point charges along with the compact layer of Helmholtz but followed by a diffuse layer reaching further into the electrolyte solution. This revised model exhibits a non-linear potential function as shown (Fig. 3 center) and more closely approximates real DLC behavior. However, Gouy-Chapman only works well at low potentials but over-estimates capacitance at higher potentials. The Stern model (far right) retains the compact layer of Helmholtz and the diffuse layer of Gouy-Chapman but modifies the point charges to include physical size of the molecules. The Stern diffuse model is better because it admits potential drop across the electrolyte, the ionic contributor to a physical cell's equivalent series resistance. The Stern model therefore most accurately predicts the nonlinear voltage dependency of capacitance, C(U), and the breakdown of equivalent series resistance as: $ESR=R_{electronic} + R_{ionic}$.

Finite conductivity of the electrolyte means that when an external voltage is applied to the ultracapacitor cell that resultant ion motion is swift and since current in the external circuit is carried by ion current within, power transfer is fast. But just how fast is this swift ionic motion? It should come as no surprise that electric fields in the compact layer of a DLC can be extremely high (~1.35V/2nm). A little math shows that an ion in proximity to an electronic charge in the carbon (Fig. 2 RHS) will experience an intense acceleration (to or away from the carbon depending on polarities) in this electric field. Electric field is force/unit charge with force magnitude given as (1) from classical electrostatics. Here, when charge separation distance, r, is taken in the range of 1 nm to a few Angstroms the force reflects that experienced by ions in solution. At 1nm separation in vacuum (e0 =1) F=23 pN of force on a unit charge (relative permittivity of acetonitrile, AN, is roughly 37).

$$F_{12} = \frac{q_1 q_2}{4\pi\epsilon_0 r^2} \tag{1}$$

After calculating the atomic mass of cations (~130 g/mole non-solvated) and anions (~87 g/mole non-solvated) the Newtonian acceleration on the larger cation comes out to roughly 100g (times gravity in the electrolyte). In other words the ions are going to move briskly into or out of the carbon pores, typically observing Walden rule [5] in the absence of ion pairing, which states that:

$$(\frac{\upsilon}{E})\eta = constant \tag{2}$$

Where η is the solvent viscosity, υ is the velocity, E is the field so that υ/E is the mobility of the ion. The ultracapacitor response is therefore far superior to orbital electron transfer and its resulting mass transfer in redox reactions in the battery, which proceed at different rates in each electrode. Maxwell Technologies ultracapacitors for example have RC time constants in the range of 400 to 700 ms, during which time an ion can accelerate to >400 m/s and will traverse a 30 um separator in one-quarter milli-second. So what prevents the ions from crashing into the carbon? At this molecular level short range nuclear forces come into play, specifically the van der Waals force. At close range, on the order of fractions of a nanometer, the van der Waals force is attractive and actually adds to the electrostatic attractive force producing acceleration of ions in the direction of the electric field. But once molecules approach to a separation that is less than the attractive peak of the Lennard-Jones potential (ϕ_w) the nucleus-nucleus repulsive force (F_w= -dϕ_w/dr) completely overpowers the electrostatic force. Figure 4 illustrates

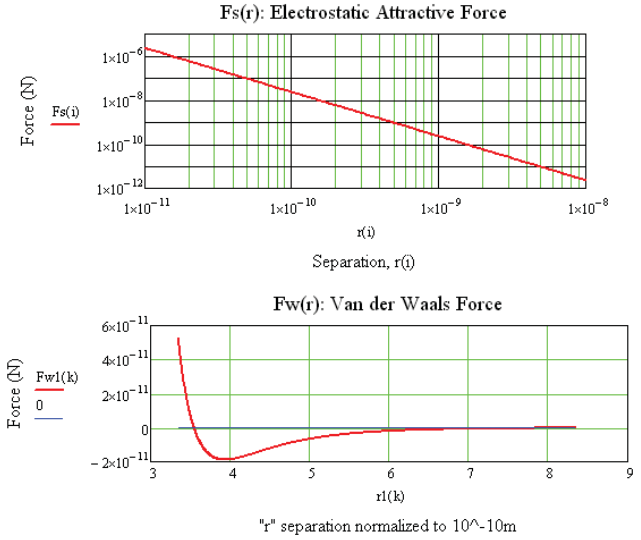

Fig. 4 Illustration of electrostatic and van der Waals Forces acting on charged molecules

the electrostatic attractive force (Fs from (1)) acting on the unit charge cation molecule in vacuum (1 Angstrom is at center of x-axis) and the van der Waals force that reverses polarity at the Lennard-Jones potential peak. Once molecules approach within 3.6 Angstrom the nuclear repulsive force dominates and balances out the electrostatic force. View this under-damped behavior as sort of a quivering equilibrium.

