



# Chapter Chatter

Todd Robinson, Associate Editor

## Norm's Notebook

A Transient Situation (circa 1988)

By Mike Violette

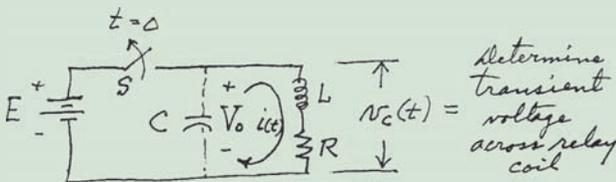
A common test in the EMC lab is Electrical Fast Transients (EFTs). The test subjects equipment to a series of fast (~1 nanosecond rise) pulses of a 500+V to signal and power cables. It is a good measure of the immunity to high-energy, short burst (high frequency) noise sources. This test simulates electrical noise generated by opening and closing of relay contacts and other transient sources.

We know from electrical theory that a current flowing through a conductor creates a magnetic field. This field represents a form of "stored" energy that cannot decrease instantaneously to zero when the current is interrupted. This is especially true in a coil or inductor, where the field concentration is "amplified" because of the additive effect of the number of turns in the coil. When the current is interrupted, the collapsing magnetic field acts to keep the current flowing. With nowhere to go, a surge voltage is produced as the current "breaks" against the open circuit. If the voltage is high enough, an arc may be produced.

From Norm's notebook, he explored the question, "What is the peak voltage generated when the coil current is interrupted?" Assume a 12 VDC coil voltage and choose one:

- 48V
- 460V
- 1200V
- 4600V

The example circuit is shown below:



The circuit shows a relay coil with inductance  $L$  and resistance  $R$  connected to a voltage source  $E$  through switch  $S$ . The capacitance  $C$  can be intentionally installed or it can be a parasitic capacitance (or a combination of both). At reference time  $t = 0$ , the relay is disconnected from the source by opening  $S$ .

Initial conditions (@  $t = 0$ ):  $v_c(0) = -E$ ;  $i(0) = I_0 = E/R$ ; charge  $q(0) = -CE$

Now, while some people pass their time doing crossword puzzles or watching "Dancing with the Stars" or playing *Angry Birds* on their iPad™, Norm liked to doodle with exponents and Green's functions and such. (This particular pastime did not get passed along, unless it has skipped a generation.)

At any rate, the underdamped, oscillatory case is of interest and is set up below:

② M. Violette

Underdamped (oscillatory) case is of interest. Then:

$$P_1 = -\frac{R}{2L} + j\sqrt{\frac{1}{LC} - \left(\frac{R}{2L}\right)^2} \quad P_2 = -\frac{R}{2L} - j\sqrt{\frac{1}{LC} - \left(\frac{R}{2L}\right)^2}$$

$$P_1 = -\alpha + j\omega, \quad P_2 = -\alpha - j\omega, \quad \alpha = \frac{R}{2L}, \quad \omega = \sqrt{\frac{1}{LC} - \left(\frac{R}{2L}\right)^2}$$

Then:  $i(t) = A_1 e^{P_1 t} + A_2 e^{P_2 t}$

Write the loop equation in terms of charge  $q(t) = \int i(t) dt$ .

Then:  $q(t) = \frac{A_1}{P_1} e^{P_1 t} + \frac{A_2}{P_2} e^{P_2 t}$

Reasonable assumptions for the values of the circuit elements and initial voltage are plugged in:

$$E = 12\text{VDC}; R = 200\Omega; C = 50\text{pF and } L = 200\text{mH}$$

And another page of dense math follows, ultimately leading to the final solution shown below:

$$v_c(t) = \frac{E}{\omega RC} e^{-\alpha t} \sin \omega t - E e^{-\alpha t} \cos \omega t, \quad \frac{E}{\omega RC} = \frac{E}{R} \sqrt{\frac{L}{C}}$$

$$v_c(t) \cong \underbrace{(4648) e^{-\alpha t} \sin \omega t}_{(1)} - \underbrace{(12) e^{-\alpha t} \cos \omega t}_{(2)}$$

The question was: "What is the peak voltage?" Solving for the maximum of the oscillatory waveform (which occurs at about 6μs) yields the answer below:

When  $\omega t = \pi/2$ ,  $\cos \pi/2 = 0$ .

