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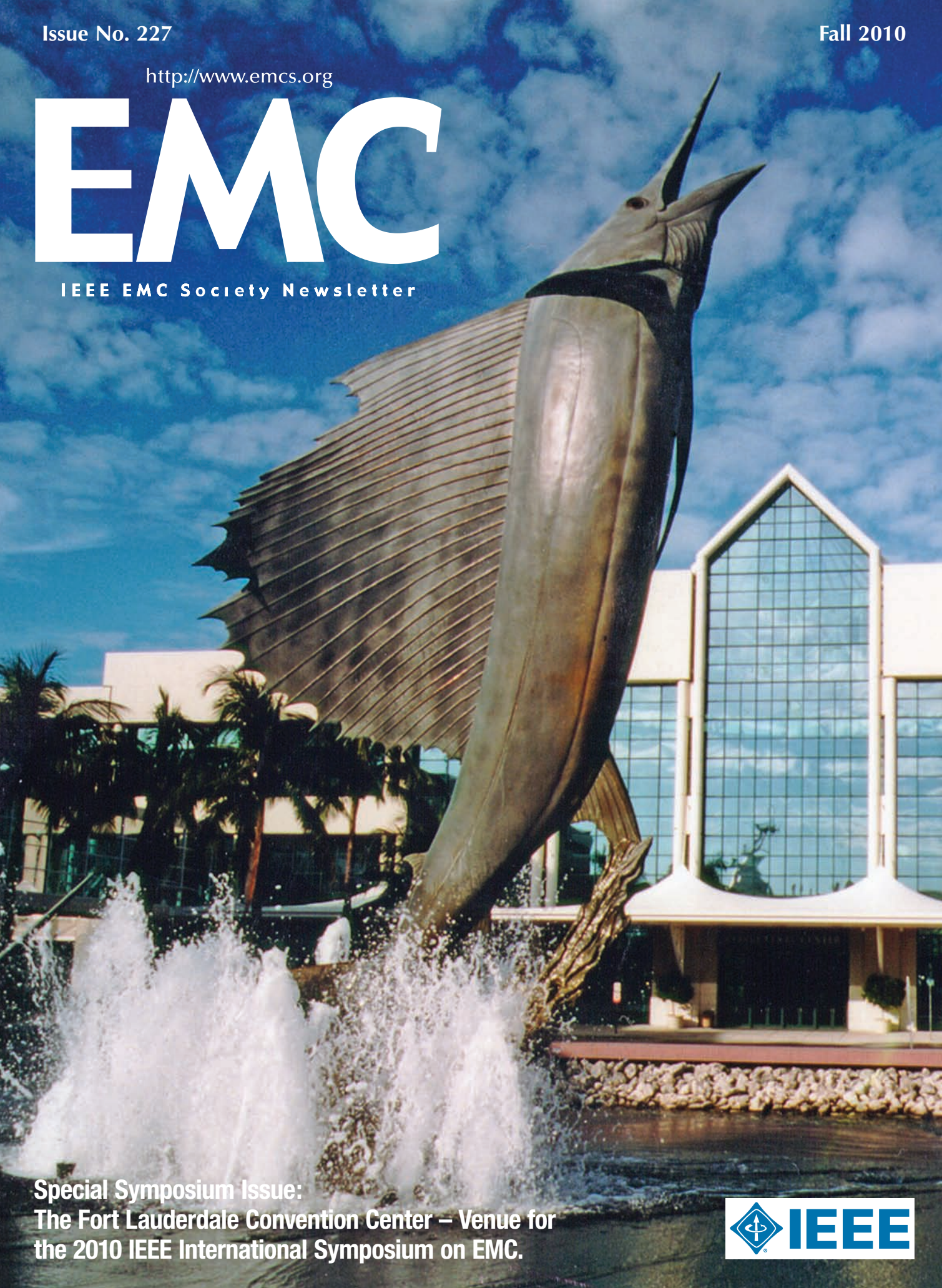
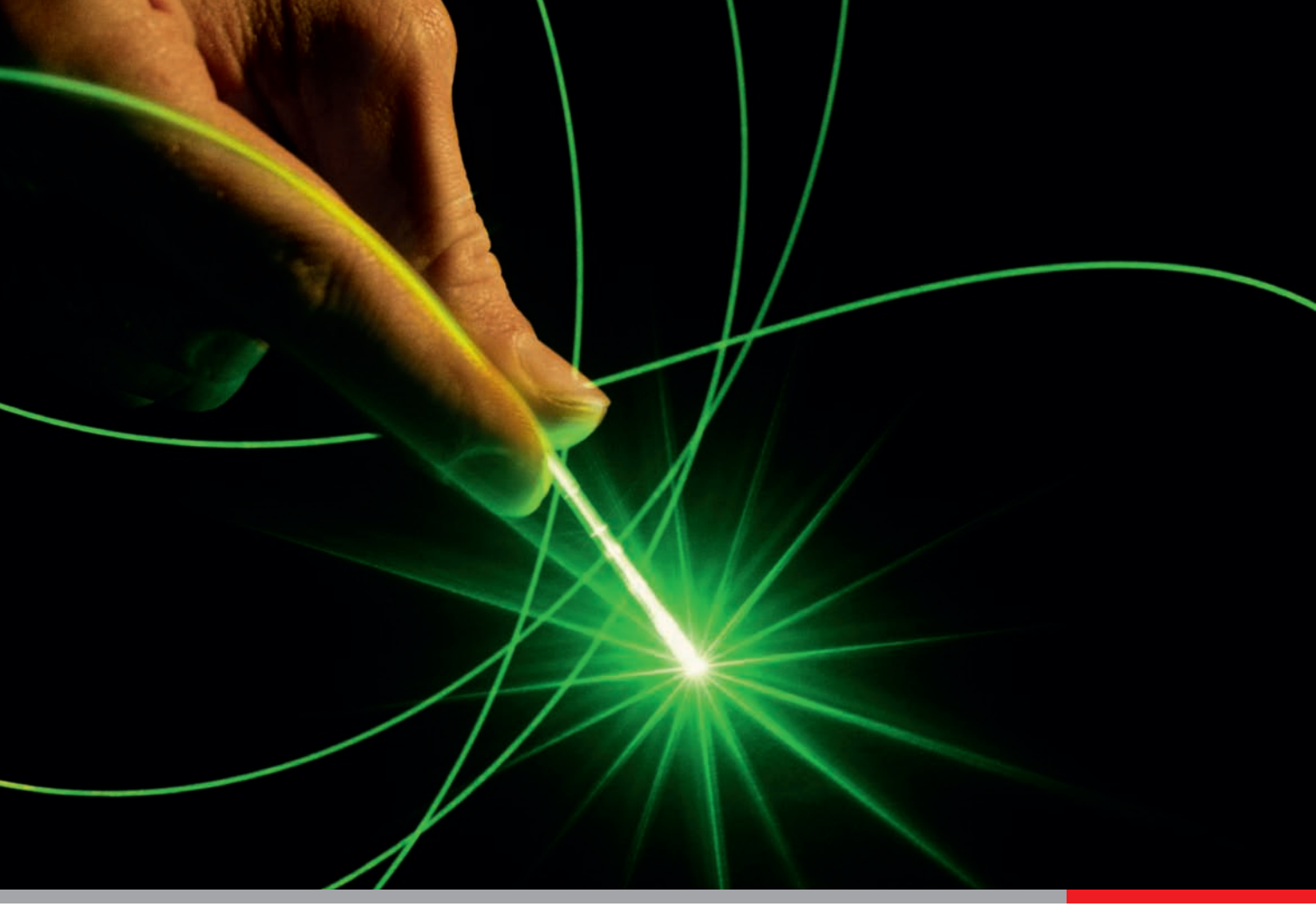
EMC

IEEE EMC Society Newsletter



Special Symposium Issue:
The Fort Lauderdale Convention Center – Venue for the 2010 IEEE International Symposium on EMC.

IEEE



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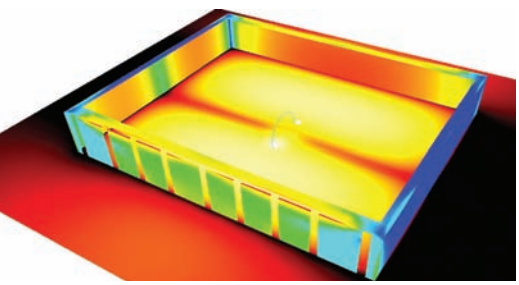

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Letter from the Editor

Newsletter Editor Janet O'Neil visits with Ray Perez, the former Associate Editor for Book Reviews, at the EMC Society Board of Directors meeting held in Fort Lauderdale, Florida, prior to the 2010 IEEE International Symposium on EMC. Dr. Perez mentioned some of the exciting work he is doing with the Jet Propulsion Lab in Pasadena, California and suggested a visit to prestigious facility when EMC engineers convene in Southern California for EMC 2011.

Fort Lauderdale Hosts EMC 2010

Fort Lauderdale, Florida was the stunning seaside location of the 2010 IEEE International Symposium on EMC.

This issue of the EMC Newsletter is dedicated to a review of our annual symposium. If you missed the EMC 2010 Symposium, you can catch up on what you missed by reading the President's Message as well as the articles on the Standards Committees, the Education and Student Activities Committee, the iNARTE committee and workshop activity, the demonstrations and experiments presented, the Global EMC University and Youth Program offered, and, most importantly, the EMC Society Awards issued at the annual Awards Luncheon. You also won't want to miss seeing the pictorial review with numerous Symposium photos found on pages 56–59.

Symposium Chair Fred Heather and his committee did a great job of organizing a successful symposium. Hilton Garcia, who was responsible for organizing the social events, created lasting memories with two very special events: the Welcome Reception and Symposium Gala. The reception started in the exhibit hall and concluded in a ballroom at the Fort Lauderdale Convention Center. The gala was held outdoors for dinner and indoors for dancing at the Harbor Beach Marriott Hotel. Both events featured wonderful bands; the live music contributed to plenty of dancing. Bruce Archambeault, Chair of the Technical Advisory Committee (TAC), and his team did a great job of putting together another outstanding technical program. This committee works very hard with the paper reviews, some of which are reviewed two to three times, to ensure a high quality technical program. This year, there was a three-way tie for Best Symposium Paper! View

COVER PHOTO CREDIT: FORT LAUDERDALE CONVENTION & VISITORS BUREAU

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FIELD OF INTEREST

The Field of Interest of the Electromagnetic Compatibility (EMC) Society involves engineering related to the electromagnetic environmental effects of systems to be compatible with itself and their intended operating environment. This includes: standards, measurement techniques and test procedures, instrumentation, equipment and systems characteristics, interference control techniques and components, education, computational analysis, and spectrum management, along with scientific, technical, industrial, professional or other activities that contribute to this field.

Newsletter Staff

IEEE EMC Society Newsletter Publication Schedule

Publication Dates	Editorial Deadlines	Advertising Deadlines
Summer	July 1	July 12
Fall	October 1	October 11
Winter	January 1	January 14
Spring	April 1	April 11

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President's Message

Francesca Maradei, President, EMC Society

This message is written while travelling from Pittsburgh (PA) where the EMC Society Board of Directors (BoD) meeting has just concluded, to New Brunswick (NJ) where I'll attend the IEEE TAB Meeting Series. During the last BoD meeting, an election of officers took place, creating a new leadership of the Society. I am pleased to announce the election of Ghery Pettit as our new President-Elect. Many of you may know Ghery as Vice-President for Conferences (2009–2010), and past Vice-President for Communication Services (2005–2008), to recall his last service to the Society. Ghery will take over the day-to-day duties for running the EMC Society on January 1, 2012.

The complete list of the newly elected BoD officers is shown below.

President- Elect	Ghery Pettit
Past President	Elya Joffe
Secretary	Janet O'Neil
Treasurer	John LaSalle
Vice-President Communication Services	Perry Wilson
Vice-President Member Services	Bob Davis
Vice-President Standards	Don Heirman
Vice-President Conferences	Bruce Archambeault
Vice-President Technical Services	Bob Scully

Congratulations to you all!

Breaking News:

Welcome to the IEEE EMC Society Magazine: Launch Scheduled for 2012

The year 2011 will be the last year in which the EMC Society will publish this Newsletter. But don't be sad for that. Owing to the success of our Newsletter, the IEEE has approved its transition to a Magazine. The launch of the EMC Magazine is scheduled for January 2012. The transition from a Newsletter to a Magazine is an upgrade as now our publication will be available on IEEE *Xplore.*

The new EMC Society officers for 2011 include (front row from left) Janet O'Neil, Ghery Pettit and Francesca Maradei, (back row from left) John LaSalle, Don Heirman, Bob Davis, Bruce Archambeault, and Perry Wilson.

The EMC Society Newsletter has appeared to be a magazine for many years, and I would take this opportunity to thank Janet O'Neil and her team of fine and dedicated Associate Editors for making this transition happen.

Global Outreach

As part of the traditional global outreach focused on strengthening the relationship with EMC communities all around the world, I attended the *EMC EUROPE 2010 Symposium*, held at the Wroclaw University of Technology (Wroclaw, Poland) on September 13–17. This edition of EMC EUROPE was a special one as it has decreed the beginning of a new era for the electromagnetic compatibility community in Europe. The reason why EMC EUROPE 2010 deserves special recognition is that this was the first edition after the merging of Europe's first and longest-running EMC conference, the International Wroclaw EMC Symposium, with the youngest and successful EMC EUROPE Symposium.

The Wroclaw EMC Symposium was held for the first time in 1972, and in 2010 celebrated its 20th and last edition.

Photos from the EMC EUROPE inauguration ceremony: Tadeusz Więckowski (on the left), rector of the Wroclaw University of Technology, and Francesca Maradei (on the right) presenting their welcome message to the symposium attendees.

The EMC EUROPE conference series begun in 1994 under the name of EMC ROMA evolved in 2000 into a successful travelling European event that has been hosted over the years in Bruges (Belgium), Sorrento (Italy), Eindhoven (The Netherlands), Barcelona (Spain) and Hamburg (Germany).

The IEEE EMC Society has been associated for many years with these two high quality conferences, EMC Wroclaw and EMC EUROPE, and it has been a great pleasure to endorse the first joint Symposium that will continue under the umbrella of EMC EUROPE.

I was very pleased and honored to have had the opportunity to deliver, on behalf of the IEEE EMC Society, a special award to celebrate the 40 years of Europe's first and longest running EMC Symposium. Professor Wladyslaw Moron and Professor Ryszard Struzak were recognized for their vision and outstanding contribution in the establishment of the Wroclaw International Symposium and Exhibition on Electromagnetic Compatibility and for 40 years of continued dedication to the high quality of the Symposium.

EMC EUROPE as the Major Regional EMC Symposium

Recently, the EMC Zurich organization has announced that they will not hold any further edition of the International Zurich Symposium on EMC, and they too joined the EMC EUROPE umbrella. EMC Zurich was one of the most

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Chapter Chatter

Todd Robinson, Associate Editor

Where the Wind Blows

By Mike Violette

Turning at a lazy six RPM a typical wind turbine cranks out 30 kW without releasing a puff of CO2. A collection of wind turbines (thirty or so) rises over the rolling countryside in a rural Midwest state; the blades whoosh like the respirations of a sleeping giant. Not long ago we received a call about possible interference to some of these marvels. My VP Steve Ferguson and I made the jaunt to the heart of the US to have a look, and, hopefully, lend a hand.