Summary

Acetonitrile (AN) electrolyte based ultracapacitors have exceptional cold temperature performance, fast charge and discharge dynamics and high power cycling capability due in large measure to the fast kinetics of the ions in solution. For power electronic system designers this means an energy storage system component that delivers or absorbs high pulse power with high efficiency. Continuous refinement of the carbon DLC means that higher cell potentials will deliver higher specific energy, lower ESR will push pulse power levels even higher and improved electrolytes will offer higher temperature performance. An example will illustrate the meaning of RC time constant in the context of an ultracapacitor pack for application to a metro train for catenary stabilization of the 1500V line.

At matched load conditions the series connection of 4 heavy transportation modules, HTM, BMOD0018-P390 rated 17.8F, 65mΩ results in an overall pack ESR = 0.26 Ω, including interconnects and parasitic inductance of 27.5 uH. With 0.26Ω load the pack voltage decays to 37% of rated in one time constant (τ = 2.314s). In figure 5 upper right the terminal voltage drops from 1560V open circuit to 780V at the load initially under matched load conditions. The inductance limited rise time of the current is 0.9ms to 3kA at 1560V for a peak internal power of 4.68 MW and peak load power ($U_{mx}^2/4ESR$) = 2.34 MW.

The 4-HTM series pack discharges 5,975A into a virtual short circuit (0.26mΩ) as shown in figure 5 on the lower right. The terminal voltage of course is near zero for this case. The current and internal voltage follow at the short circuit time constant τ = 1.157s. Load current response (i.e., ion transfer kinetics) is very fast enabling the ultracapacitor with extremely high, and bi-directional, pulse power capability limited only by circuit parameters and the ultracapacitor ESR.

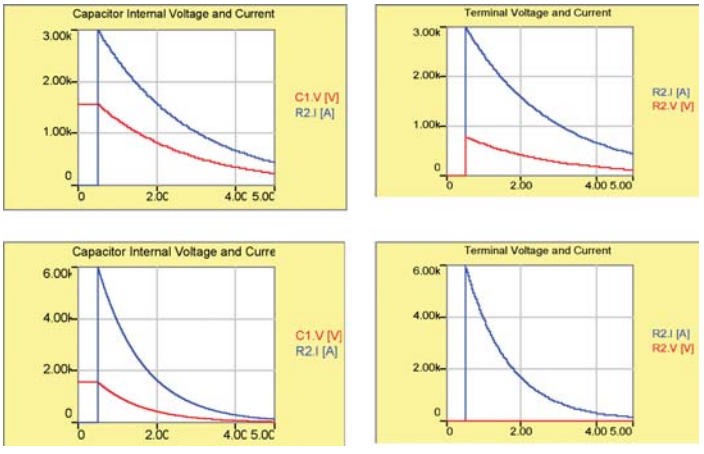

Fig. 5 Example of ultracapacitor time constant and current pulse response.

Electrochemical capacitors, being free from reaction rate kinetics, deliver orders-of-magnitude faster response times than chemical kinetic rate dependent lithium batteries [6]. The demarcation in power capability between lithium-ion cells and ultracapacitor cells remains at approximately 20s. Energy recuperation and delivery at high rates having durations less than 20s are the purview of ultracapacitors whereas energy recuperation durations exceeding 20s are best served with a battery.

References

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Dr. John M. Miller spent 30 years of his career in the aerospace, white goods, private practice and automotive industries. He took an early retirement from the Ford Motor Co. in 2002 and in Jan. 2006 he joined Maxwell Technologies as vice president where he now pursues systems, applications and integration of ultracapacitor energy storage components into a wide range of applications.

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What's in a Name?
A New Model for Regenerative Electrical Energy Storage

Joel Schindall,
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A tale of batteries, capacitors, and... batacitors?

Sometimes we can gain great insight into a device by thinking a bit about the concept of operation. Batteries have been around for so long (since the Volta Pile in 1800) that no one reflects much on their basic principle of operation. Most people would define a battery as "a chemical way to store electrical energy." If asked for more detail, they would focus on the chemical interactions that take place in the electrodes of the battery.