Then transient peak:

$$v_c(t_{max}) = (4648)(0.998) = \underline{4638 \text{ volts}}$$

So if you guessed – or inferred – that a 12 VDC coil could generate a peak transient of almost 400 times the initial voltage, you guessed – or inferred – correctly.

If you are interested in the entire derivation, visit <http://wll.com/inprint.html#other>.

Happy arcing.

## Baltimore

Robert Berkovits, Baltimore Section EMC Chapter Chair, reports that there was one meeting on March 2, 2011 which was a joint meeting with the Power Engineering Society. The speaker was Jerry Ramie, an EMC Society Distinguished Lecturer, of ARC Technical Resources. There were 21 members in attendance at the National Electronics Museum (NEM) in Linthicum, Maryland. The topic was "Green Power and the Modern Grid." The meeting divided into two parts. The first part was about the modern grid and the development of the technical concepts and policies over the past 30 years. The second part presented communications and EMC aspects. The unique way that Jerry presented his topic allowed for enthusiastic audience participation and discussions. The meeting lasted for two hours. The meeting was finished at 8:30 PM and there were several attendees that had dinner at the BWI Airport Marriott next to the museum.

## Boston

John Clarke reports that the Boston Section held a meeting on May 4, 2011 at the C.S. Draper Laboratory, in Cambridge, Massachusetts. The speaker was Mark Steffka, EMC Society Distinguished Lecturer, EMC Technical Specialist-GM Powertrain, General Motors Corporation, Milford, Michigan. The proliferation of digital methods from data communication to machine and equipment control, as well as the increasing use of switched mode power supplies (SMPS), has shown that conducted emissions (CE) are becoming more of a concern. This presentation discussed the diagnostic methods to identify the nature and source of conducted emissions. Included in the presentation were the following subjects:

- The effect of Pulse Width Modulation (PWM) signals and CE
- Demonstration of design techniques to reduce CE
- Examination of linear power supply and SMPS waveforms
- How to determine product CE pass / fail characteristics
- Purpose of "X" and "Y" capacitors and important issues in their selection
- Other filter capacitor and inductor selections and considerations
- Physical layout of power supplies, filter to enhance meeting requirements
- Smaller power supplies

Twenty-one people attended this meeting, including 14 IEEE members (of which five were also EMC Society members) and seven guests. Contact information for Mark Steffka is available at [www.marksteffka.com](http://www.marksteffka.com).

## Chicago

The Chicago Chapter IEEE EMC Society Spring 2011 season concluded on Tuesday, May 10 with our 13th annual Mini-Symposium at the Itasca Country Club. Once again it was masterfully organized by Frank Krozel of EIA and supported by the executive committee and Chapter volunteers. Our 100 attendees took advantage of the multiple programmed opportunities to engage with 27 exhibi-



*At Chicago's 13th MiniSymposium, Tom Braxton opens the technical program with "EMC Fundamentals."*



*At Chicago's MiniSymposium, the EMC-Opoly winner, Toni Ruel from JCI, is shown flanked by registrar Neil Hurley (left) of Elite Electronic Engineering and Chapter Chair Jack Black (right) of DLS Electronics.*

tors at their table-top displays. The technical program was tuned to our audience's needs, while our EMC-Opoly game and periodic prize raffles kept the energy and interactions going strong all day.

The program started with Tom Braxton of Shure Inc. presenting his ever-popular "Fundamentals of EMI/EMC" which brought the whole audience up to speed. Then a coffee break gave attendees and exhibitors a first chance for exchanges.