Balanced on the top of a 300' foot tall hollow steel tube, the turbine "nacelle" is about the size of a small Winnebago, but with fewer appointments. A massive steel shaft connects the hub of the turbine to a transmission that ups the speed to 1200 RPM, driving a generator which, in turn, pushes joules to an inverter system that matches the voltage and frequency output of the assembly to the electrical grid.

If it were only that simple. These machines are feats of engineering achievement, considering the electrical, control, structural and materials puzzles that had to be solved. The technology, though, is becoming *de rigueur* as more countries install wind-generating capacity to sate the rising energy demands and, maybe, mitigate rising sea levels.

To maintain the rotational speed at the optimum 6 RPM, the control electronics in the hub of the unit adjusts the pitch of the blades. Other circuitry aims the nose of the turbine into the wind and the entire assembly is designed to extract the most energy from breezes down to a few miles per hour.

The robust engineering, however, had an Achilles heel. About three miles north of the installation is a NOAA weather radar station, pumping out L-band (1–2 GHz) energy. Intermittently, the pitch-positioning sensors—delivered from encoders mounted on the blades to the control circuitry—would register an erroneous "out of bounds" indication. The control software, sensing a potentially unsafe condition, would trip the turbine and the thing would shut down to a safe mode. Obviously, this halted the energy production from that unit. Given that the most-affected units were closer to the source, the radar was immediately suspected. The intermittent aspect of the problem was probably due to the varying orientation of the turbine to the L-band source, that is, the incident angle of the radar signal relative to the circuit varied with wind direction.

Our task was two-fold: to measure the field levels at the top of the wind turbine and, hopefully, find a "fix" to the problem. Our other objective was to get up and down the wind turbine without suffering cardiac arrest.

The trip up the tube was a hand-over-hand ladder climb (300 rungs, more or less). Fortunately, we were blessed by a seasonable February day with light winds and temperatures in the 40s. Not bad for climbing in retrospect and the swaying of the tower was minimal. It took us a good 45 minutes to make the ascent (including rests) and we popped the hatch on the nacelle to a wide view of the open country side.

Fig. 1. Can I Just Take the Elevator?

Fig. 2. Steve Pops out the Top of the Nacelle.

Fig. 3. That First Step is a Doozy.

Fig. 4. Mike on the top of Wisconsin. Note NOAA weather radar station visible to the right.

Now, for me, flying in little planes is not a big deal and tours of the top of tall structures doesn't normally make me nervous, but standing atop this wind turbine made me just a little…unsettled. Our guide, a seasoned technician and part-time hog farmer, strolled around the top of the nacelle like he was in his living room. I am not ashamed to say that I stayed pretty close to the hatch and re-checked my safety harness more than once.

The tower was equipped with a hoist that carried our spectrum analyzer, antennas and other necessary doo-dads to the top. We just had to haul our own bulk up to the top of the tower. Another fortunate design feature is the installation of "rest decks" at intervals along the ladder. We took advantage of these, to be sure. Over the gasps of trying to catch my breath at one of the rest-stops I asked our guide what was the "record" time of a climb up the tower. "There's one guy here who can do it in six minutes, without stopping." Show-off.

Once we got up to the top, we collected our data, setting up our equipment in the relative comfort of the nacelle proper. Verily, we measured a peak field strength of ~25 V/m from the radar. However, the control electronics were housed in the "nose" of the hub. Crawling over the top of the nacelle from the hatch to the hub was probably the most, ahem, thrilling part of the job. Fortunately, I held my water and made it into the hub section, a cozy spot with just enough room for two. At this point, it was really only possible for a physical inspection of the design (which we continued on the ground with the control electronics assembly on the bench). What was evident was the use of plastic-coated metallic conduit from the pitch sensor head to the control electronics. Shielded? Most definitely, but the water-tight connection at the enclosure entry looked a little fishy: how was the cable assembly "shield" grounded?

Resolution. Further to our clambering up and down the turbine and finishing up the measurement part (we took some additional data farther away from the radar to see how the propagation changed) we continued our inspection and posited that the radar energy was entering the enclosure via the cable. We confirmed by inspection that the plastic weather seal isolated the metallic conduit from the metal gland nut at the enclosure ends.

Solution: Home Depot. The "fix" was as simple as the window aisle at the local hardware store. Our recommendation was to over-wrap the control cable with window screen, "grounding" the screen at both ends, secured by heavy duty cable ties. Things have been working flawlessly for almost two years. Consider that our contribution to the fight against climate change. New technologies, but an EMC solution as old as the wind.

BeNeLux

Cees Keyer reports that the BeNeLux (Belgium, Netherlands, Luxembourg) EMC Chapter, in cooperation with the Dutch EMC-ESD Society and Hogeschool van Amsterdam, organized the EMC-ESD Practical Day on October 27, 2010. The mini-symposium was held at the Hogeschool van Amsterdam (Amsterdam University of Applied Sciences) Department of Electronic and Electrical Engineering. After a lively key note speech by the chair of the EMC-ESD Society, IEEE EMC Society Distinguished Lecturer, Professor Giulio Antonini, gave a talk entitled, "Spectral Methods for Time-Domain Analysis of High-Speed Interconnects." His presentation was mathematical but very interesting for the PCB designers and integrated circuit designers in attendance. The mini-symposium also featured a vendor display area where numerous companies displayed their

Professor Antonini (right) is shown with Jorien Schreuder, Manager – Department of Electronic Engineering, at the October mini-symposium of the Belgium/Netherlands/Luxembourg Chapter.

Attendees are shown arriving for the technical presentations at the October mini-symposium of the Belgium/Netherlands/Luxembourg Chapter.

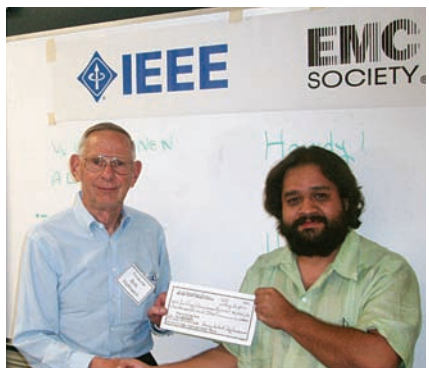
Johan Catrysse (right) is shown with Cees Keyer, the local organiser of the Belgium/Netherlands/Luxembourg Chapter's October mini-symposium.

equipment and services. The breaks during the EMC-ESD practical day were a great opportunity to network and catch-up with friends and colleagues. The final lecture was given by Johan Catrysse, and the topic was, "EMC of Large Systems." All the presentations, partially in Dutch, can be downloaded from: http://www2.fhi.nl/praktijkdag/page.php?page_id=4

Chicago

Jerry Meyerhoff, Chapter Secretary, reports that the Chicago IEEE EMC Chapter's fall 2010 season started one month earlier than usual on August 25 at the IIT Rice campus in Wheaton, IL. The Chapter provided a pizza dinner for the social hour and is soliciting sponsors to step up for future events. Chair Jack Black opened the meeting for our 30 attendees in the auditorium with brief announcements and introductions of Chapter officers and notable guests. The "jobs available" segment produced seven opportunities for members in need to pursue. The guest speaker, Daniel D. Hoolihan, is currently President of his own EMC consulting firm in Minnesota after working many years at AMADOR and Control Data Corp. Dan has served the EMC Society as President, on many board and committee positions as well as in his local Chapter which he helped found in 1985. Dan also serves on or advises multiple government and industry technology and standards agencies. We're fortunate to have him as our Chapter Angel. Dan's talk, "Radiated Emission Measurements at 1/3/5/10/30 Meters" explored the history and physical basis of the familiar measurements. He emphasized the big three underlying assumptions and their limitations: 1/d field strength vs. distance, free-space and far-field. Dan noted situations where they clearly apply, as well as when the fit may be awkward or even inappropriate, particularly as products and technology continue to evolve. The lively audience participation with questions and shared experiences nicely expanded the discussion. Dan encouraged everyone to read the referenced papers for further understanding. The second meeting, again organized by Programs Chairs, Andrea Spellman of UL and Tom Braxton of Shure Inc., was on September 15, kindly hosted at the ITT Technology Institute in Mt. Prospect, IL. This meeting attracted 41 eager listeners and 20 engineering students from ITT Professor Mike Reed's class. The popular local Wapaghetti's pizza provided by the Chapter may also have boosted attendance. Treasurer and Scholarship Chair Bob Hofmann awarded $1,000 scholarships to two worthy electrical engineering students: Vic Palacios who leads the DeVry University IEEE Student Chapter and Jeremy Borgman of Bradley University who is active in his IEEE student Chapter and the Electronics Club. Our

Chicago Treasurer Bob Hofmann (left) presents the scholarship award to Vic Palacios of DeVry University.



Chicago Treasurer Bob Hofmann (left) presents the scholarship award to Jeremy Borgman of Bradley University.

Dan Hoolihan (far right) makes a point about 3 Meter measurements at the September Chicago Chapter meeting.

Chicago Chapter Chair Jack Black (right) presents the speaker recognition plaque to Dr. Sergiu Radu at the September meeting.

speaker was Dr. Sergiu Radu, an EMC Society Distinguished Lecturer from Oracle, previously Sun Microsystems. http://www.ewh.ieee.org/soc/emcs/dl-main.html. His expansive talk, "PCB Level EMC Design" in 12 Chapters, captivated all eyes and ears for nearly two hours. Dr. Radu provided many take-aways which engineers could apply to their own high frequency microprocessor server designs. The next Chicago meeting will be the famous Oktoberfest Feast to satisfy both body and the mind, sponsored by ELITE Electronic Engineering. The speaker Dr. William Radasky, IEEE Fellow and founder of Metatech, will address High Power E-M Threats to the Power Distribution System. The Chicago Chapter continues to be blessed with active volunteer officers and committee members who create programs and activities to serve our large membership. Please visit the Chapter's website, skillfully maintained by Frank Krozel of EIA, for future meeting information www.emcchicago.org.

Hong Kong

The IEEE Hong Kong EMC Chapter held a successful technical seminar at the City University of Hong Kong on 11 September 2010. Mr. Edmund Lai of Electrical and Mechanical Service Department, Hong Kong SAR Government presented the first topic on "Electrical Product Safety Regulations in Hong Kong." Mr. Kevin Leung of Specialized Technology Resources (H.K.) Ltd. presented the second topic on "Safety Assessment of Electrical Household Appliances." Mr. Steven Tsang of Bureau Veritas Hong Kong Limited presented the third topic on "Electromagnetic Compatibility for Household Appliances." A total of 65 participants attended the seminar.

Mr. Edmund Lai is shown presenting the topic, "Electrical Product Safety Regulations" to the Hong Kong Chapter in September.

Mr. Kevin Leung presents a paper on the topic, "Safety Assessment of Electrical Household Appliances" to the Hong Kong Chapter in September.

Mr. Steven Tsang speaks to the Hong Kong Chapter about "Electromagnetic Compatibility for Household Appliances."

The speakers and the committee members of the Hong Kong EMC & PSE Chapters taking a group photo before their September 2010 seminar. From left, Dr. Peter Leung, Dr. Brian Chan, K W Chen, Howard Wan, S L Mak, Wilson Loke, Steven Tsang, Kevin Leung, Edmund Lai, Dr. Patrick Wong (Chairman of the Hong Kong EMC Chapter), Perry Ho, Horace Lau, and Henry Yuen.

Nanjing

The IEEE MTT-S/AP-S/EMC-S Joint Nanjing Chapter was a technical co-sponsor of the 2010 International Symposium on Signals, Systems and Electronics (ISSSE2010), held in the Mandarin Garden Hotel, Nanjing, China on September 17–20, 2010. This symposium is held every three years, and is organized under the guidance and sponsorship of the international steering committee of the URSI Commission C (Radio Communication Systems and Signal Processing) and D (Electronics and Photonics). There were 310 papers submitted to ISSSE 2010 from 33 countries and regions. A total of 253 papers were accepted after a peer review by the technical program committee members. The acceptance rate of the conference was 82%. The registered attendance was 255 people, including 245 who pre-registered and 10 on-site registrations. The conference events consisted of five keynote presentations, 18 oral sessions, seven poster sessions, and three shared tutorials with ICUWB2010. Three papers were awarded best student paper in the best student paper competition. Five companies, including one platinum sponsor, participated in the industrial exhibition. The IEEE MTT-S/AP-S/EMC-S Joint Nanjing Chapter also co-sponsored the 2010 IEEE International Conference on Ultra-Wideband (ICUWB2010) at the Mandarin Garden Hotel, Nanjing, China on September 20–23, 2010. This conference provided a forum for the latest UWB systems, technologies and applications in both microwave and millimeter wave bands. ICUWB2010 is a continuation of a series of annual international UWB conferences. A total of 407 papers were submitted to ICUWB2010 from 33 countries and regions. The 69 technical program committee members from 18 countries reviewed the papers for their technical merits and the interests to the UWB communities. A total of 219 papers were accepted for presentation in ICUWB2010, and the registered attendance was 227 people. This was a very large event that included five keynote speakers and five invited talks from universities and industrial sectors. Also included were one special session

The Mandarin Garden Hotel, venue for the 2010 International Symposium on Signals, Systems and Electronics, and the 2010 IEEE International Conference on Ultra-Wideband, both co-sponsored by the Nanjing EMC Chapter.

Committee members from the 2010 International Symposium on Signals, Systems and Electronics, co-sponsored by the Nanjing EMC Chapter.

The Best Student Paper Awards are presented at the 2010 IEEE International Conference on Ultra-Wideband, co-sponsored by the Nanjing EMC Chapter.

"Development of UWB in China", 20 oral sessions, five poster sessions and three shared tutorials with ISSSE2010. Three papers were awarded best student paper in the best student paper competition. Seven companies, including one gold sponsor and two silver sponsors, participated in the industrial exhibition.

Phoenix

Glen Gassaway reports that the first IEEE EMC Phoenix Chapter meeting of the fall was held on September 21, 2010 at Garcia's Mexican Restaurant in the Embassy Suites Hotel in Tempe, AZ. Our featured speaker was Kevin Slattery, the Manager for Advanced Signaling and Interference Technologies at Intel, who has been working in the field of EMI/EMC for 18 years and has developed measurement techniques and analytical approaches for the evaluation of high speed processors, chipsets, LAN, and display electronics. With the advent of mobile computing, wireless communication has become an integral part of the computer platform. Wireless is now ubiquitous in laptops, and modern cell phones contain several integrated communications devices. The problem is these devices were never intended to coexist. Mr. Slattery presented a wealth of novel approaches to ensure reliable communications performance. It is a sobering thought that 3 dB of noise can reduce the performance of your communications system by 50%. It is even more sobering that 20 or even 30 dB of noise is common on some devices. In various bands, emissions suppression requirements to provide compatibility between digital electronics and co-existing communications devices are 30 dB more stringent than meeting FCC radiated emissions requirements. Some solutions have involved the use of costly metal shielding. Other solutions are far superior. The designer needs to think that mitigation schemes are layered, where one can use a number of methods to achieve compatibility. The careful use of differential signaling can be beneficial, but it must be considered that imbalanced differential systems are not ideal because of differential to common mode conversion. A skew of 75% of the waveform rise time can completely negate the benefit of differential signaling. Skew can be introduced by unequal trace or wire lengths, and can even be affected by changes in wire insulation relative permittivity. The speaker noted that in some cases it is necessary to specify wire insulation permittivity along a wire's length! Even with the best differential signaling design practices, one typically still needs 5–10 dB of additional isolation. Another digital technique involves the use of a pseudo-random bit stream. Synchronized periodic signals emit on the order of 20 dB more than random signals. When

PHOTO BY STEVE GERARD.