Perhaps this is misleading. I would submit that the real phenomenon that is taking place in a battery is that ions, i.e. electrical charges, are migrating from one electrode or plate into the electrolye and a corresponding number of ions from the electrolyte are being stored through a redox combination in the other. The resulting electrochemical potential is what produces the voltage, but it is the ion transfer and storage that supports the charge storage and hence the current. For any given electrochemical potential, the energy storage capability is directly proportional to the number of ions that can be absorbed in the electrodes.

A capacitor stores electrical energy in quite a different manner. There is no electrolyte and there is no ion flow. The voltage is generated by an electrical field rather than an electrochemical potential, and the current results from electron accumulation/depletion in the electrodes rather than ion transfer.

There is a less-well-known device commonly referred to as an ultracapacitor, double-layer capacitor (DLC), electrochemical capacitor, or supercapacitor, which falls between a battery and a capacitor. In fact, I would suggest that the abundance of names suggests an ambivalence about whether its fundamental physics are those of a battery or that of a capacitor. An ultracapacitor consists of two inert porous electrodes (usually aluminum coated with a thin layer of activated carbon) separated by a porous insulator and filled with an electrolyte similar to that used in a battery (figure 1). When a voltage is applied to the electrodes, ions from the electrolyte are attracted to and stored in the pores of the plate with opposite charge. There is no chemical reaction, but a capacitive voltage builds up between the ion layer and the porous carbon. So the voltage is generated capacitively by the electrical field between the ion layer and the carbon, but the current results from battery-like ion transfer and storage in the plates. An ultracapacitor can achieve a capacitance C=_A/d that is over ten million times higher than an equivalent metal-plate capacitor, simply because the effective surface area "A" of the activated carbon is tens of thousands greater than the linear surface area, and the effective spacing "d" between the ions and the carbon is more than a thousand times smaller than the spacing between the plates of the device. To give a specific example, commercial ultracapacitors the size of a D-cell battery are typically rated at 350 farads, while a paper capacitor the same size would be more like 20 microfarads.

I would suggest that both the ultracapacitor and the battery are fundamentally ion storage devices. The amount of charge they can store is equal to the ion storage (absorption) capability of the electrodes. The battery stores these ions via an electrochemical redox-couple reaction (Faradaic reaction), and generates its voltage through the electrochemical potential defined in the periodic table, whereas the ultracapacitor stores the ions electrostatically (non-Faradaic) without a chemical reaction and generates its voltage through the Helmholtz capacitance that is formed at the interstitial layer. However, the voltages obtained in both devices are similar, so the energy storage capacity is basically proportional to the number of ions that can be stored (absorbed).

To review, there are three primary differences between the battery and the ultracapacitor:

1. The battery electrochemically reacts the ions either volumetrically within a chemical lattice (e.g. Li-Ion) or via surface plating (e.g. lead-acid), whereas the ultracapacitor electrostatically stores the ions fractally within a highly porous material, i.e. the storage "volume" is dependent on the surface area of the highly convoluted or "fractal" structure of the activated carbon or other porous electrode material [thanks to John Miller of Maxwell for suggesting the analogy to fractal geometry].
2. The battery generates its voltage chemically, while the ultracapacitor develops its voltage capacitively.
3. The battery derives its ions from the electrode material, while the ions stored in the plates of a charged ultracapacitor are derived from the ions present in the electrolyte solution.

I suggest that items 2 and 3 do not represent significant differences. Regarding item 2, the voltages are in a similar range and the charge dependence of the capacitor voltage is easily regulated by external circuitry. In fact, the overwhelming advantage here rests with the ultracapacitor. Because there is no chemical reaction, an ultracapacitor typically achieves efficiencies in the high 90% range and can be charged and discharged in just a few seconds. Also, lack of a chemical reaction means almost unlimited lifetime (both shelf life and charge-discharge cycles) and limited degradation at low temperatures. Regarding item 3, this means that ultracapacitors require sufficient electrolyte ions (molarity) to support the total amount of stored energy. This represents somewhat of a limit, but electrolytes in the 2 molar concentration range that are available today can support up to 80 Wh/kg, and higher molarity electrolytes are a promising research area.

So the primary issue is item 1: *how many ions can be stored in the electrode per unit weight or volume.* The primary limitation of today's commercial ultracapacitors is that they can generally store only about 5% as many ions as a modern Li-Ion battery. So for most applications, their long lifetime and rapid charge/discharge characteristics are not enough to overcome their limited storage capacity.