We returned for our featured speaker, Lee Hill of Silent, who discussed "Essential Tools" for doing EMC work. He emphasized the need to select the right "Pool Cue Stick" for the specific problem, so you can fix it fast and look good while doing it. Lee explained his choices of spectrum analyzers, current probes, near-field probes, voltage probes and impedance "bridges". Lee emphasized the technique of using current probes to analyze cables acting as unintended antennas for emissions, as



*Speaker Lee Hill of Silent demonstrates unintended resonance in shielding at the Chicago MiniSymposium.*



*The Atwater brothers, Clark and Carson (left and center), discuss ferrite filtering applications with Paul Zdanzowicz of Fair-Rite Products at the Chicago MiniSymposium.*

well as its pitfalls. He finished up with a quick guide to ferrites.

Then we enjoyed a hearty family-style lunch followed by more quality time with the exhibitors. Lee returned to the stage

with his applications talk, “Shielding of Electronic Products, Enclosures and Cables.” He emphasized that the details of implementation and their mechanization usually is more critical to success than strict adherence to theory. After a brief review of shielding effectiveness, Lee illustrated best practices and theory using several case studies: 1. Connector cable shield clamps should have 360 degree contact. 2. When to connect a cable shield to the enclosure at one vs. both ends? 3. Risks of using shield pigtail terminations. 4. Choosing the enclosure metal type, thickness and conductivity. 5. Understanding the unintended consequences of an enclosure becoming a resonant cavity. Lee included several live physical demonstrations which drove the principles home.

The afternoon included another hour break to interact with the exhibitors, additional raffle drawings and concluded with prizes for the best EMC-Opoly submissions. Additional thanks to ELITE for handing the registration and Bob Hofmann for printing the program booklets.

After another successful MiniSymposium, the Chapter went on summer hiatus and looked forward to the International Symposium in August and then resuming the regular program in September. Please check our website for details [www.emcchicago.org](http://www.emcchicago.org). Cheerfully submitted by Jerry Meyerhoff, Secretary.

## Hong Kong

The IEEE Hong Kong EMC Chapter held a successful Technical Forum at the City



*Wilson Loke is shown during his presentation to the Hong Kong Chapter on “Introduction of Electromagnetic Exposure.”*

University of Hong Kong on 28 May 2011. Mr. Wilson Loke of KEMA Quality Hong Kong Limited presented the first topic titled, “Introduction of Electromagnetic Exposure.” Dr. Brian K. H. Chan of City University of Hong Kong presented the second topic titled, “Real-life Applications of ICNIRP Guidelines to Various Human EMF Exposure Issues,” and Dr. K. C. Lee of Hong Kong Standards and Testing Centre



*Dr. Brian K. H. Chan is shown presenting to the Hong Kong Chapter on the topic of “Real-life Applications of ICNIRP Guidelines to Various Human EMF Exposure Issues.”*



*A recent speaker for the Hong Kong Chapter, Dr. K. C. Lee, is shown presenting “Briefing of EN62493 – Assessment of Lighting Equipment related to Human Exposure to Electromagnetic Fields.”*

presented the third topic titled, “Briefing of EN62493 – Assessment of Lighting Equipment related to Human Exposure to Electromagnetic Fields”. A total of 53 participants attended the Forum.

## Oregon and SW Washington

Alee Langford, Chapter Vice-Chair, reports that the Oregon and SW Washington Chapter concluded the spring program by welcoming Mark Steffka (Distinguished EMC Lecturer) for the April meeting. The presentation covered EMC approaches applied to automotive systems, from the conventional “legacy” systems to the latest developments in electric vehicle propulsion. There was discussion about the unique environment that automotive systems function in and how some of the methods used to meet automotive system functional requirements can determine the vehicle’s EMC characteristics. Typical automotive EMC requirements were identified and examined, along with some interesting “case studies”.