Kevin Slattery, speaking to the Phoenix Chapter, provides some unique ideas to combat platform interference to a large turnout in Phoenix.

a system's clock or synch signals are pseudo-random, significant interference reduction is achieved. The speaker told us of his experimentation with a variety of clock wave shapes, which he analytically and empirically optimized to achieve minimum noise at the system's communications bands. Other techniques include careful selection of clock frequencies, which can be adjusted so high order harmonics do not reside within system receiver bands. If it is impossible to move a clock frequency that far, then it may at least be reasonable to change the clock frequency where an odd harmonics falls within the receiver band instead of an even harmonic (or vice versa). Antenna placement is also critical. It's best to move communications antennas as far away from the emissions source as possible. As an example, a Wi-Fi antenna placed across the top of a laptop display can be very close to display drivers.

Romania

Andrei Marinescu, Romania IEEE EMC Chapter Chair, reports that on June 30, 2010 the IEEE EMC Romania Chapter, in cooperation with the Research, Development and Testing National Institute for Electrical Engineering (ICMET Craiova), Romanian EMC Association (ACER), National Authority for Scientific Research (ANCS) and Romanian Academy for Technical Sciences (ASTR), organized a workshop on "Electromagnetic Shielding in Modern Technique." The half day meeting took place at the ICMET Craiova with 49 attendees from Romanian universities, research institutes and test laboratories; of these, 20 participants were young engineers or researchers. The event was started by the General Manager of ICMET, Marian DUTA, who thanked the participants for their interest in attending. Next, Professor Andrei Marinescu, Chair of Romanian EMC Chapter, presented the workshop program and welcomed the participants to this event. The scientific event was started by Professor Andrei Marinescu with "Introduction in Electromagnetic Shielding Issues." His presentation addressed the scope of electromagnetic shielding methods for determining shielding effectiveness, applicable standards and the need to update their measurement uncertainty, etc. Next, Professor Alimpie Ignea from the University "Politehnica" Timisoara presented a tutorial about "shield and shielding" which included a review of basic concepts. The technical program sessions included a number of important papers including: "Electromagnetic Shields/ Absorbers Based on Chiral Honeycomb Structures," by Valeriu David, Ionut Nica, and Alexandru Sălceanu, of the Technical University; "Method for SAR Reduction When Using Mobile Phone Terminals" by Andrei Marinescu, Ionel Dumbravă, and Violeta Voicu of ICMET Craiova; "Attenuation of Mains Frequency Magnetic Fields in Electric Power Installations" by Sorin Coatu, Marian Costea, and Dan Rucinschi of theUniversity "Politehnica" Bucharest; "The Assessment on Magnetic Fields Generated by High Voltage Lines and Circuits From Substations," by Ileana Baran, Sorin Coatu, Marian Costea, and Dan Rucinschi of the University "Politehnica" Bucharest; and "Progress in International Standardization Regarding The Shielding Effectiveness," by Dan Rucinschi, Sorin Coatu, and Marian Costea, of the University "Politehnica" Bucharest. The workshop papers and the photo gallery can be found on the websites www.icmet.ro/lista_lucrari_ws_2010.pdf and www.icmet.ro/album_ws_2010/index.html.

Santa Clara

The IEEE Santa Clara Valley EMC Chapter held its second Mini-Symposium at the Doubletree Hotel on September 23–24. More than 50 attendees participated from companies such as Apple, Cisco and Lockheed Martin. This year 20 plus vendors exhibited which was a mixture of those that exhibited last year and new faces. The exhibit floor was filled with attendees, booth staff and volunteers whose total number was close to 100. The vendor exhibition was open just on the first day. In an effort to encourage the attendees to visit the booths, we created an "SCV EMC Passport" system where participants would get "stamps" for every booth they visited which then would qualify them to enter the raffle. The majority of the attendees stayed for the reception for a chance to win prizes such as a $50 gift certificate for Home Depot provided by AR RF/ Microwave Instrumentation and a $50

PHOTO BY JERRY RAMIE

Professor Todd Hubing of Clemson University was the invited speaker for the Santa Clara Valley EMC Chapter's Mini-Symposium on September 23.

PHOTO BY JERRY RAMIE

Eriko Yamato of TechDream, Inc. helped organize the Santa Clara Mini-Symposium and built excitement for the raffle during the reception.

PHOTO BY JERRY RAMIE

Krassen Karagiosov played delightful music during the reception at the Santa Clara Mini-Symposium.

PHOTO BY JERRY RAMIE

Professor Tom Jerse of The Citadel was the invited speaker for the Santa Clara Valley EMC Chapter's Mini-Symposium on September 24.

gift certificate for Amazon provided by INCompliance Magazine. Dr. Hubing of Clemson University presented, "EMC Modeling and Design" and Dr. Jerse with the Citadel presented, "Radiated Immunity and Cosite Interference." Both lectures were very well received and attendees felt that there were many fruitful takeaways. The exhibitors were also very satisfied with the abundant opportunity they had to interface with the local engineers. With all the positive feedback both from the exhibitors and attendees, we believe the SCV EMC 2010 Mini-Symposium was a success and we plan to hold one again in 2011. On October 12, Dr. Richard Briët of Aerospace Corporation gave a presentation to the Santa Clara Valley Chapter entitled, "Spacecraft and Surface Charging Mitigation." Dr. Briët spoke about spacecraft and surface charging with an emphasis on practical applications of the current state of the art of spacecraft charging mitigation. Dr. Briët also briefly discussed new developments in the use of surface charging as an enabling process to detect subsurface defects, and to use reverse engineering of current transients from electrostatic discharges as a means to locate the initiation points of ESD on solar panels. Dr. Briët earned his doctorate degree in Solid State Physics (Nuclear Magnetic Resonance and Plasma Physics) and Mathematics at the University of Utah in Salt Lake City, UT. After an exciting and challenging career in survivability, vulnerability, and endurability at Boeing, Military Aircraft Company in Wichita, KS, General Dynamics, Convair Division in San Diego, CA, and TRW, Redondo Beach, CA, Dr. Briët joined The Aerospace Corporation, an FFRDC (Federally Funded Research and Development Center) in El Segundo, CA, where he was assigned additional responsibilities in support of many commercial and non-commercial space programs. Through his many publications and presentations at national and international conferences in the USA, France, Germany, The Netherlands, United Kingdom, Taiwan, and Japan, Dr. Briët has become a widely recognized expert in plasma physics, electromagnetic effects, lightning, and space radiation effects.

PHOTO BY JERRY RAMIE

Dr. Richard Briët spoke to the Santa Clara Valley EMC Chapter on "Spacecraft and Surface Charging Mitigation."

SE Michigan

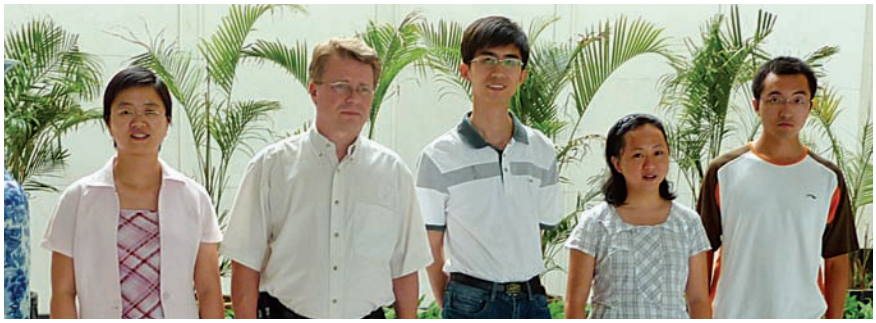
On May 20, 2010, Southeastern Michigan's EMCFest took participants back to school for the "EMC Aspects of Hybrid Vehicles and Motors" organized by Mark Steffka of GM and the University of Michigan. Dr. Gary Skibinski, James Muccioli, and Dr. David Johns regaled us with the basics of EMC engineering design with regards to hybrid vehicles. The papers presented by these gentlemen were excellent. "Hybrid Electric Vehicle EMI Challenges" was taught by Dr. Gary L. Skibinski, a Fellow Engineer at Rockwell Automation Drives Division, who has been working on power electronics for 34 years. Dr. Skibinski taught how high voltage inverters and motors used in hybrid electric vehicles face similar but somewhat different EMC challenges as drive systems connected to the grid. A summary of recent work on how to obtain high frequency cable and high frequency motor models was presented to tie into mobile EMC. Discussion of shielding and bonding techniques was highlighted. Lastly, he covered simulation tools to study conducted noise that lead to radiated noise. "Battery Pack and Shielded Cable Considerations for HEV Bench Level EMC Testing" was taught by James P. Muccioli, an EMC consultant and owner of Jastech EMC Consulting LLC for the past 25 years. He has worked for X2Y Attenuators, Chrysler and United Technologies as Chief Technical Officer, EMC expert and System Engineer. He has taught EMC undergraduate courses and professional education seminars at Lawrence Technological University and at the University of Michigan. Mr. Muccioli's presentation examined the challenges for hybrid and electric vehicles (HEV), as engineers define their test specifications for the new high voltage/current technology. Competitive advantages as well as the cost for research and development were significant factors that he discussed. HEV battery pack and associated interfaces using system engineering to highlighted requirements, trade-offs and challenges that would correlate bench

Speakers at Southeastern Michigan's EMCFest in May are pictured, left to right: David Johns, Gary Skibinski, Mark Steffka, and James Muccioli. Thanks speakers for your hard work!

level EMC testing to vehicle level testing were also discussed. "Simulation of Cable Interference and Emissions in Vehicle Power Systems" was covered by Dr. David P. Johns, the VP of Engineering and Support for CST of America. He received his Ph.D. in Electromagnetic Analysis from Nottingham University (UK) in 1996 for developing a new 3D frequency-domain TLM method. He contributed to the development of CST's 3D time-domain TLM code MICROSTRIPES and in particular efficient techniques for modeling current diffusion, apertures and wires. David has over 20 years of electromagnetic simulation experience and specializes in the modeling of real world EMC/EMI problems. He is a regular speaker at IEEE EMC conferences and Chapter meetings and recently the co-chair of the IEEE EMC Symposium Workshop, "How to Simplify Real-world Complex Systems into Realistic, Solvable, Accurate Models." The use of high voltage power systems in hybrid and electric vehicles adds to the already considerable challenges in meeting automotive EMC requirements. The switching associated with power converters or inverters can generate differential and common noise that propagates in cabling and interferes with other electronics systems. His presentation explored techniques for modeling the power system EMC problem and assessing interference between cables routed in close proximity. The effect of cable imbalance was discussed and also a comparison of shielded and unshielded cable coupling. On June 17, Arnie Nelson gave a great presentation on the "Basics of PCB Design" and working with component specifications for the Southeastern Michigan (SEM) EMC Society Chapter covering both the history and present day technology. Arnie retired from Visteon-Ford in 2005 with over 35 years experience in a number of disciplines. Since retiring, Mr. Nielsen has been active in consulting on electronic design and EMC for over 20 companies (including electric vehicles). In his presentation, Arnie described test anomalies that should be taken seriously and showed how Ford has been able to speed up the EMC test cycle by putting components under duress. Arnie discussed Ford's clattering relay as a great way to see how components deal with spurious signals across the frequency spectrum. Mr. Nielsen talked about Power Spectral Density (PSD) calculations and the effect of the PSD on testing decisions. He examined the different characteristics of diodes and those waveforms, his slides on this point were very illuminating and are on the SEM website. Arnie involved the group in considering ESD failures. Some ESD events cause components to become vulnerable to other stress that would not normally cause failure. So he emphasized the order of testing components. Arnie Nielsen's presentation was amazing; check out our website at www.emcsociety.org and look at past meetings to enjoy his slides. On August 19, 2010 Kimball Williams gave an insightful presentation on "Training an Automotive EMC Engineer." Kimball is the Senior Manager with Denso International America in Southfield, MI, USA where he is the technical lead for the EMC test laboratory. Kimball has had many years of significant and influential experience in the EMC industry. Kimball explained that training and certification of EMC personnel to work in the automotive industry requires a unique and remarkably broad range of education, experience and talents. A great source of EMC personnel are HAM radio enthusiasts. Car enthusiasts who work with and have a deep understanding of their cars are another good source of EMC engineers. He explained the need for the new EMC engineers to understand the standards we test to and the importance of keeping abreast of the current technology with continuing education and networking with the EMC community. Kimball said the growth path for someone looking to make this avenue a career choice will likely take them into many areas where they originally had not planned to go. Those who assist the budding EMC engineer should expect to roll up their sleeves and get their hands dirty. On September 16, 2010, the Southeastern Michigan EMC Society was graced with a two hour presentation, "Engineering Aspects of PCB Level EMC Design" by Dr. Sergiu Radu, a distinguished lecturer of the IEEE EMC Society. He is currently Principal Engineer at Sun Microsystems, leading the EMC Design group in Menlo Park, California. He taught how to place traces to reduce crosstalk. Dr. Radu explained where the power supply should be located. He let us know how we should deal with partial or split ground planes. He gave examples of how spread spectrum could and has been used. Dr. Radu let us know where heatsink grounding should be placed in relation to other components. Ports and buses were also discussed. It was a great presentation and everyone was very impressed!

Shanghai

Hongmei Fan reports that on August 28, 2010 at Unilab Co., Ltd, EMC professionals in Shanghai gathered to discuss the Chapter operation. Mr. Esa Korhonen, the IEEE EMC Shanghai Chapter Chair, welcomed two new members, Rong Wang and Yuan Hu. Topics regarding funding for the Chapter, membership issues, November EMC event, Chapter website and newsletter were discussed. Later the Chapter



IEEE EMC Shanghai Chapter August event attendees included (from left) Hongmei Fan, Esa Korhonen, Yuan Hu, Rong Wan and Xin Zhang.

Mr. Esa Korhonen, the IEEE EMC Shanghai Chapter Chair, welcomed two new members.

committee added a new volunteer, Yuan Hu as Website Administrator, apart from Esa as Chair, Hongmei Fan as Co-Chair and Weigang Chen as Secretary. The near future plan was made about contacting the IEEE Shanghai Section with the fund account, checking the active member list, getting new members, inviting professional speakers, building up a Chapter website and even publishing a Chapter newsletter. After the Chapter administrative discussion, Hongmei shared her experience in attending the past EMC Symposium in Fort Lauderdale. Funded by the EMC Society Financial Assistance Program, Hongmei attended the symposium in July, attended the Chapter Officer Training, discussed a strategy to develop IEEE memberships in China, presented her paper and networked with EMC peers. In the Chapter meeting, Hongmei gave a brief introduction about the symposium and also presented her paper titled "Influence of Planar Sampling Techniques of Near Field Magnitude-only Data on Predicting Far Field Radiation of PCBs by Genetic Algorithms." The two-hour event ended with a tour of the Unilab testing facilities.

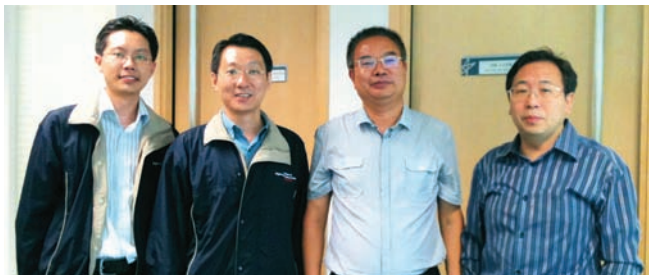
Dr. Hongmei Fan of Cisco Systems (China) Co., Ltd., locally presented her paper published in the Fort Lauderdale EMC symposium.