The key issue here seems to be that a chemical lattice structure such as that of a Li-Ion battery is a very volumetrically-efficient way to store ions. Activated carbon is extremely porous, but its fractal surface area is simply not as great (and the irregularities of the pore sizes further reduce its effectiveness). If we could find an inert, conductive electrode material with sufficiently high (fractal) surface area), I submit that we could increase the energy storage capacity of ultracapacitors to the point where it approximates that of batteries. Since ultracapacitors are superior to batteries in almost every regard other than total energy (e.g. charge/discharge rate, lifetime, cold temperature performance), this would be a profound breakthrough. (As mentioned: ultracapacitor voltage is charge-dependent, but this is easily overcome with external charge pumps. Also, the ion depletion in the electrolyte is an issue, but this might be overcome with higher molarity electrolytes or the use of ionic liquids.)

Nanotechnology to the rescue

We have seen that activated carbon has an immense interior surface area, but it still falls short of the volumetric ion storage efficiency of a chemical battery electrode. What if we could nano-engineer an inert electrode structure whose porosity allows it to have as much "internal volume" for electrolyte ions as the chemical lattice of, say, a lithium ion battery? In a way, we are talking of engineering a fractal surface whose surface area permits as much volumetric ion absorption as the three-dimensional lattice of a traditional battery electrode compound. There seems to be no physical reason that this cannot be done. The key question is what natural phenomenon might accomplish this (because we are constrained to operate within the natural scaffolding of Nature's materials), and how to find and implement a realistic and cost-effective process for producing this material.

One such approach (and this is only one of many possibilities) is some work being carried on in my group in the Laboratory for Electromagnetic and Electronic Systems at the Massachusetts Institute of Technology. Many researchers have demonstrated that a microscopic forest of vertically aligned nanotubes can be grown on a (nonconductive) silica substrate by use of a thin catalyst layer and a chemical vapor deposition process. The silica is coated by a nanometer-thick layer of a catalyst such as iron. When the material is heated in a vacuum, the catalyst breaks into tiny droplets. When a hydrocarbon gas is passed over the substrate, carbon atoms are grabbed by the catalyst and a long nanotube self-assembles and pushes upward from the catalyst droplet.

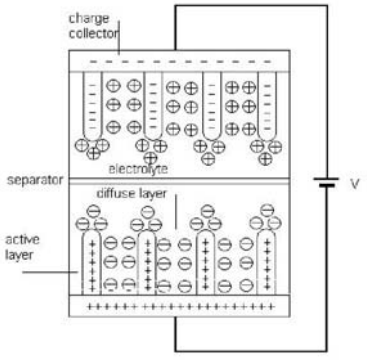


Fig. 1 Diagram of Nanotube-Enhanced Ultracapacitor Configuration (not to scale – nanotubes are much longer than shown) Top and bottom ends are the electrodes. Vertical tubes are the nanotubes. Circles are the ions. + and – signs represent positive and negative charges

Our work is still in process, but we have demonstrated that nanotube forests can also be grown on a conductive substrate. As compared to activated carbon, this is somewhat analogous to a paintbrush as opposed to a sponge. Our calculations indicate that the surface area of this forest should exceed the effective surface area of activated carbon devices by at least a factor of five, and we also anticipate being able to operate at higher voltages due to the inert chemistry of the nanotubes as compared to activated carbon. In our early testing we have measured true ultracapacitor action with extremely low impedance, but the cell chemistry is complex and we have not yet refined our cell assembly to the point of verifying the anticipated energy density increase.

How we model the world defines what we can do with it!

We certainly hope for success with our nanotube forest, but the primary point of this article is to suggest that viewing the battery as primarily an ion storage devices leads to the insight that perhaps the storage mechanism itself does not have to be chemical. To some, a non-chemical battery may seem like a contradiction in terms (though I would point out that the term "battery" was coined by Benjamin Franklin to describe a stack of charged glass plates which we would now call – a capacitor). Almost everything that is "bad" about batteries (relatively short lifetime, limited high current capability and poor low temperature capability) stems from the chemical reactions in the electrodes. In the 1960s, Philip Jose Farmer launched the science fiction series "Riverworld" in which huge ships are powered by a wondrous rechargeable device called a batacitor. We now have the technology to engineer a wide variety of passive electrode structures with high accessibility and fractal-like surface area. Perhaps it is time to use this technology to re-invent the battery.