*At a recent meeting of the Oregon and SW Washington Chapter, speaker Mark Steffka (left) is shown with Chapter Chair Mark Briggs. Mark is presenting the speaker with a gift for his outstanding presentation.*



*Pictured are the recent speakers and the committee members of the Hong Kong EMC Chapter. From left, George Chan, Stanton Lui, Dr. Brian Chan, Steven Tsang, Dr. K. C. Lee, Dr. Duncan Fung (Chairman of the Hong Kong EMC Chapter), and Dr. Peter Leung.*

The Chapter will continue with the monthly meetings in the fall with intriguing topics and presenters. Meeting details and additional information can be found by visiting the Chapter website at <http://ewh.ieee.org/r6/oregon/emcc/>.

## Phoenix

Brent Treadway reports the Phoenix Chapter met April 14th, 2011 at Garcia's Mexican Restaurant in the Embassy Suites Hotel at Rural Road and I-60 in Tempe, Arizona. The speaker for the evening was Nicholas Wright of HV Technologies who presented the practical impact that advances in technology and transient test standards have on the EMC test lab. His topics included changes to standards and test equipment requirements for induced lightning and voltage spikes including updates to DO-160/ED14, Airbus ABD 0100.1.2G, Airbus ABD0100.1.8G, MIL-STD-461 HEMP requirements, MIL-STD-461 and DO-160 indirect effects of lightning (IEL). Mr. Wright began by defining indirect lightning and breaking it up to four fundamental components. In the case of an aircraft, indirect lightning is a secondary effect derived from a direct lightning event; for example, coupling through apertures such as windows, aircraft skin and magnetic fields induced into aircraft cables. Nick discussed the evolution of international standards and the introduction of DO-160 as an internationally accepted standard for generic LRU level testing. He went on to discuss the series of standardized waveforms used for damage tolerance and immunity tests and highlighted some of the more common waveforms, their origin, and their accepted uses. Nick updated us on the anticipated changes for DO-160G which will add a new hybrid waveform WF6H and proposes to replace section 19 with CS115 to simulate chattering relays. He also updated us on the changes to the Airbus standards ABDO100.1.2 to handle the new composite materials of the A380 aircraft.



Nicholas Wright of HV Technologies explains the indirect effects of lightning to the Phoenix EMC Chapter.

## Santa Clara

The Santa Clara Valley EMC Chapter organized their third annual MiniSymposium on May 19, 2011 at the Biltmore Hotel. There were over 25 vendors, 55 attendees and many raffle prizes. Dr. Eric Bogatin was the featured speaker for the one-day event

and many Signal Integrity/EMC Engineers praised his lectures... and his famous chocolate candy throwing skills (candies for participation during class)! Many of the attendees and vendors came from different industry backgrounds, including Cisco, Juniper, Intel, Apple, Lockheed Martin, Metlab, etc; AR RF/Microwave Instrumentation, EM Test, TESEQ, LeCroy, ElectroRent Corp, Advanced Test Equipment Rentals, In Compliance, WEMS,



Dr. Eric Bogatin provides an excellent course on Signal Integrity and EMC during the Santa Clara Valley Chapter's MiniSymposium in May.

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# EMC, RADIO, TELECOM ENVIRONMENT, SAFETY

PHOTO BY JERRY RAMIE

PHOTO BY STEPHEN GERARD

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*Dr. Eric Bogatin was the featured speaker for the Santa Clara Valley's MiniSymposium in May.*

PHOTO BY JERRY RAMIE



*Eriko Yamato of TechDream and Rob Rowe of AR announce a door prize winner at the Santa Clara Valley MiniSymposium in May.*

PHOTO BY JERRY RAMIE



*Mackenzie O'Connell of ARC Technologies discussed interference control solutions with attendees at the Santa Clara Valley MiniSymposium.*

TechDream, etc., respectively. AR, manufacturer of broadband and microwave amplifiers, has been a Platinum Sponsor for three consecutive years. LeCroy who



PHOTO BY JERRY RAMIE

*Holly Madden of CKC Laboratories discussed EMC testing services with attendees at the Santa Clara Valley MiniSymposium.*

offers oscilloscopes, serial data analyzers, and protocol test solutions joined the event for the first time.