Singapore

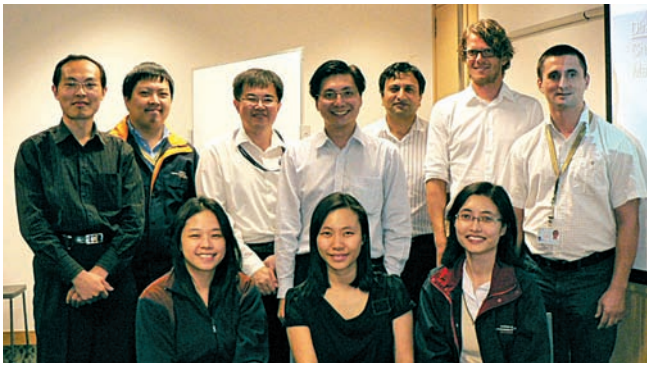
Richard Gao Xianke, Chapter Chair, reports that the Singapore Chapter was honored with the "2010 Best Chapter-of-the-Year" award by the IEEE EMC Society at the IEEE EMC Symposium held in Fort Lauderdale, Florida on July 29, 2010. Congratulations to all Chapter members! Thanks were expressed for everyone's great contribution and dedication. The consistent support from Chapter founders, Professor See Kye Yak and Dr. Er-Ping Li, and immediate past chair, Dr. En-Xiao Liu, is greatly appreciated. On August 2, 2010, Dr. Tony Centeno from Imperial College London, United Kingdom, delivered one technical talk entitled, "Localized Surface Plasmon Resonance: FDTD Modeling and Applications," followed by an ardent discussion during the Q&A session. There were a total of 22 attendees, of which 10 were IEEE members. In August, the Chapter invited Professor Wen-Yin Yan from Zhejiang University, China, who is also a Distinguished Lecturer of the EMC Society from 2011 to 2012, to deliver a series of technical talks entitled, "Multi-physics Modeling Techniques for Silicon-based Miniaturized Devices and High-density TSV Interconnects," "Development of Modeling Techniques for Carbon Nanotube-built Interconnects and Field Effect Transistors," and "EMP^2—Electromagnetic Pulse and Electromagnetic Protection." On August 17, 2010, Mr. Elya B. Joffe, the immediate past president of the EMC Society, presented an excellent and interesting talk with the title of "Introduction of Leadership." It was well attended even though the seminar started at 6 pm. On August 24, 2010, Dr. Dirk Baumann from ETH Zurich, Switzerland, delivered one technical talk entitled, "Exploring New Optical Technologies to Improve Survival and Outcome in Stroke and Brain Injured Patients." There were a total of 29 attendees of which nine were IEEE members. On September 6, 2010, Mr. Thomas Kaufmann from ETH Zurich, Switzerland, delivered one technical talk entitled, "Meshless Method for Electromagnetic Computation." The seminar attracted 13 people, of which five were IEEE members. Associate Professor Ji Chen from the University of Houston, USA, delivered two technical talks on September 13, 2010, which were titled, "Time Domain Modeling Periodic Structures" and "Stochastic Analysis in Electromagnetics." There were a total of 24 attendees, of which 12 were IEEE members. Two days later, Professor Jin-Fa Lee from Ohio State University, USA, delivered a technical seminar entitled, "EM & CEM Research in OSU." There were a total of 17 attendees, of which eight were IEEE members. One of the major events in 2010 organized by the Singapore Chapter, "EMC Design Contest 2010", was held at Nanyang Technological University (NTU) on September 24, 2010. Professor See Kye Yak from NTU, who is also a committee member of the Chapter, chaired the half-day contest. Seven delegates were shortlisted for the final competition of which each delegate

*Dr. Tony Centeno from Imperial College London, United Kingdom, gave a technical talk at the Institute of High Performance Computing of A*STAR, Singapore, in August.*

The participants listened attentively to Dr. Tony Centeno's seminar on August 2, 2010.



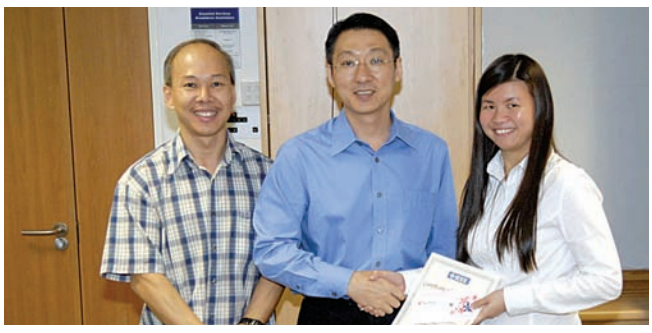
*Professor Wen-Yan Yin (second from right) from Zhejiang University, China, delivered a series of technical talks at the Institute of High Performance Computing of A*STAR, Singapore, from August 10 to September 2, 2010. From right to left are Professor Er-Ping Li, Professor Wen-Yan Yin, Dr. Richard Gao Xianke, and Mr. Phua Wee Kee.*



The participants enjoyed photo taking with Dr. Dirk Baumann (second from right, back row) after the seminar on August 24, 2010.

The panel members of the EMC Design Contest included (from right to left) Dr. Deng Junhong, Dr. Wang Chao-Fu, Dr. Liu Enxiao, Dr. Richard Gao Xianke, and Dr. Chua Eng Kee.

Professor See Kye Yak from Nanyang Technological University, Singapore, chaired the EMC Design Contest organized by the Singapore Chapter on September 24, 2010.

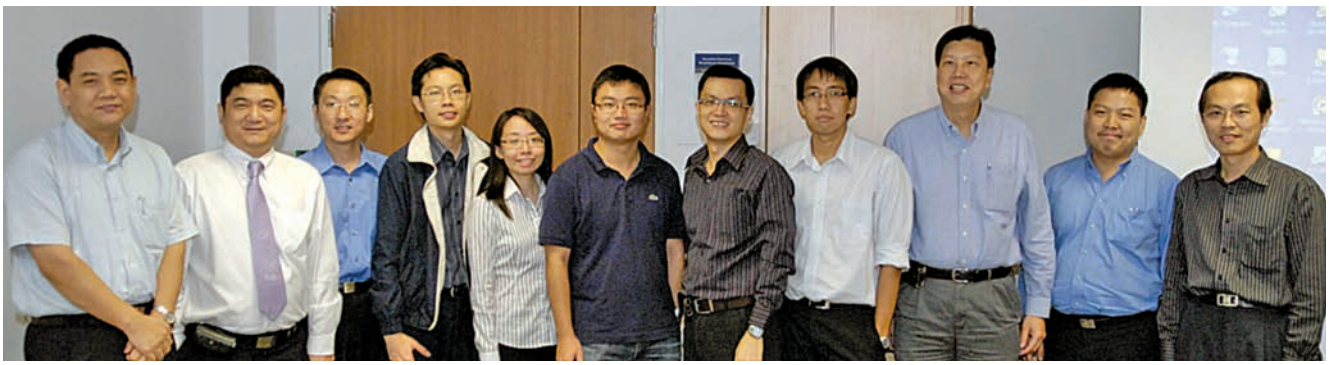


The delegate from Nanyang Technological University received the certificate from Dr. Richard Gao Xianke (center), Chapter Chairman, at the EMC Design Contest.

The participants listened attentively at the EMC Design Contest.

The delegate from ST Electronics (Info-Comm) received the certificate from Dr. Richard Gao Xianke (center), Chapter Chairman, at the EMC Design Contest.

*Dr. Eric Bogatin from Bogatin Enterprises, USA, delivered a technical talk at the Institute of High Performance Computing of A*STAR, Singapore, on October 11, 2010.*



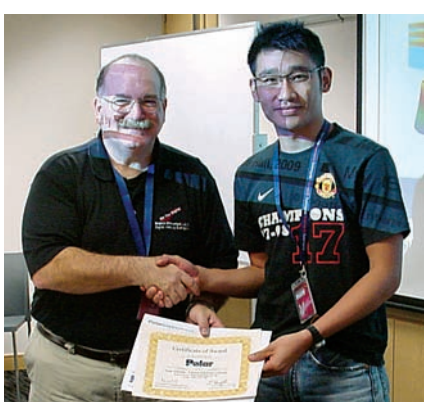
The final winners of the EMC Design Contest enjoyed photo taking with panel members on August 24, 2010.

would give a 20 minute presentation with five minutes Q&A. There were a total of 22 attendees, of which most were from industrial companies. This contest received a good response and the Chapter will continue to organize similar events in the future. After this contest, Dr. Richard Gao Xianke, Chapter Chairman, hosted the third administrative meeting and updated the activities organized by the Chapter. Dr. Chua Eng Kee, Chapter Treasurer, updated the financial report for the first three quarters of 2010. The committee passionately discussed the work plan for the fourth quarter of 2010 and the year of 2011, which includes organizing technical seminars and distinguished lectures, short courses, membership development, social activities for Chapter members, best student paper contest, etc. The candidates for the four key positions on the Chapter committee for 2011 were also nominated during the meeting. On October 11, 2010, Dr. Eric Bogatin from Bogatin Enterprises, USA, delivered an excellent technical talk entitled, "Controlling Loss in Transmission Lines: The New Challenge for Circuit Board Design and Fabrication." The seminar was well attended with a total of 47 participants, of which most were from industrial companies.

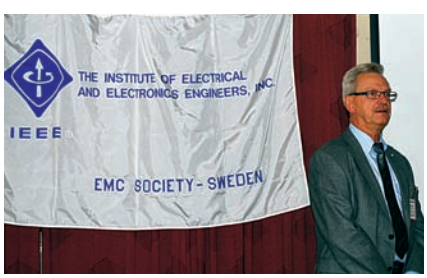
Sweden

In October, the Swedish Chapter had a little celebration of 20 years of activity. The first meeting took place in Linköping at FOA3, now FOI Swedish Defense Research Agency, on October 17, 1990. Eight members and eleven non members participated. Meeting #55 was also held in Linköping on October 5, 2010, but this time at Combitech, which sponsored

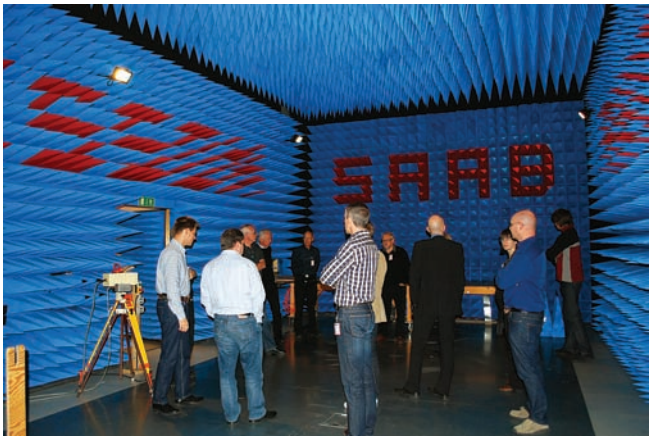
Dr. Eric Bogatin did a lucky draw after his seminar and presented his book as a gift prize to Mr. Timothy Foo.



The second gift prize, a Polar EM simulation toolkit, was presented by Dr. Eric Bogatin to the winner.

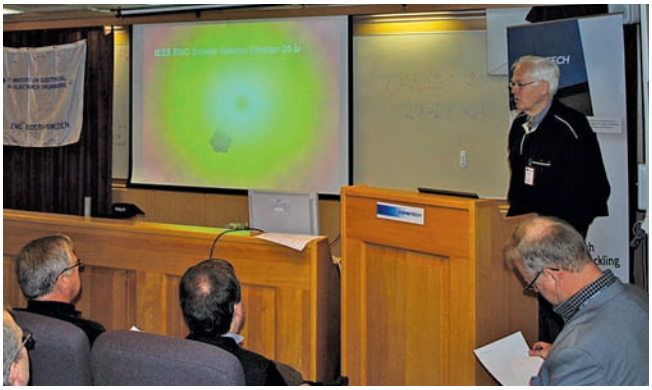


Chairman Jan-Olof Brink opens the Sweden Chapter's 20 Year Anniversary meeting.



The Combitech's EMC Test Facility, which hosted the October meeting of the Sweden Chapter.

Members of the Sweden Chapter enjoy the evening social after a day of Chapter business and technical presentations.



Founding father of the Sweden Chapter: Peter Landgren (far right).

Mats Bäckström of Combitech was the gracious host of Sweden's 20 year anniversary meeting.

Managing Director Marie Bredberg of Combitech welcomed everyone to the meeting.

Sweden Chapter members enjoy a tour of the mode stirred chamber at Combitech.

the social activity on the preceding evening. Some 50 EMC engineers attended this meeting. When the Chapter started 20 years ago, there were about 30 IEEE EMC members and now there are more than 100! With 55 meetings held in 20 years, we have 2.8 meetings per year on average, which is close to what we had hoped for in the beginning. Six of the participants in the first meeting also visited this meeting, indicating a long term commitment to EMC. The meeting was a joint activity with SNRV, section E, which is the Swedish branch of URSI. During the social activity, the managing director of Combitech, Marie Bredberg, gave a short presentation about the company. The program started with a formal planning session with election of the local board and planning for the upcoming meetings, followed by information from the participants. This time we had a history part of the meeting. Peter Landgren presented a short paper with the title "20 år sedan första mötet inom IEEE/EMC; hur det hela började", which translates to "20 Years Since the First Meeting with IEEE/EMC; How it All Began." He had managed to get a copy of the petition from IEEE HQ. Of the 13 petitioners,

Attendees of Sweden's 20 year anniversary meeting enjoy a technical presentation.

four are still in the EMC business. Most of the others are retired. The next paper "Presentation of Combitech" was given by Per Hagström, local manager of the EMC test facility at Combitech. This presentation was followed by another entitled, "Intentional EMI – An Overview". This talk was given by Mats Bäckström of Combitech. Mats was also the host for this meeting. One more paper was given before lunch: "Radiated Front Door Interference in Future Railway Systems (ERTMS)" by Daniel Månsson, High Voltage Valley and KTH, Royal Institute of Technology. After the morning presentation, the attendees enjoyed lunch and a visit to Combitech's EMC test facility. Before the afternoon coffee break, Magnus Olofsson, Director General of the Swedish National Electrical Safety Board, talked about "EM-threat from an Authority View." After the break, Mikael Alexandersson from FOI, discussed "Interference of GPS – Threat and Vulnerability Tests" and Magnus Höijer, also from FOI, talked about "The Vulnerability of Electronic Equipment – the Most Important Parameters." The meeting was closed by our Chairman, Jan-Olof Brink, who thanked the host Mats Bäckström and his secretary, Therese Nilsson, for a very well organized meeting.

Speaker Sergiu Radu (left) receives thanks from Dave Britton following an excellent Distinguished Lecturer presentation at the October Oregon and SW Washington Chapter meeting.

Oregon and SW Washington

Alee Langford, Chapter Vice-Chair, reports that the Oregon and SW Washington Chapter had the pleasure of having their own Chapter Chair, Mark Briggs of Elliott Laboratories, present at the September meeting. The topic was R&TTE Directive: Wireless Modules and Multi-Function Equipment. The meeting was well attended and valuable information was presented. In October, the Chapter welcomed Sergiu Radu, Ph.D., IEEE

Mark Briggs, Chapter Chair of the Oregon and SW Washington EMC Chapter, was the featured speaker at the September meeting.