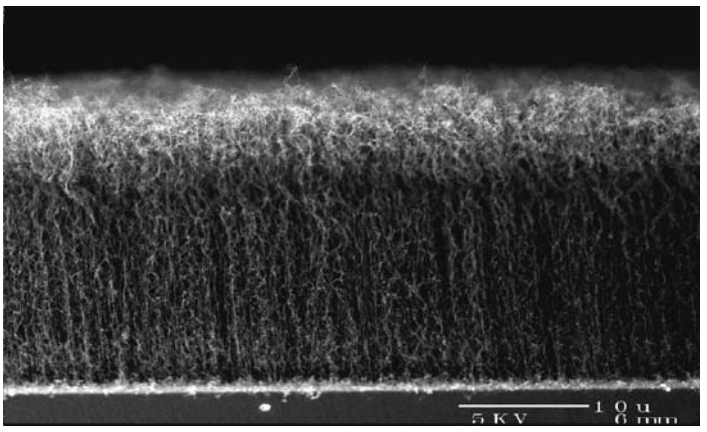


Fig. 2 Electrode cross-section. Bottom plate is the electrode, vertical "hairs" are the nanotubes (courtesy, Riccardo Signorelli, research assistant, MIT Laboratory for Electromagnetic and Electronic Systems).

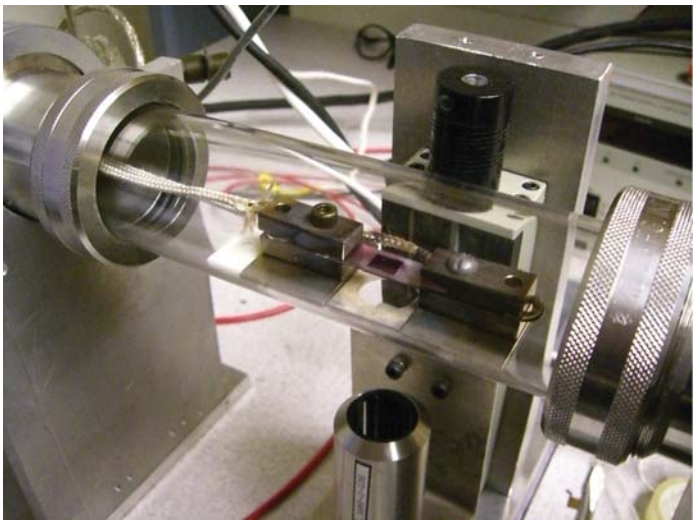


Fig. 3 Chemical Vapor Deposition (CVD) growth chamber with carbon nanotube sample in place

Joel Schindall received his BS, MS and PhD in electrical engineering from MIT in the 1960's. After a 35 year technical and management career in the aerospace, telecommunications, and satellite industries, including president of Loral Conic and Chief Engineer of Globalstar, he returned to MIT in 2002 as the Bernard Gordon Professor of Product Design in the Electrical Engineering and Computer Science Department.

Meetings of Interest

23rd Annual Applied Power Electronics Conference and Exposition (APEC2008) is announced for 24-28 Feb 2008 at the Austin Convention Center, Austin, TX. APEC2008 is co-sponsored by IEEE PEL's, IAS and PSMA. For more updates visit the website at: www.apec-conf.org

I&CPS 2008 the Industrial and Commercial Power Systems conference is scheduled for 4-8 May 2008 at the Sheraton Sand Key hotel in Clearwater Beach, FL. The meeting site is near Tampa, FL on the Gulf side. For more information please visit: www.ieee.org/icps2008

OPTIM-2008 venue: Biannual (in same Mountain Resort), on Power Electrical and Electronics Enginnering; May 22-24, 2008, Brasov, Romania and technical co-sponsored by IEEE – IAS, IES, and PEL's. For details please visit: http://info-optim.ro and http://optim.8m.com. Also, see the announcement in this issue.

39th IEEE Power Electronics Specialists Conference, PESC08 will take place on the island of Rhodes, Greece from 15-19 June 2008. Form more information please visit PELs website or contact PESC08 General Chair, Dr. Stefanos Manias (IEEE IAS/PELs/IES Greece Section Chair) at National Technical University of Athens, manias@central.ntua.gr