### SE Michigan

MOM knows best...how Method of Moments can solve today's complex world problems or The Original Green Math was presented April 7, 2011 by Candace and John Suriano to the Southeastern Michigan IEEE EMC Society Chapter. The basis of the talk was Green's functions developed by self educated George Green in the 19th century. Green's functions form the basis for the Method of Moments (MOM) which is a numerical method for modeling many problems associated with EMC. MOM is used in the popular Numerical Electromagnetic Code (NEC) to solve electromagnetic problems associated with antennas and other radiating structures. The talk reviewed the differences between the moment method and other numerical

techniques such as finite element modeling and presented examples.

On May 18 2011, the Southeastern Michigan IEEE EMC Society welcomed well known experts Colin Breuch and Werner Schaefer for a full day of seminars at the 2011 EMCfest. They elucidated correct methods for understanding EMC laboratory measurements and equipment as well as proper application of modeling techniques. Colin Breuch taught three sessions, "EMI Shielding, Design and Measurements Methods for Product Development," "Antenna Behavior for EMC Engineers and Measurements" and "Modeling Two Very Similar Issues." Werner Schaefer taught three sessions, "Absorber Placement for Achievement of Free-Space Conditions," "Measurement of Impulsive Signals with a Spectrum Analyzer or EMI Receiver" and "Significance of EMI Receiver Specifications for Commercial EMI Compliance Testing." After the enjoyable and informative sessions, attendees were treated to prizes and delectable ice cream sundaes. A great time was had by all!

Mark Steffka, EMC instructor and automotive EMC expert, dazzled the assembled IEEE Southeastern Michigan EMC Society on 16 June 2011 speaking on his favorite topics, "Antennas and Transmission Lines." Mark brought them back to the basics talking about the expeditious use of antennas to transfer energy. Mark succeeded in showing the audience how to recognize the parts of a system that act as antennas and assist them when it comes to eliminating electromagnetic susceptibility and radiated emissions. Mark shared many practical tips from his hands-on approach to high frequency



*Colin Breuch was one of the featured speakers at the SE Michigan Chapter's EMCfest 2011.*



Scott Lytle draws business cards for door prizes at SE Michigan's EMC Fest 2011.



Mark Steffka during his June presentation to the SE Michigan Chapter on "Antennas and Transmission Lines."

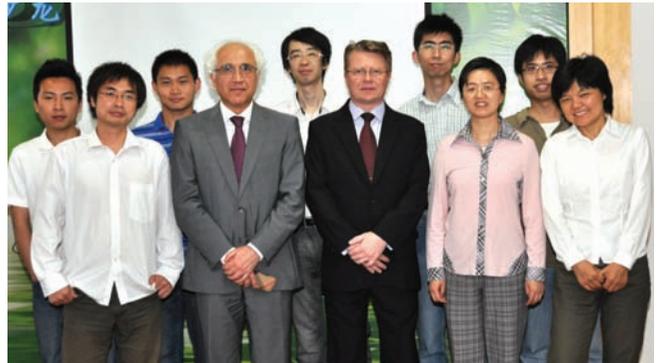
electromagnetics. Mark even introduced the latest technology to the room when he showed a ninety-nine cent app for his iPad that gives an antenna's radiation pattern.

## Shanghai

Hongmei Fan reports that on May 21, 2011 at the Shanghai University Yanchang Campus, about 10 EMC professionals from various companies gathered for two technical speeches organized by the IEEE EMC Shanghai Chapter.

The first talk was given by an international speaker, Professor Alireza Baghai-Wadji of the RMIT University, Melbourne, Australia. He is an honorary member and fellow of The Electromagnetics Academy, USA. His speech, entitled "Near-field Phenomena in EMC Applications," introduced an innovative method for simplifying complicated integral expressions for near-field calculations in EM modeling and simulation. The core of his method is referred to as the "natural regularization," by which certain "unwanted" singular terms cancel out automatically in wave-number domain.