Oregon and SW Washington Chapter officers, including Alee Langford, Henry Benitez, Mark Briggs and Sidney Chan (from left) meet over a nice lunch to plan upcoming Chapter meetings.

EMC Society Distinguished Lecturer. He discussed engineering aspects of PCB level EMC design. With his extensive knowledge and background, he was able to offer information and suggestions useful to engineers during their design stage. The last meeting of the year will be in November with speaker Bob Scully of NASA. The topic has not been determined; however, this is a highly anticipated meeting, and the Chapter is excited to welcome him to the Pacific Northwest. The Chapter will end the year with their annual Christmas social at "Who Song and Larry's" on the Columbia River as they enjoy the parade of Christmas ships. Visit the Chapter website for more information http://ewh.ieee.org/r6/oregon/emc/.

John Maas (far left) of IBM Corporation with Dan and Brodie at the Twin Cities, Minnesota meeting.

Speaker Dan Hoolihan (left) from Hoolihan EMC Consulting with Minnesota IEEE EMC Chapter President Brodie Pedersen from Nonin Medical.

Twin Cities (Minnesota)

The 2010 Minnesota EMC Event was held on Friday, September 17, 2010 at the Ramada Mall of America in Bloomington, Minnesota. The activities at the event included three technical tracks, EMC exhibits by experienced EMC vendors and fabulous prizes which were awarded at the end of the day. The Technical Tracks included notable EMC professionals presenting in their respective area of expertise with topics related to Military EMC, Medical EMC, EMC Testing Labs, EMC Design and EMC standards. After the event was concluded, the local IEEE EMC Chapter meeting was held and included a great presentation by the Chairman of the EMC Society's History Committee, Daniel Hoolihan. His topic was "25 Years of the Twin Cities EMC Chapter – a Historical Review." **EMC**

Congratulations Jim!

PHOTO BY JANET O'NEIL

Jim Blaha, Chair of the Milwaukee EMC Chapter, and his wife Mary Ellen enjoy the Gala event during EMC 2010 in Fort Lauderdale. Following the Symposium, Jim was recognized by the IEEE Member Geographic Activities (MGA) Board as the 2010 recipient of the MGA Achievement Award. Jim was nominated by the IEEE Milwaukee Section for this very prestigious award to recognize "his vision, leadership, and commitment in assisting the professional development of IEEE members by organizing the Electromagnetic Compatibility (EMC) seminars in Milwaukee from 2001 to 2010."

EMC Chapters Recognized at the 2010 IEEE EMC Annual Awards Luncheon

PHOTOS BY KEN WYATT

Erping Li accepts the "Chapter of the Year" on behalf of the Singapore Chapter. He received the award from EMC Society President Francesca Maradei.

Ryuji Koga received a Certificate of Acknowledgement for outstanding service as the Chairman of the 2009 International Symposium on EMC held in Kyoto, Japan.

Congratulations to the Following EMC Chapters for Awards Received in Absentia at the Awards Luncheon

The **Nanjing Chapter** received the "Most Improved Chapter" award.
Riana Gerschke was honoured for her efforts in founding the IEEE EMC joint Chapter in South Africa.
Stephen McClain was honoured for his efforts in founding the IEEE EMC joint Chapter in Vancouver, British Columbia.
Achim Enders received a Certificate of Acknowledgement for outstanding service to the German EMC Chapter as chair of the working group on biological effects.

2010 Chapter Chair Luncheon

Chapter Chairs and representatives from many of the EMC Chapters worldwide convened in Fort Lauderdale for the annual Chapter Chair Luncheon organized by the EMC Society Membership Services team of Bob Davis, Vice-President for Member Services, and Sergio Pignari, EMC Chapters Coordinator.

Giulio Antonini is shown getting ready for the annual Chapter Chair Luncheon at EMC 2010. He is shown with the microphone while Francesca Maradei, Bob Davis and Sergio Pignari (from left on far right) prepare for their welcome presentations.

Frank Leferink gave a presentation on the activities of the BeNeLux (Belguim, Netherlands and Luxembourg) EMC Chapter. Chapters are encouraged to share "best practices" at the annual luncheon to inspire other Chapters in their future planning efforts.

Sister Society Efforts of the EMC Society

Chuck Bunting, Sister Society Coordinator

In 2008, our then EMC Society president, Elya Joffe, strongly advocated for an increasingly global perspective on the role of the EMC Society pointing to the significance of Thomas Friedman's idea of an increasingly "flat world". With the second consecutive EMC Society president, Francesca Maradei, being from outside the US, a continued emphasis on maintaining a worldwide view is reflected in her message from the Winter 2010 issue of the EMC Newsletter. She particularly highlighted the need to "extend and strengthen our perception as a global Society." EMC is one of those activities that are truly "global" in impact as systems developed in one part of the world must operate in other parts of the globe with a minimum of interruption or disruption of electronic systems.

In November 2009, I began serving as the Sister Society Coordinator for the EMC Society and would like to share my vision of what Sister Society Agreements between the EMC Society and other technical societies can do for its membership.

The Sister Societies Committee has a vision to increase cooperation and awareness of global EMC issues that are essential to the continued development of safe and reliable electronic systems and devices, to increase the participation of individual members of the IEEE EMC Society with global partners, and to facilitate the growth and support of emerging and expanding technologies.

The IEEE has suggested possible collaboration in the areas of membership, publications, technical meetings, and various joint activities. These can be defined in terms of mutual and periodic promotion of membership, technical meetings, publications, the exchange of access privileges to mailing lists, and mutual web site linkages. In the area of publications, Sister Society Agreements will promote the exchange of on-line information access privileges, co-sponsorship of publications available on-line and in printed technical journals and magazines, and discounted subscriptions. Technical meetings will benefit from co-sponsorship of conferences, symposia and workshops, and the mutual granting of registration discounts. In addition, other partnerships in technical, educational, humanitarian and other areas shall be investigated.

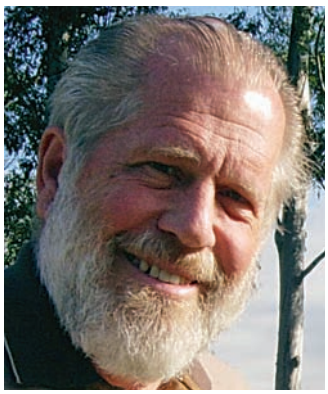
A partnership web page will be used to insure information dissemination for the benefit of the memberships of both societies. The page will contain all relevant records and reports of all collaborative events, announcements, messages, and calls for papers. Additionally, the page will contain liaison/contact information and the agreement tracking mechanisms that indicates major agreement items and states their implementation status and will be visible from both societies' web sites.

A memorandum of understanding template has been approved by the EMC Society Board of Directors. The chief target is reaching outside the US to IEEE and non-IEEE EMC entities, particularly in India, Japan and China. If you are aware of relationships that should be considered by the Sister Society Coordinator, please contact the coordinator, Chuck Bunting, at reverb@okstate.edu. **EMC**

Completed Careers

Don Heirman, Associate Editor

Since the printing of the Spring 2010 issue of the EMC Newsletter, it saddens me to report that John Howard, Roger Sudbury and Paul Cardinal have passed away. We honor their lifelong service to the IEEE and the EMC Society with a short review of their careers below.



John Howard

John Howard left Four Phase in October of 1985 to join Southwall Technologies, a small research company in Palo Alto. He was the sole Electrical Engineer in the company and as the Director of Electronic Products Development was tasked with developing shielding products using wide web thin film technology developed by Southwall. Southwall produced windows (for buildings, not Microsoft) that were reasonably transparent visually but moderately opaque to much of the electromagnetic spectrum. One company interested in this technology was Lockheed Missiles and Space Company. John left Southwall in February 1987 and joined the Research and Development division of Lockheed in Palo Alto, a part of the famous Lockheed "Skunk Works" division. For the next three years he managed an anechoic chamber test facility and participated in research projects to develop low radar cross section technology. This time spent in the deep security "black world" of military defense technology was a world away from the previous environment of commercial product development. John left Lockheed and returned to the commercial world in August 1990 by joining Tandem Computers as Advisory Engineer. This position involved assisting the varied product development teams in achieving EMC compliance with minimum cost and pain. Tandem's downsizing provided John with the opportunity to try EMC consulting in 1992. His consulting work was quite satisfying but he was persuaded to rejoin a company after only six months. John became a Senior Staff Scientist for Parallan Computer from July 1992 until the company failed in April 1994. His EMC expertise was well exercised at Parallan as their high performance server products all met Class B at the first test. The demise of Parallan again left John with the life of EMC consulting, where he remained until his passing.

John joined the IEEE while a student at OSU in 1969 under unusual circumstances. One of his professors submitted a term paper to the IEEE that he had written as part of the student paper contest. John won the paper contest along with a small monetary prize. After the award presentation, they discovered that he didn't belong to the IEEE. Therefore, a condition of accepting the prize money was that he spend it by joining the IEEE. He had been a member of the IEEE since then and a member of the EMC Society since 1982.

John had been active in several areas of the EMC Society. He served a two-year term as Secretary of the Santa Clara Valley chapter of the EMC Society from 1989 until 1991. He subsequently served one-year terms as Treasurer, Vice Chair, and Chair during the following three years. During his service in 1992 as Vice Chair he initiated a program to provide a grant to San Francisco State University (under the direction of Professor Zorica Pantic-Tanner) to start an undergraduate EMC class at SFSU. The success of this venture led to another grant later to San Jose State University, also led by Dr. Pantic-Tanner who was willing to commute from San Francisco to San Jose to teach this evening class.

These events led to a proposal by John to establish the University Grant subcommittee (under the Education Committee) in the EMC Society. The University Grant program has been continuously supported by the Board of Directors since inception and has been responsible for creating an EMC class in the curriculum of over seven universities around the world. This is an ongoing program to offer seed money as a one-time grant to a new university each year to ensure that new EE graduates will have some familiarity with EMC.

John was a NARTE certified EMC Engineer, a member of the dB Society, and a Senior Member of the IEEE. John was also member of Eta Kappa Nu, the honorary Electrical Engineering Society.

John was very involved with several sideline activities. He had been a general aviation pilot since 1968. Over the years, he earned all of the airplane ratings including Airline Transport Pilot. He earned flight instructor ratings for both single and multi-engine airplanes, as well as instrument flying. He owned and flown a Beechcraft Bonanza since 1973. For several years he also owned a twin engine Beechcraft Baron. This he found to be a marvelously efficient method in which to dissipate money! He helped himself with the financial aspects

of airplane ownership by earning the Airframe and Powerplant Mechanics rating from the FAA in 1977 so that he could perform aircraft maintenance himself. Unfortunately, he was the pilot of a single engine Bonanza when it crashed near Rollins Pass, just on the other side of the border with Boulder County.

Roger Sudbury

Roger W. Sudbury, IEEE Division IV Director, longtime volunteer, and IEEE Fellow, died on August 22 after a prolonged illness.

"Roger was a dedicated volunteer who truly loved his work with the IEEE," said 2010 IEEE President Pedro Ray. "To say he will be missed as a colleague and a friend is not sufficient to truly express the sadness that I know his entire IEEE family shares today."

In 2009, Roger chaired the Employee Benefits and Compensation Committee, which recommends guidelines and benefits for employees. He was former executive officer of the MIT Lincoln Laboratory in Lexington, Massachusetts, where he had a 41-year career. He was nationally recognized as a visionary leader in the development of gallium-arsenide monolithic circuits for applications in electronically scanned radars.

He served on numerous IEEE boards and chaired countless committees and conferences throughout the years. Among his many accomplishments, he was president of the Microwave Theory and Techniques Society in 2000. He chaired the Conference Publications Committee, which oversaw the transition to electronic submission of conference publications as well as the development of author support software for IEEE Xplore® compatibility. On the Membership Development Committee, he worked to simplify the online membership application. On the Educational Activities Board, he chaired the Continuing Professional Education Committee (CPEC) and oversaw an expansion of the Educational Partners Program, the integration of the Expert Now IEEE as a CPEC activity, and member access to the courses. As honorary general chair, he ran the Steering Committee for the 2007 IEEE Radar Conference in Boston. On the IEEE Awards and Presentation Committee, he advocated improvements in the IEEE Honors Booklet and Ceremony.

Roger attended Georgia Tech as a National Merit Scholar, earning the B.E.E. degree with highest honors in 1960 and the S.M. and Engineer degrees from MIT in 1963 and 1964. He was a member of Phi Kappa Phi, Phi Eta Sigma, Sigma Xi, Tau Beta Pi, and Eta Kappa Nu honor societies.

Roger is survived by his wife, Margot, and his sons Jonathan and Andrew.

Paul Cardinal

Paul Cardinal peacefully passed away on August 31, 2010 at the age of 56. Paul achieved his BSc Hons. in physics from the University of Ottawa in 1976, followed by Masters and Ph.D degrees from the University of Toronto Institute for Aerospace Studies in laser physics. Although he was initially employed developing lasers for industrial and educational purposes, the highlight of Paul's career was working with Research in Motion (RIM). Paul began his career with RIM in 2000 and thrived with the challenges of being the Director of RIM Testing Services. He considered himself to be extremely fortunate to have had the opportunity to grow with this dynamic company. Paul pursued personal interests in history, genealogy and music. He was an avid reader of science fiction novels. A keen traveler, Paul's goal was to visit the 100 Wonders of the World.

Paul will be forever remembered by his wife Marguerite, and daughters Nicole and Danielle. Paul will also be mourned by his brother Marc and his family in Blackfoot, Idaho; aunt Gertrude Blais in Ottawa; nieces in British Columbia; as well as by canine family members Marshmellow and Crosby.

EMC

Please Let Us Know

I would like to continue to solicit your support in helping me receive the names of EMC Society members that have recently passed away. You can either forward them directly to your local Chapter chair, or if you don't know who that is, you can forward the names to me (d.heirman@ieee.org) or any other committee member which can be found on the EMC Society web page (www.emcs.org) and by clicking on the "Committees" button in the left column. Thank you in advance for your assistance as we honor EMC Society members who have completed their careers.

A Message from the EMC Society Technical Advisory Committee Chair

By Bruce Archambeault

The Technical Program for the 2011 IEEE International Symposium on EMC in Long Beach, California will have something for everyone — from the novice EMC engineer to the advanced practitioner. The technical papers have enjoyed a reputation for extremely high quality in the past years, and EMC 2011 will be no different!

In fact, I am excited and pleased to announce that the EMC 2011 Symposium will have guest speakers who are the top leaders in their respective fields. This is a unique opportunity to see these technical giants in person!

- Henry Ott will teach the fundamentals of EMC based on his award-winning book, *Electromagnetic Compatibility Engineering*

- Dr. Howard Johnson will organize a special session on Signal Integrity

Technical papers will cover a wide range of topics including EMC Measurements, EMI Control, Computational Electromagnetics, Signal Integrity, High Power Electromagnetics, EMC Management, Electromagnetic Environments, as well as the newest technical topic areas for the EMC Society: Nanotechnology, Engineered Materials, and Smart Grid.

Remember, for the latest research in EMC – visit us in Long Beach!