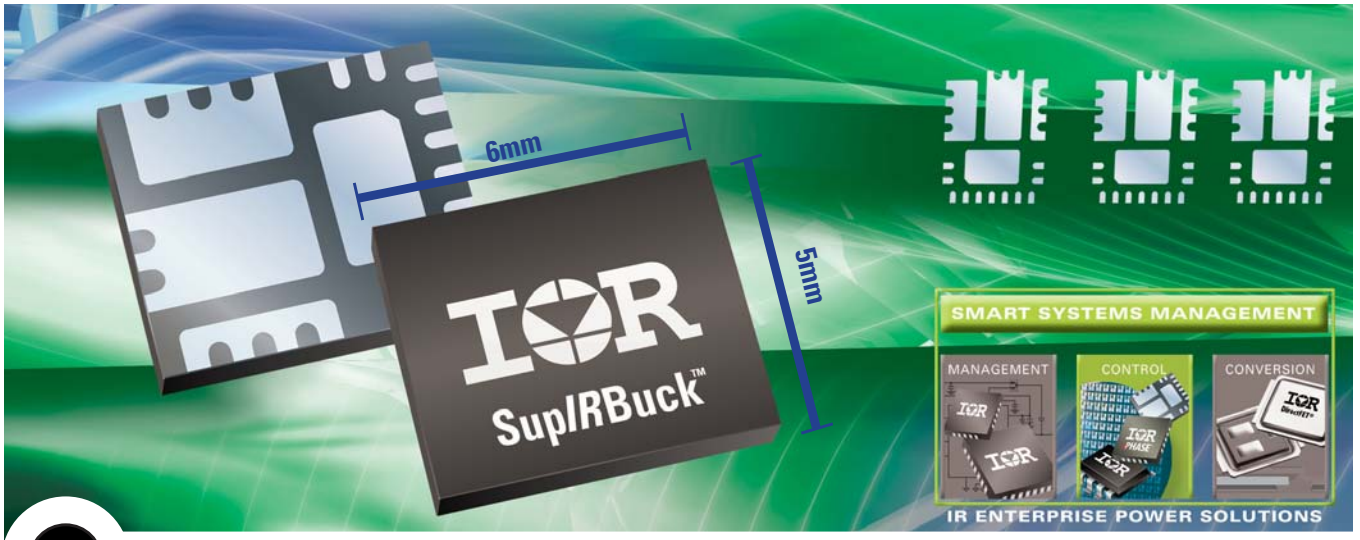
11th IEEE Workshop on Control and Modeling for Power Electronics: COMPEL2008, to be held 18-20 August 2008 at ETH Zurich, Zurich, Switzerland. Digest submission deadline is 14 April 2008. For more information visit the conference website: http://www.pes.ee.ethz.ch/compel2008

43rd Industry Applications Society annual meeting is announced for 5-9 October 2008 at the Weston, Edmonton, Alberta, Canada. Author's deadlines are abstract and digest by 15 Jan 2008 followed by notice of acceptance by 31 March 2008. For more information on the conference and technical program visit the website at: http://www.ieee.org/ias2008

5th Vehicle Power and Propulsion (VPPC2008) Conference is announced for 3-5 September 2008 in Harbin, China. Correspondence may be directed to: vppc2008@hit.edu.cn. VPP'08 general chair: Prof. C.C. Chan, Harbin Institute of Technology. Abstracts with contact details should be submitted by 1 March 2008. VPP'08 is co-sponsored by PEL's. For more information visit the website at: www.vppc2008.com

1st Annual Energy Conversion Congress and Exposition (ECCE2009) is announced for 20-24 September 2009 at the Double Tree Hotel at 2050 Gateway Place in San Jose, CA. For more information on ECCE2009 visit the conference website: www.ecce2009.org

44th Industry Applications Society annual meeting is announced for 4-9 October 2009 in Houston, Texas. This will be a new meeting format following the transition of IAS committees to ECCE2009 with more emphasis on tutorials and workshops. For more information visit the website at: www.ieee.org/ias2009



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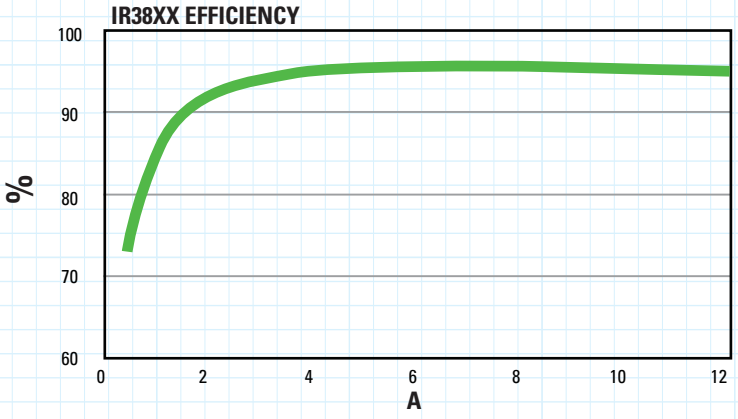

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