The second talk was given by a local ACB Examining Engineer and iNARTE Certified EMC Engineer, Mr. Qin Zhang. As a technical support manager at the American TCB China Office, he introduced the different requirements of FCC/IC/CE rules or standards for short range devices. During his two hour presentation, the audience gained a broad understanding of profound mathematical electromagnetic computations involved in mandatory product EMC certification.



Shanghai Chapter May seminar event attendees included (first row from left) Deming Li, Alireza Baghai-Wadji, Esa Korbonen, Hongmei Fan, Dibua Shi as well as (second row from left) Chunlei Shi, Liyuan Wang, Qin Zhang, Yuan Hu and Quanbui Sun.

On July 23, 2011 at the Shanghai Jiao Tong University Minhang Campus, 16 EMC professionals and postgraduate students gathered for a technical speech organized by the IEEE EMC Shanghai Chapter. The talk was given by an international speaker, Professor Mauro Feliziani of the University of L'Aquila, Italy. Professor Feliziani's research interests include electromagnetic compatibility, bio-electromagnetics, radio frequency identification (RFID), ultra-wideband, wireless communications, power line communication, leaky line antennas,



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# EMC, RADIO, TELECOM

# ENVIRONMENT, SAFETY



*Shanghai Chapter July seminar event attendees included (first row from left) Dibua Shi, Liang Zhou, Esa Korbonen, Mauro Feliziani, Hongmei Fan, Tianbong Xu, Qingqing Zhang as well as (second row from left) Lizheng Zhang, Shunchuan Yang, Yuan Hu, Menglin Zhai, Mingda Zhu, Gaowei Shi, Xing Zhao and Qiliang Pan.*



*Shown during a campus tour at Shanghai Jiao Tong University after Shanghai's July seminar event are (from left) Hongmei Fan, Esa Korbonen, Mauro Feliziani, and Yuan Hu.*

and micro-electromechanical systems/film bulk acoustic resonators. His speech, titled "Advanced Numerical Techniques for EMC-related Bio-electromagnetic and Medical Applications," introduced advanced numerical models and methods for bio-electromagnetic applications and medical devices. The audience gained a broad understanding of how to model the human body from the viewpoints of physical, electromagnetic and thermal properties. The interesting applications presented included numerical dosimetry of EMF sources, communication performances of body area network and RFID systems, hyperthermia and wireless power transfer in implanted medical devices.

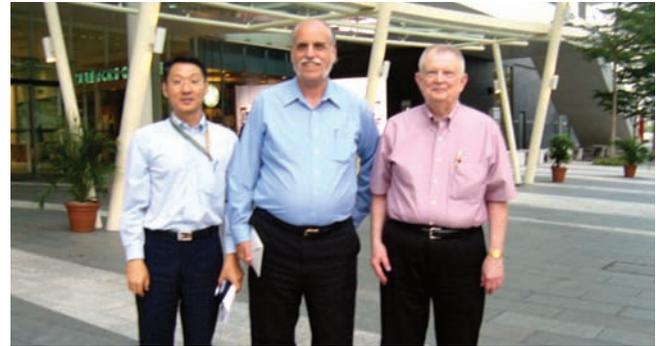
The IEEE EMC Shanghai Chapter would like to thank Professor Liang Zhou of the Shanghai Jiao Tong University and Professor Wenyan Yin of the Zhejiang University for facilitating this seminar.