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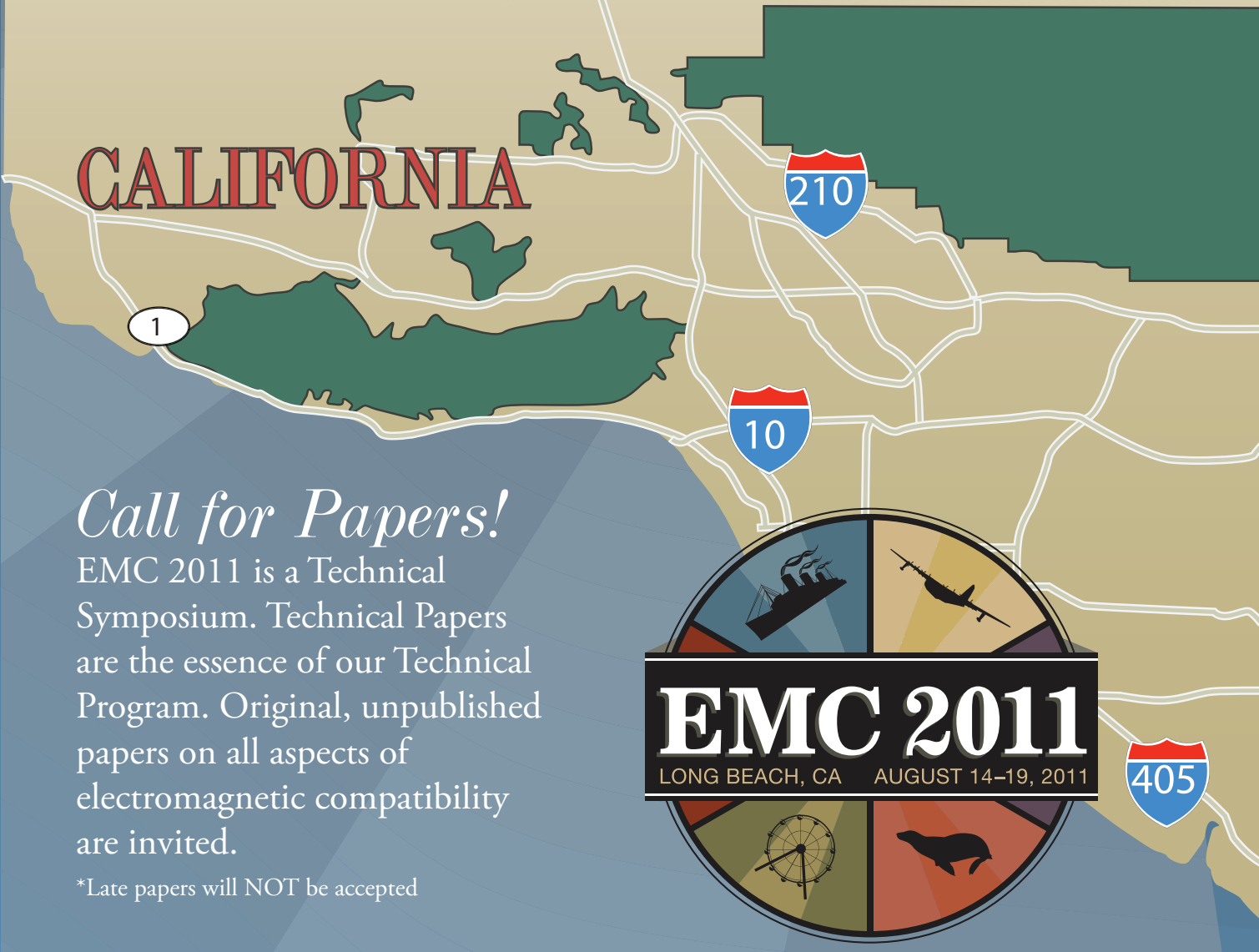

Call for Papers!

EMC 2011 is a Technical Symposium. Technical Papers are the essence of our Technical Program. Original, unpublished papers on all aspects of electromagnetic compatibility are invited.

*Late papers will NOT be accepted

Important Dates

- *Preliminary Full Paper Manuscript:* November 1, 2010 - January 15, 2011
- *Acceptance Notification:* March 15, 2011
- *Final Paper and Workshop/Tutorial Material Due:* May 1, 2011

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EMC Personality Profile

Frank Sabath, Associate Editor

Introducing Erping Li

With this Personality Profile, I leave Europe and would like to introduce a colleague from Asia. The person I would like to introduce is Erping Li. In the EMC Society, Erping is well known as the conference chair of the Asia-Pacific EMC Symposium (APEMC).

Dr. Li's connection with electromagnetic research goes back to his Master degree study in 1984 at Xi'an Jiaotong University, a prestigious university located in the western part of China. His supervisor, Professor Chen Degui, assigned him to a project of developing a 2D finite element method for analysis of electromagnetic fields and applications for the design and optimization of a current sensitive electromagnetic device. As you might know in those days, there was no sophisticated computational electromagnetic software. As a consequence, the students had to develop their own code to simulate the electromagnetic problems. Dr. Li completed his research successfully and obtained his Master degree in mid 1986 from Xi'an Jiaotong University. Thereafter, he continued his research for one and half years at the same location. In early 1989, he was selected by the university to pursue his Ph.D in Sheffield, UK. During his Ph.D research he focussed on the field of three-dimensional computational electromagnetics.

In late 1992, Erping and his family moved from the UK to Singapore. There he started his professional career under the Singapore Government talent program. In the first four years, he was with the Singapore Institute of Standards and Industry Research as a senior research engineer. In 1997, he moved to a British Company located in Singapore as a principal engineer. He was in charge of the EMC control and design for various electrical and electronic systems; this is where he accumulated his extensive EMC experience. In 1999, the company requested he take a higher position in Hong Kong in order to manage the business there and in mainland China. He turned down this offer because he had to take care of his two little boys. Instead, he went back to his academic career and joined the Singapore National Research Institute as a division manager for EMC research. Dr. Li conducted various EMC related research; in particular, he addressed high speed electronics, signal integrity, and complex system EMC research. He is currently a principal scientist and department director. Under his leadership, the research department grew rapidly and the assigned research fields were extended beyond EMC fields, such as to electromagnetics in electronic packages and high density three-dimensional integrated circuits. In 2007, he was elected to the Fellow Grade as a research engineer/scientist "for contributions to electromagnetic modeling and simulation with applications in high speed electronics, EMC/EMI and signal integrity."

In addition to his technical achievements, Dr. Li has made other contributions to his profession. He was co-founder of the IEEE EMC Singapore Chapter in 2001. He served as Chapter

Erping Li (left) and his Master Degree Supervisor, Professor Degui Chen, at the campus of Xi'an Jiaotong University, China in 1984.

Erping Li and his family, including Mrs. Li (left) and son Junze (center), at the Shanghai Expo in June 2010.

Erping Li (seated front row) visited Professor Robert Weigel's (second from left) research lab at Erlangen, Germany in September 2010.

Erping Li (second from left) visited with Professor Wu Qun (far right), Chair of IEEE EMC Harbin Chapter, at the Harbin Institute of Technology, China, December 2009.

Vice-Chair from 2001 to 2004, Chapter Chair from 2005 to 2006 and executive committee member from 2007 until the present. Under his leadership, the Chapter received the Most Improved Chapter Award in 2005 and the Best Chapter Award at the 2010 IEEE International Symposium on EMC in Fort Lauderdale. He was the organizer and President of the 17th EMC Zurich Symposium in Singapore in 2006 and the first Asia-Pacific EMC Symposium in 2008. Dr. Li received the IEEE EMC Society Technical Achievement Award in 2006 and served the EMC Society as a Distinguished Lecturer from 2007–2008. **EMC**

EMC Society History

Daniel D. Hoolihan, Associate Editor, History Committee Chair

Introduction to History Section

There are three articles that are devoted to EMC Society History in this issue of the Newsletter. The articles are:

1) 50-25-10 Years Ago-Articles from previous EMC Society Newsletters
2) Presidents of the IEEE Electromagnetic Compatibility Society – Current Status
3) Historical EMC Articles-How do we best preserve them?

The first article is one that is written for every Newsletter. It goes back and looks at the most interesting articles in previous Newsletters. This month, there were two Newsletters from 50 years ago in the Fall of 1960 (September and November) so we have four previous Newsletters that were reviewed for interesting anecdotes, historical summaries, and anecdotes. The other two Newsletters reviewed included the Fall 1985 issue and the Fall 2000 issue.

The second article is a "Status Report" on the Past-Presidents of the EMC Society. There have been 32 Presidents of the EMC Society; 21 of them are still alive. The status of those 21 is reviewed in this article.

The third article is an attempt to get our EMC Society members thinking about preserving important EMC documents. It is written around a technical paper that was written by Sprague Electric Company back in 1962. Questions are raised on the how, what and why we should be digitizing such articles. **EMC**

EMC Society Newsletter Review – 50–25–10 Years Ago

Number 13 – September 1960 – The Institute of Radio Engineers, Inc. (IRE) Professional Group on Radio Frequency Interference (PGRFI) Newsletter

The cover story included a "Message from the Chairman." The Chairman was Dr. Ralph M. Showers.

"The Professional Group on Radio Frequency Interference has just completed its second full year of operation. In this two-year period, it has grown from an initial membership of 150 to 719. It has conducted two symposia: one in New York in 1959, with an attendance of 200 people, and one this past June in Washington, with an attendance of over 400. In addition, it has cooperated with the U.S. Signal Corps and the Armour Research Foundation on the Interference Reduction Conference held in Chicago. Two copies of the TRANSACTIONS of PGRFI have been issued and a third is in preparation. Copies of the Interference Reduction Conference Proceedings have been distributed to all members since 1958.

It is the purpose of PGRFI to provide the means by which engineers active in radio interference work can exchange ideas and in so doing advance the field as a science. In addition, it should provide the means by which other engineers and management personnel can become familiar with the problems which characterize this field of endeavor and to anticipate them as much as possible. Radio interference considerations can contribute substantially to the cost of electronic equipment, unless they are properly taken into account at the earliest possible moment.

To be of maximum service to the members, it is necessary to have the participation in PGRFI activities of all those interested in the field. One of the best means of exchanging information is through the TRANSACTIONS, which has been conceived as a high quality technical publication which would provide in as concise a manner as possible advances in the field on a current basis. In addition, it is planned to expand activities in the preparation of tutorial manuscripts. All members are encouraged to contribute papers describing their work in the field. In order to maintain our desired standards, these are subject to critical technical review and editorial comments, and the cooperation of the members in the procedures which have been established is appreciated. In addition, a correspondence column is available for handling brief technical notes of general interest with a minimum of publication delay.

As an additional service to members, plans are underway to establish a complete bibliography on radio interference in the very near future.

Please direct any suggestions you may have on the operation of PGRFI to any member of the Administrative Committee. You can be assured they will receive serious consideration."

Later in the Newsletter, the following announcement appeared:

A. T. Parker Forms Own Company – A. T. Parker, formerly chief engineer of Stoddart Aircraft Radio Company, Inc., Hollywood, California, announces the formation of A. T. Parker and Associates, 5909 Melrose Avenue, Hollywood 38, California. The Parker organization states that it is oriented principally toward the broadband interference aspects, rather than the frequency allocation phase of RFI work.

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Number 14 – November 1960 – The Institute of Radio Engineers, Inc. (IRE) Professional Group on Radio Frequency Interference (PGRFI) Newsletter

Three cover stories appear in this issue: "Nominations for PGRFI Administrative Committee Membership," "San Francisco Forms PGRFI Chapter," and "Inland Empire Cooperative Interference Committee Formed to Combat Interference."

The first article announced that Harold E. Dinger, United States Naval Research Laboratory, had been appointed Chairman of the Nominations Committee of the PGRFI for the 1960–1961 period. The primary functions of the Nominations Committee are to prepare a slate of nominees for the Administrative Committee and to see that the election is carried out in accordance with PGRFI By-Laws. The membership of the Administrative Committee included W. Q. Crichlow, Rexford Daniels, Harold E. Dinger, John J. Egli, R. W. Fairweather, Herman Garlan, H. A. Gauper, Z. V. Grobowski, Milton Kant, Leonard Milton, O. P. Schreiber, R. B. Schultz, H. W. Schwenk, R. M. Showers, and Leonard W. Thomas.

The second article simply announced: "A petition has been received by the IRE for the formation of a Chapter of PGRFI in the San Francisco Section of the IRE. The organizer of this Chapter is Peter F. Spencer, Assistant Chief Engineer, Filtron, Co., Inc., Culver City, California."

The third article was from the Newsletter of the Professional Group on VC dated September 15, 1960. The article said, in part, "Secretary Donald A. Crisp of the Inland Empire Cooperative Interference Committee (CIC) put out a 'news release' recently describing the formation of the CIC, operating in the Spokane, Washington area to locate and eliminate radio interference problems. Mr. Crisp, of the Washington Water Power Co., noted that the purpose of the CIC 'is to bring together representatives of all the various services such as broadcasters, two-way radio people, manufacturers, amateurs, public safety people, military, in fact every group concerned with radio communications.'"

The death of Dr. E. Vernon Potter was announced in this issue of the Newsletter; he died unexpectedly on Thursday evening, October 6, 1960, in Chicago. He was attending the Sixth Conference on Radio Interference Reduction and Electronic Compatibility at the Armour Research Foundation. Dr. Potter was Division Director of Physics and Electronics at the Naval Civil Engineering Laboratory, Port Hueneme, California.

The editor of the above two Newsletters was Rexford Daniels.

Issue No. 127 – Fall 1985 – IEEE Electromagnetic Compatibility Society Newsletter

The editor of this Newsletter was Robert D. Goldblum and the cover page featured two articles.

The first article was on the IEEE A/P-S Symposium. It announced that "The 1986 International Symposium, sponsored by the IEEE Antennas and Propagation Society, and the National Radio Science Meeting, sponsored by the USNC/URSI Commissions A, B, E, F, and J, will be held jointly at the Wyndham Franklin Plaza Hotel, Philadelphia, Pennsylvania, June 9–13, 1986. The technical sessions for IEEE AP-S and the National Radio Science Meeting will be coordinated to provide a comprehensive and well-balanced program. Authors are invited to submit papers on all topics of interest to the AP-S and URSI membership."

The second article dealt with IEEE IMTC/86. It said "The IEEE Instrumentation/Measurement Technology Conference will be held March 25–27, 1986, at the University of Colorado, Boulder, Colorado. New and expanding technologies and related standards in instrumentation and measurements constitute the thrust of the technical program. Papers to be presented on test instruments, measurement methods, and technology in keeping with the conference theme 'Standards of Excellence' include: DC and Low-Frequency; Acoustic, RF, Microwave, and Thermal Noise; EMI and EMC; and Optical Electronics."

A report on the 6th Zurich Symposium and Technical Exhibition on Electromagnetic Compatibility was found on an inner page of the Newsletter. The results of the Symposium, which was held March 5–7, 1985, showed 850 participants from 26 countries and a total of 43 exhibitors. The technical program featured 116 papers (in 19 sessions), five workshops, two discussion panels, an exhibition, and two technical excursions. With 34 papers, the USA was the leading contributor to the technical program; 18 other countries contributed the remaining 82 papers. Members of the organizing committee included Professor Dr. P. Leuthold (Symposium President), Dr. Thomas Dvorak (Organizing Chairman), Professor Dr. Ralph M. Showers (Technical Program Chairman) and Herb Mertel (Workshops Program Chairman).

Issue No. 187 – Fall 2000 – IEEE Electromagnetic Compatibility Society Newsletter

The cover page of this Newsletter was titled "2000 IEEE International Symposium on EMC" and it had four pictures of various aspects of the "2000 Symposium."

Joe Butler wrote the "President's Message" in the Newsletter; Todd Hubing wrote the "Chapter Chatter" column; Colin Brench had an article on "TC-9 Computational EMC;" Bob Olsen edited "Practical Papers, Articles, and Application Notes;" Don Heirman covered "EMC Standards Activities;" Elya Joffe wrote an article titled "Standards Advisory and Coordination Committee (SACCOM);" Andy Drozd handled "Membership Development: What's in it for all of us?;" Bill Duff interviewed Benoit Nadeau for the "Personality Profile" section of the Newsletter; the "Board of Directors Activities" was summarized by Janet O'Neil; David Case detailed "Inter-Society Activities;" Andy Drozd tutored us on "EMC Society Webmaster Activity;" Maqsood Mohd wrote about the "IEEE EMC Society Education and Student Activities Committee;" Andy Drozd wrote a third article titled "2000 EMC Symposium Experiment Demonstrations in Washington, D. C. and a 'Call for Experiments' for the 2001 EMC Symposium in Montreal;" and EMC Abstracts were handled by Osamu Fujiwara.

Institutional listings on the back cover included Amplifier Research, ARA, CKC Laboratories, EMC Test Systems, Fair-Rite Products Corporation, Lehman Chambers, Lindgren RF Enclosures, Patton & Associates, Schaffner EMC, and Texas Spectrum Electronics.

The Editor of the Newsletter was Janet O'Neil. **EMC**

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Presidents of the IEEE Electromagnetic Compatibility Society – Current Status

Introduction

The list of past-presidents of the EMC Society is shown below. It includes, of course, the Presidents of the Professional Group on Radio Frequency Interference, the forerunner to our IEEE Electromagnetic Compatibility Society. Those with an asterisk by their name have passed away, but that still leaves a significant number of EMC Society Presidents around the world.

I thought it would be interesting to see what they are presently doing.

1957–1959	*Harold R. Schwenk (20 November 1957–30 June 1959)
1959–1960	James P. McNaul (1 July 1959–30 June 1960)
1960–1961	Ralph M. Showers (1 July 1960–30 June 1961)
1961–1962	*Harold E. Dinger (1 July 1961–30 June 1962)
1962–1963	*Herman Garlan (1 July 1962–30 June 1963)
1963–1964	Donald R.J. White (1 July 1963–31 December 1963)
1964–1965	*Zigmund V. Grobowski (1 January 1964–30 June 1965)
1965–1967	*Aaron H. Sullivan, Jr. (1 July 1965–31 December 1967)
1968	*Richard B. Schulz (1 January 1968–31 December 1968)
1969	*Fred J. Nichols
1970–1971	*Heinz M. Schlicke
1972	*John J. O'Neil
1973	Joseph (Joe) F. Fischer, Jr.
1974–1975	William E. (Gene) Cory
1976–1977	James C. Toler
1978–1979	*Jacqueline (Jackie) R. Janoski
1980–1981	Donald N. Heirman
1982–1983	William G. Duff
1984–1985	*Eugene D. Knowles
1986–1987	B. Leonard "Len" Carlson
1988–1989	Donald E. Clark
1990–1991	Edwin L. Bronaugh
1992–1993	H. Robert (Bob) Hofmann
1994–1995	Warren A. Kesselman
1996–1997	William G. Gjertson
1998–1999	Daniel D. Hoolihan
2000–2001	Joseph E. Butler
2002–2003	Todd R. Hubing
2004–2005	Kimball Williams
2006–2007	Andrew Drozd
2008–2009	Elya Joffe

James McNaul is happily retired and living in Nevada. He attended the 50th Anniversary Symposium and Celebration of the EMC Society in 2007 in Hawaii.

Ralph Showers is still active in standards for EMC. He is a member of the Standards Committee of the EMC Society, he is Past-Chairman and still an active member of the ANSI-ASC C63® committee on EMC, he is chairman of the Board of Directors of the United States EMC Standards Corporation and he was last seen at the 74th International Electrical Commission General Meeting in Seattle, Washington in early October of 2010, where he represented the USA on a number of committees.

Donald R. J. White is retired from EMC and living in Florida.

Joseph (Joe) F. Fischer, Jr. is still active in EMC business; he helps run Fischer Custom Communications in California. He has attended the IEEE International Symposiums on EMC for many years and he is a charter and still active member of the dB Society.

Gene Cory is mostly retired and living in Texas. He attended the 2009 International Symposium on EMC in Austin, Texas where he received the EMC Society's Hall of Fame Award.

James C. Toler is actively living in retirement in Atlanta, Georgia and is keeping a low-profile in the EMC world of engineering.

Don Heirman is very active in EMC especially in Standards. He is a member of the Standards Committee of the EMC Society and Chairman of the CISPR Committee on the international level. He also serves as Chairman of the ANSI-ASC C63® committee on EMC as well as serves on many other subcommittees and working groups in EMC Standards.

Bill Duff remains active in EMC. He still writes and edits numerous Personality Profile articles for the EMC Newsletter. He attends IEEE EMC Symposiums on a regular basis and he was awarded the Society's prestigious Hall of Fame Award at the 2010 International Symposium on EMC held in Fort Lauderdale, Florida.

Len Carlson is happily-retired from Boeing and living in the Washington-state area. He regularly attends the annual International Symposiums on EMC and contributes to the local Seattle chapter on EMC. He is an active member of the dB Society.

Donald Clark has the distinction of being the President of the EMC Society that appointed the author (Hoolihan) to the Board of Directors back in August of 1988. He attends the annual IEEE Symposiums on EMC on a regular basis and he received the prestigious Hall of Fame Award at the 2010 International Symposium on EMC in Florida.

Ed Bronaugh has retired from EMC and is living in Texas. He attended the 2009 IEEE International Symposium on EMC in Austin, Texas where he received the Society's prestigious Hall of Fame Award.

Bob Hofmann has retired from active employment but remains active in the Chicago local EMC Chapter and inputs his ideas frequently to EMC Standards Development in the EMC Society Standards Committee and for the ANSI-ASC C63® committee on EMC. He attends the IEEE International Symposium on a regular basis.

Warren Kesselman retired from the US Army many years ago and is living in New Jersey in retirement. He is the newsletter editor for the ANSI-ASC C63® Committee on EMC. He received the Society's prestigious Hall of Fame Award in 2009.

William Gjertson is still active in EMC and he is still working at Boeing. He attends the IEEE International Symposiums on EMC on a regular basis.

Joe Butler is still working for Chomerics, which is now part of Parker-Hannifin Corporation. He attends the IEEE EMC Symposium on a regular basis and contributes to the local EMC Chapter in the greater Boston area.

Todd Hubing is the Vice-President for Communications Services on the EMC Society Board of Directors. He is also the Michelin Professor of EMC Engineering at Clemson University.

Kimball Williams is getting ready to retire from being a Senior Manager at Denso in the Detroit area. He is a member of the Board of Directors of the EMC Society and active in the local EMC Chapter in the Detroit area. He was the Chairperson of the very successful 2008 IEEE International Symposium on EMC in Detroit.

Andrew Drozd is working for his own firm (ANDRO Consulting) and is still active on the Board of Directors of the EMC Society. He is presently chairing the Standards Development Committee (SDCom) of the EMC Society.

Elya Joffe is very active in the EMC Society as Past-President. He is in charge of the Nominations Committee of the EMC Society and is active in the long-range planning of the EMC Society. He is actively working and recently co-authored a book on "Grounding." **EMC**

Historical EMC Articles – How do we best preserve them?

Introduction

From time-to-time, I receive some historical materials from Bob Goldblum, the former editor of the IEEE EMC Society Newsletter. The material he sends me is sometimes related to the Newsletter and sometimes it is related to his activities in industry when he was actively working. The materials are much appreciated but my storage space in my house and garage is limited so a long-term solution is needed.

The EMC Society's History Committee is investigating digitizing important records and historical written documents for long-term preservation and storage purposes. One of the key issues is how do we decide what to digitize? It should be valuable and important; our budget does not allow us to just digitize every record we have.

Another issue is should it be "key-word" searchable? This is a very valuable tool for researchers, but it is a more expensive process than just "digitizing" the records or documents.

A Recent Example

A document Bob recently sent me is titled "Sprague Technical Paper No. 62-1 - Interference Control Techniques." It is written by the Staff of the Interference Control Field Service Department of the Sprague Electric Company located in North Adams, Massachusetts; Vandalia, Ohio; and Los Angeles, California.

On this document; questions quickly come to mind relative to digitization. Does Sprague Electric Corporation still exist today? Who owns the rights to this "Technical Paper No. 62-1?" Is it already digitized by someone?

The Abstract of the document reads as follows:

The successful operation of modern electronic systems demands that information-bearing signals, error signals, navigation data, and similar types of electrical intelligence be free of all types of spurious energies. Introduction of electrical noises, transients, harmonics, and other spurious signals can cause misinterpretations of data, introduce errors in computer outputs, and prevent use of communications systems. Many electronic circuits are fed with extremely low-amplitude signals which can easily become buried beyond detection, by undesirable noises introduced into the circuit input.

The design engineer has the task of anticipating and disposing of this electronic noise while his project is still in the design stage. To do so at this point will avoid many later difficulties after the system has become operational.

This publication is provided as an aid to the design engineer in his work. It presents the latest techniques in interference control, and, while it does not profess to be complete, it does contain the bulk of remedies known at the present state of the art.

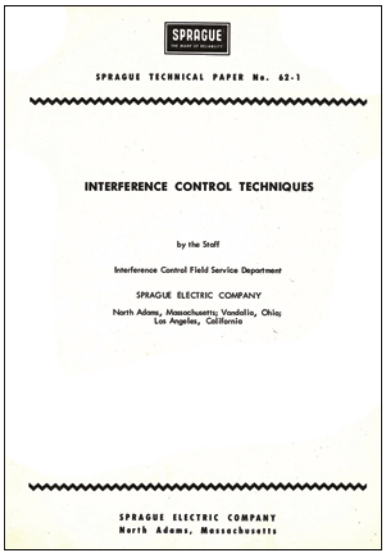
If the design engineer will approach the problem as outlined herein, carrying out each step to its full measure, satisfactory results will usually follow. There will be situations where no amount of suppression,

shielding, and decoupling will produce the desired result. It is at this point that a specialist in this field should be consulted.

The Sprague Electric Company maintains an Interference Control Field Service Department, staffed with personnel and equipment to handle problems which cause difficulties to equipment designers and manufacturers. Consulting this department may prevent costly delays both in design, and production, of electronic systems.

The content of the "Interference Control Techniques" Technical Paper is divided as follows:

1) Definitions
2) Interference Control Techniques
3) Grounding
4) Interference Control Techniques, Design Considerations


SPRAGUE

SPRAGUE TECHNICAL PAPER No. 62-1

INTERFERENCE CONTROL TECHNIQUES

by the Staff

Interference Control Field Service Department

SPRAGUE ELECTRIC COMPANY

North Adams, Massachusetts; Vandalia, Ohio; Los Angeles, California

SPRAGUE ELECTRIC COMPANY
North Adams, Massachusetts

5) Electrical Design Considerations
6) Mechanical Design
7) Interference Control Progress Check
8) Summary of Design Considerations
9) Example of Application of Interference Control Techniques

The 31-page technical paper has 19 figures in it for illustrating important points and 27 charts and graphs. There is no copyright on the document and the title (No. 62-1) indicates that it was published in 1962.

Your thoughts are solicited on whether this is the kind of document that the EMC Society should digitize. Please call me at 651.213.0966 or send me an email to d.hoolihan@ieee.org.

EMC

Letter from the Editor

continued from page 3

the paper titles and author affiliations in the complete list of Awards presented at EMC 2010 on pages 62–63. Incidentally, the highest number of student papers to date was submitted for presentation at EMC 2010. It's nice to know that EMC is becoming a popular area of interest for students.

Before you delve into the Symposium related articles, please note a few new articles are included in this issue. Chuck Bunting shares information on the new "Sister Society" program on page 21. This was created to extend and strengthen our perception as a global Society. As Professor Bunting notes, "EMC is one of those activities that are truly global in impact as systems developed in one part of the world must operate in other parts of the globe with a minimum of interruption or disruption of electronic systems." Bruce Archambeault, Chair of the Distinguished Lecturer Committee, announces the new EMC Society Distinguished Lecturers for 2011–2012, on page 53.

In closing, many thanks go to Mr. and Mrs. Fred Heather (shown below) and the entire EMC 2010 Symposium steering committee and the supporting TAC for an excellent Symposium.

EMC

PHOTOS BY KEN WYATT

EMC 2010 Symposium Chair Fred Heather enjoys the pirate-themed Symposium Gala held at the Harbor Beach Marriott Hotel. It was a perfect evening to enjoy dinner outdoors near the beach.

Sue Heather (left) was recognized at the Awards Luncheon for her efforts as the Companion Club Coordinator for EMC 2010. She received the award from EMC Society President, Francesca Maradei.

2011 Asia-Pacific EMC Symposium

May 16-19, 2011, Jeju Island, Korea

APEMC Korea 2011 May 16-19

Preliminary Call For Papers

The 2011 Asia-Pacific Symposium & Exhibition on Electromagnetic Compatibility (2011 APEMC) will be held in Jeju, Korea, from May 16 to 19, 2011. We are delighted to announce this meeting. Please consider the possibility of your participation and also encourage your team members to join us in beautiful Jeju Island, Korea.

Continuing the success of the Symposium on Asia Pacific Electromagnetic Compatibility, co-hosted by the KIEES and the IEEE EMC Society, and co-sponsored by KCC, RRA, and the EMC Center of RAPA, the authors are cordially invited to submit their high-quality papers representing their original results in all areas of EMC in electrical and electronic engineering.
Proposals for tutorials/workshops/special sessions are highly encouraged.

The symposium will cover the entire scope of electromagnetic compatibility.

Topics of interest include, but are not limited to :

- Sources of Electromagnetic Interference
- EMC Management
- EMC Measurement Techniques
- Lighting & Power System EMC
- Grounding
- System-Level EMC and PCB EMC
- Transportation and Automotive EMC
- Antenna and Propagation Issues
- Electronic Packaging and Integration EMC
- Power Integrity and Signal Integrity
- Computational Electromagnetics
- Nanotechnology in EMC
- Semiconductor EMC
- Communication EMC
- EMC Material
- Bio-Medical Electromagnetics
- Electromagnetic Field Dosimetry
- Propagation Through Biological Media
- Biological Effects of Electromagnetic Fields
- Electromagnetic Modeling of the Human Body
- Electromagnetic Interference with Medical Devices
- Advanced Numerical Modeling
- Regulatory Activities and Safety Trends
- Any other relevant topics

Submissions will be opened for :

- Regular papers (oral and poster) including student papers for the best student paper contest
- Invited papers
- Special sessions, workshops, and tutorials
- Exhibitions and demonstrations

Please visit http://www.apemc2011.org and submit your paper taking care of the following schedule :

- Proposals for special/invited sessions and topical meetings, workshops and tutorials : August 22, 2010
- Preliminary paper submissions : November 14, 2010 (4 pages in PDF format only)
- Notification of acceptance : January 31, 2011
- Final paper submission : March 4, 2011

Please forward the information on this preliminary call to all those potentially interested in submitting their contributions. We are looking forward to seeing you in Jeju Island, Korea.