## Singapore

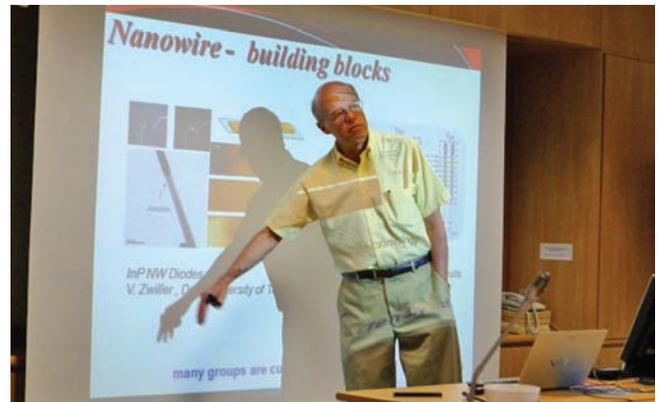
Richard Gao Xianke, Chair of IEEE EMC Singapore Chapter, reports that Mr. Donald Heirman, Life Fellow of IEEE and the Chairman of the IEC Special International Committee on Radio Interference (CISPR), was invited by the Singapore EMC Chapter to deliver a speech entitled, "Selected EMC Standards and the Process from Start to Finish" at the Institute of High Performance Computing (IHPC) of A\*STAR, Singapore, on 16 June 2011.



*Participants listened attentively during Mr. Donald Heirman's seminar at the A\*STAR Institute of High Performance Computing in Singapore on 16 June 2011.*



*Mr. Donald Heirman joined Dr. William A. Radasky and Dr. Richard Gao Xianke (from right to left) at the Fusionopolis in Singapore, on 16 June 2011.*



*Professor Howard E. Jackson from the University of Cincinnati, USA delivered a technical presentation at the one-day workshop at the Nanyang Technological University on 28 June 2011.*

There were a total of 14 attendees (seven were IEEE members) from universities, research institutes and industrial companies. Dr. William Radasky accompanied Don for the presentation and also provided some excellent remarks during the talk.

On 24 June 2011, Chapter Chair, Dr. Richard Gao Xianke, updated the Chapter activities and reviewed the Chapter plan with committee members at the second Chapter administrative meeting. The treasurer, Dr. Liu Enxiao, also updated the finance report. In the afternoon, Professor Tie Jun Cui from Southeast University, China, delivered a technical talk entitled, "Metamaterials and Their Applications in Microwaves" at the National University of Singapore (NUS). There was an overwhelming response with a total of 45 attendees, of which 20 were IEEE members.



Chapter members with their families and loved ones enjoyed the "Family Day" at Desaru, Malaysia on 16 July 2011.



Professor Paul Harrison from the University of Leeds, UK, delivered a technical presentation at the one-day workshop at the Nanyang Technological University on 28 June 2011.



Members from Singapore EMC Chapter (from left to right), Dr. Chao-Fu Wang, Mr. Samuel Chan, Dr. Eng-Kee Chua, Dr. Mark Tan, Dr. Lock Kai Sang, Dr. Richard Gao Xianke, and Mr. Timothy Foo at the "Family Day" on 16 July 2011.

On 27 June 2011, Professor Cui gave another presentation entitled, "Computational Electromagnetics and Applications" at the Temasek Laboratories at the NUS. A total of 21 attendees (11 were IEEE members) participated the seminar.

On 28 June 2011, the EMC Chapter, MTT/AP Chapter and Nanyang Technological University (NTU) jointly organized a one-day workshop of "Advanced Microwave and Photonic Materials and Devices" at NTU. Six renowned professors delivered excellent presentations to the audience from universities, research institutes and industrial companies. There were of total of 158 attendees of which 78 were IEEE members.

The first speaker was Professor Howard E. Jackson from the University of Cincinnati, USA. His talk was entitled, "Photo-modulated Reflectance Spectroscopy of Single Semiconductor Nanowires." The second speaker was Professor Paul Harrison from the University of Leeds, UK. He presented, "Terahertz Quantum Cascade Lasers." Professor Hongxing Jiang from Texas Tech University, USA, was the third speaker and his talk was entitled, "III-nitride Photonics on Si Substrates." The next speaker was Professor Vijay K. Arora from Wilkes



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*Family members enjoyed “Family Day” with the Singapore EMC Chapter, including this five year old that rode the world’s fastest bird!*

University, USA, who delivered the talk entitled, “Ballistic Transport in Nanowires and Carbon Nanotubes.” The fifth speaker was Professor Tie Jun Cui from the Southeast University of China, who presented the talk entitled, “Controlling Microwaves Using Metamaterials and the Applications.” The last speaker was Professor Sailing He from the Royal Institute of Technology-Zhejiang University Joint Center of Photonics, Sweden, who delivered the talk entitled, “Some Recent Studies of Zero-Index Metamaterials and Nano-/Micro- Hybrid Plasmonic Structures.”

On 16 July 2011, “Family Day 2011” was jointly organized by the EMC and MTT/AP Chapters. The purpose is to mingle our members and friends from industry and academia and spend valuable time with families and beloved ones. This was a one day tour trip to Desaru, Malaysia. All participants, especially the children, were very excited to visit the ostrich farm, fruit farm, and mini zoo. The most exciting thing was riding on the boats for firefly viewing in a late evening. I cite one comment from a Chapter member, Dr. Lock, after the trip, “... a wonderful day trip which members of my family and I very much enjoyed. The itinerary was well-planned and details well taken care of. This is my first participation in the MTT/AP and EMC joint Chapter Family event. I would like to express my appreciation to fellow members for the friendliness, cooperation and consideration which made the trip a success. It was a pleasure meeting several old friends and many new friends.”

## United Kingdom and Republic of Ireland

On July 13, 2011, the UK and RI Chapter held a meeting at the Visitor Centre of the Tyseley Railway Works in Birmingham, UK. The program included a mix of technical presentations on EMC topics which were connected wherever possible with railways.

The first presentation had the unlikely title, “EMC of Steam Locomotives” in which Rob Morland gave an account of the planning and construction of the Tornado steam locomotive which was the first main line steam locomotive to be constructed in the UK since 1960. The electrical and electronic content required to allow use on main lines presented quite a few problems as coal dust and electronics do not mix. The videos of the Tornado under steam were a treat for some of the old timers present.

A paper on “Magnetic Fields from DC Light Rail Transit Systems” by Ade Ogunsola was presented by Ivo Skalicky and provided useful insight into the

methods of minimizing emissions caused by the large currents involved.

Chris Marshman of York EMC Services gave a presentation on “Recent Railway EMC Projects” in which he showed a wealth of – sometimes alarming – track side emission measurements. He also provided some insight



*United Kingdom (UK) and Republic of Ireland (RI) Chapter Chairman Paul Vertannes welcomed attendees at the July 13 meeting held at the Visitor Centre of the Tyseley Railway Works in Birmingham, UK.*



*Steve Hayes gives a presentation to the UK and RI Chapter about “EMC of Electric Road Vehicles.”*



*Mohammed Khan giving an overview of “Corrosion Protection Systems” to the UK and RI Chapter.*



*Rob Morland speaking to the UK and RI Chapter on “EMC of Steam Locomotives.”*



*Chris Marsbman discussing recent “Railway EMC Projects” with the UK and RI Chapter.*

into the causes and solutions to the problems uncovered.

Steve Hayes of TRAc gave a presentation on “EMC of Electric Road Vehicles” which although not a railway topic was interesting and well received.

The final paper by Mohammed Khan of HITEK Electronics Solutions on “Corrosion Protection Solutions” was of interest to all. It may be possible that one product described could reduce boiler corrosion in steam locomotives!



*UK and RI Chapter members Brian Jones, Paul Vertannes and Tony Swainson (from left) on a guided tour of part of the Locomotive Works where classic steam locomotives are maintained.*

A high point of the day was a guided tour of part of the Locomotive Works where classic steam locomotives are worked on. The site is not normally open to the public. We saw historic steam locomotives in the process of restoration.

Many of these are currently authorized for use on main lines and are regularly used on excursions run for enthusiasts. One of the locomotives was stripped down for a complete rebuild, including renewal of the boiler tube. **EMC**