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President's Message

continued from page 5

Francesca Maradei (far right) and Elya Joffe (far left) present a special award to recognize the 40 years of Europe's first and longest-running EMC Symposium to the founders Ryszard Struzak (second from left) and Wladyslaw Moron (second from right).

prestigious, successful and longest established conference in Europe being founded in 1975, and holding its 20th and last edition in 2009. In the future, the EMC EUROPE Symposium will be the major International EMC Conference in Europe providing an excellent forum for networking and exchange of scientific and technical information between researchers and practitioners from academia, research laboratories, industry and government agencies.

Chapter Outreach Activity

As part of the Society's global outreach activity, I visited the IEEE EMC Polish Chapter. The meeting was held on September 15, 2010 at the Wroclaw University of Technology during the international symposium EMC EUROPE 2010. I had the privilege of being one the speakers together with Elya Joffe and Ryszard Struzak. I appreciated meeting the EMC Society members from Poland and above all, the founders of the oldest EMC Symposium in Europe.

While in Pittsburgh for the recent BoD meeting, I had the privilege of being the technical speaker for the IEEE EMC Pittsburgh Chapter. The Chapter meeting was hosted at the Westinghouse Cranberry Headquarters and was a good opportunity for me, as well as for the other Board members present, to meet with the very active local EMC community. In fact, this Chapter, under the direction of Chapter Chair Mike Oliver of MAJR Corp, will host the 2012 IEEE International Symposium on EMC.

Board of Directors Meetings

The third EMC Society Board of Directors (BoD) meeting in 2010 held in Pittsburgh has just concluded. Other than the Officer's elections for the term of 2012–13, the BoD addressed several other important issues. A brief summary on the most important issues addressed during this meeting follows.

- A new procedure has been approved for providing technical co-sponsorship to conferences. Details may be found on the EMC Society website.
- The IEEE EMC Society has approved a strategic plan for 2011–2015. The strategic planning will soon be posted on the EMC Society website.

The next EMC Society Board of Directors (BoD) meeting is scheduled for March 28–30, in Fort Lauderdale, Florida. I remind you that all meetings of the EMC Society BoD are open. Any member who would like to attend will be most welcome. The schedule of the BoD meeting is posted on the website at http://www.ewh.ieee.org/soc/emcs/conferences.html, and in the calendar section of the EMC Newsletter.

Call for Volunteers

The success of our Society is possible thanks to the many fine volunteers who have contributed unselfishly of their time and talent. As the Society evolves, and new initiatives emerge, we are always in need of volunteers. Please, give serious consideration to becoming involved in our broad and challenging goals and objectives. The full list of committees may be found on our website at http://www.ewh.ieee.org/soc/emcs/directors.html.

I look forward to working with all of you who join the volunteers of the Society in helping achieve our goals for the benefit of us all. To make a suggestion, comment, or for just dropping a friendly note, please do not hesitate to e-mail me at: fr.maradei@ieee.org.

EMC

A group photo taken at the end of the IEEE EMC Polish Chapter meeting in Wroclaw.

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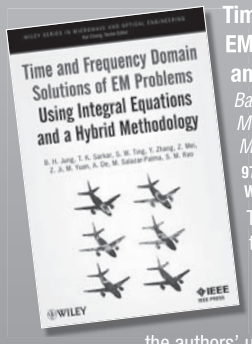
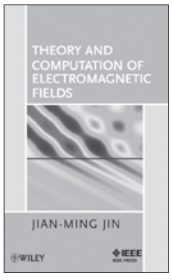


Time and Frequency Domain Solutions of EM Problems Using Integral Equations and a Hybrid Methodology

Baek Ho Jung, Tapan K. Sarkar, Yu Zhang, Zhong Ji, Mengtao Yuan, Magdalena Salazar-Palma, Sadasiva M. Rao

9780470487679 • Cloth • 516pp • $89.95 • Oct 2010
Wiley-IEEE Press

This book provides a compendium of solution techniques dealing with integral equations arising in electromagnetic field problems in time and frequency domains. Written by leading researchers in the field, it documents the authors' unique space/time separation approach using Laguerre polynomials. Numerous examples that illustrate the various methodologies and user-friendly computer codes make this volume highly accessible for engineers, researchers, and scientists.

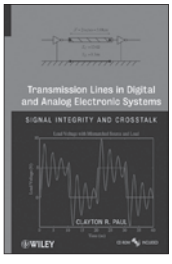


Theory and Computation of Electromagnetic Fields

Jianming Jin

9780470533598 • Cloth • 616pp • $140.00 • Nov 2010 • Wiley-IEEE Press

This book serves as a textbook for both an entry-level graduate course on electromagnetics and an advanced-level graduate course on computational electromagnetics. No textbook is available for the advanced course; this book fills that void and presents electromagnetic theory in a systematic manner so that students can advance from the first course to the second without much difficulty. Accompanied by an instructor's guide, it covers both fundamental theories and advanced topics.



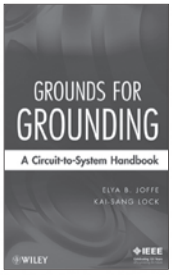
Transmission Lines in Digital and Analog Electronic Systems

Signal Integrity and Crosstalk

Clayton R. Paul

9780470592304 • Cloth • 298pp • $99.95 • Aug 2010 • Wiley

This book grew out of the realization that most of today's EE and CpE graduates lack a critically important skill: the analysis of transmission lines. This text prepares readers for increasingly difficult design problems in a high-speed digital world, arming them with the basic though intricate knowledge they need to succeed.



Grounds for Grounding

A Circuit to System Handbook

Elya B. Joffe, Kai-Sang Lock

9780471660088 • Cloth • 1088pp • $145.00 • Dec 2009 • Wiley-IEEE Press

Blending theory and practice, this is the first book to provide a thorough approach to grounding from circuit to system. It covers: grounding for safety aspects in facilities, lightning, and NEMP; grounding in printed circuit board, cable shields, and enclosure grounding; and applications in fixed and mobile facilities on land, at sea, and in air. It's an indispensable resource for electrical and electronic engineers concerned with the design of electronic circuits and systems.

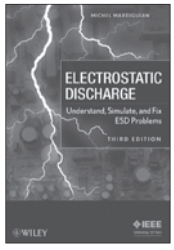
Inductance

Loop and Partial

Clayton R. Paul

9780470461884 • Cloth • 379pp • $115.00 • Nov 2009
Wiley-IEEE Press

This is an unprecedented text - thoroughly illuminating loop inductance as well as the increasingly important partial inductance - which are integral systems of understanding for the proper operation of high-speed digital systems. It fills a hole in the market and addresses industry-wide failure to adequately understand and calculate inductance, giving a badly needed refresher on magnetic fields. Written by a world-renowned leader and respected teacher in the field of Electromagnetics, this is a key text for graduate level engineering students, working engineers, and professionals engaged in electrical system scientific or research work.



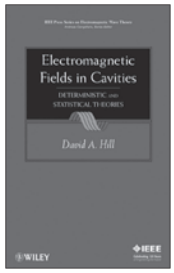
Electrostatic Discharge

Understand, Simulate, and Fix ESD Problems, 3rd Edition

Michel Mardiguian

9780470397046 • Cloth • 299pp • $99.95 • Sept 2009
Wiley-IEEE Press

With the growing consumer demand for reliability and availability, this timely book provides design engineers with a clear understanding of the ESD threat and offers a methodic, step-by-step attack to reduce its risk and test for immunity at all levels. Complete with case histories and their successful fixes, this is truly the most thorough and concise treatment of the broad ESD continuum available.



Electromagnetic Fields in Cavities

Deterministic and Statistical Theories

David A. Hill

9780470465905 • Cloth • 280pp • Sept 2009
Wiley-IEEE Press

The first book of its kind, *Electromagnetic Fields in Cavities* presents a unique combination of rigorous solutions to Maxwell's equations with conservation of energy to solve for the statistics of many quantities of interest: penetration into cavities (and shielding effectiveness), field strengths far from and close to cavity walls, and power received by antennas within cavities. Including all modes, rather than just the dominant mode, as well as wall losses and a special treatment of the current source region, the book is a valuable tool for researchers, practicing engineers, professors, and graduate students.

Radio Frequency Circuit Design, 2nd Edition

W. Alan Davis

9780470575079 • Cloth • 424pp • $110.00 • Dec 2010 • Wiley-IEEE Press

This new edition of *Radio Frequency Circuit Design* features novel applications of RF technology, an area that continues to grow and evolve. It provides a thorough basis for design of RF circuits, including phase locked loops, filters, transformers, amplifiers, mixers, and oscillators. This new edition offers a better understanding of RF power amplifiers and expands upon class D and E power amplifier treatment. Also included are summary tables, graphs, equations, and SPICE examples.

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IEEE

Practical Papers, Articles and Application Notes

Flavio Canavero, Technical Editor

Both articles of the current issue are related to measurement techniques for EMC.

The first article is entitled "Shielded Cables Transfer Impedance Measurement" by Bernard Démoulin and Lamine Koné, with the TELICE Lab at the University of Lille, France. The determination of transfer impedance of cables and connectors is a common practice for several EMC applications, but it has various hidden subtleties that can often make the result of measurements inaccurate. Despite this fact, I don't remember having seen fresh and innovative discussions on this subject at conferences or in journal papers, recently. This article brings us the highly competent view of an experienced team on transfer impedance characterization of cables. In particular, Professor Démoulin played a significant role during the1970s at the former Laboratory for Radiopropagation and Electronics (now TELICE), where testing procedures for cable shielding effectiveness were developed and subsequently incorporated by IEC Standards. Recently, Professor Démoulin retired and now he enjoys writing books where he consolidates the long and rich experience on EMC he accumulated in his long carrier. I am delighted to have the privilege of offering you this article (and two more, that will appear in the next issues) shedding light on practical and more subtle fundamental issues of shielded cable transfer impedance measurements. I'm sure it will stimulate discussions and thoughts.

The second article is entitled "EMI Failure Analysis Techniques: III. Correlation Analysis" by Weifeng Pan and David Pommerenke from the EMC Lab of the Missouri University of Science and Technology in Rolla, Missouri. This is the third and last contribution of a series covering different methods for EMI failure analysis of devices. This paper focuses on how to determine the inter-relation between multiple near-field signals and the far-field signal, by means of correlation techniques. However, the reader must be warned that correlation analysis requires advanced measurements and data analysis methods and it is not meant to provide an immediate result for quick EMI troubleshooting.

In conclusion, I encourage (as always) all readers to actively contribute to this column, either by submitting manuscripts they deem appropriate, or by nominating other authors having something exciting to share with the Community. I will follow all suggestions, and with the help of independent reviewers, I really hope to be able to provide a great variety of enjoyable and instructive papers. Please communicate with me, preferably by email at canavero@ieee.org.

Shielded Cables Transfer Impedance Measurement

B. Démoulin, L. Koné
TELICE-IEMN Group, Université Lille 1 (France)

Introduction

Transfer impedance measurement represents perhaps the most objective methodology to estimate the shielding effectiveness of cables or connectors. Similarly to the propagation parameters of cables (ie, the characteristic impedance, the propagation velocity and the per-unit-length attenuation), the transfer impedance characterizes the shielding properties, independently of the external conditions of cables or connectors.

This article is devoted to the description of some measurement techniques that are commonly employed for transfer impedance determination [1], [2].

The first Section concerns the definition of transfer impedance as derived by means of a measurement setup including an injection line made by an outer metallic tube, coaxial with the shielded cable under test. The measurement procedure consists in generating along the shield a perturbing sinusoidal current, with ideally uniform longitudinal distribution. We will designate this setup as "triaxial" due to the existence of three coaxial cylinders, i.e., the outer tube, the shield under test and the inner conductor of the cable. For a cable with two wires inside the shield, such conductors must be shortened at their ends, in order to be equivalent to the single inner conductor of a conventional coaxial cable.

The second Section describes the coupling between the injection line and the coaxial cable, assuming that each line is matched, i.e. terminated with their respective characteristic impedances. This analysis will result in two equations providing the voltages generated at the coax terminations. Such voltages will be called near-end and far-end voltages. A detailed study of these equations will provide an insight about the role of propagation on the signal transfer and this, in turn, will allow us to derive rules for the reduction of systematic errors due to interference of signals propagating along the cable.

The third Section deals entirely with the technological description of triaxial setups, and provides tips for the estimation of the injection current and for the measurement of the very low voltages that must be collected at the terminations of the sample under test.

The fourth Section discusses the calibration of the measurement setup and describes the test samples needed to perform the calibration.

The fifth Section provides examples of measurements performed on coaxial cables of various types. One experiment clearly evidences the presence of the propagation phenomena encountered during the transfer impedance measurement of a cable with a length of approximately 10 m. Other results allow to appreciate the wide dynamic range related to transfer impedance measurements.

Definition of Transfer Impedance

Let us consider the coaxial cable shown in Fig. 1. A uniform current I_S, independent from the longitudinal variable z, flows along the shield. The internal conductor is connected to the shield at the extremity situated in $z = L_0$, while the extremity situated on the reference origin is connected with an impedance of value Z_0. Consequently, the residual voltage due to the shield imperfection assumes the value $V_c(0)$. We assume a sinusoidal current giving rise to a TEM mode, whose wavelenght is much larger than the cable length.

Assuming that Z_0 is approximately equal to the characteristic cable impedance Z_c, we can derive the simplified equivalent circuit of the cable, as represented in Fig. 2.

The electromotive source E_0 appearing in the diagram of Fig. 2 is given by $E_0 = Z_t I_{S0} L_0$, where I_{S0} is the constant value assumed by the current along the shield.

In principle, the transfer impedance can be experimentally determined by a current-to-voltage ratio, as follows

$$Z_t = \frac{1}{L_0}\frac{V_c(0)}{I_{S0}} \tag{1}$$

Different procedures have been considered to carry out the measurement of the transfer impedance of a shielded cable. First of all, we will analyze the most rudimental setup called "*Triaxial matched setup*".

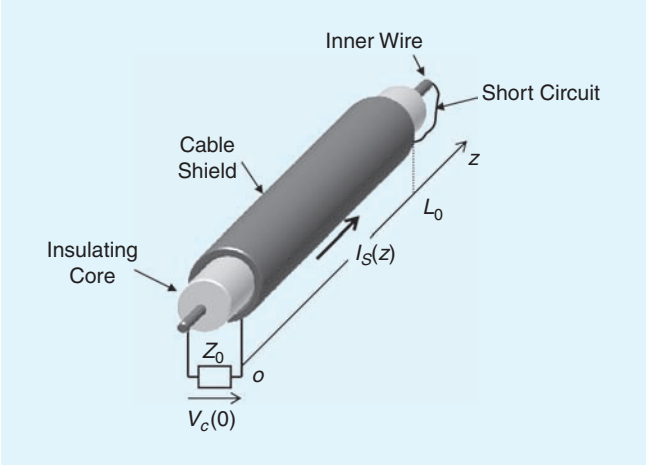

Fig. 1. The shielded cable and its terminations.

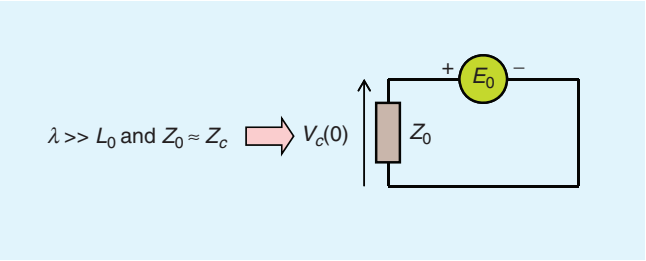

Fig. 2. Parameters of the equivalent circuit.

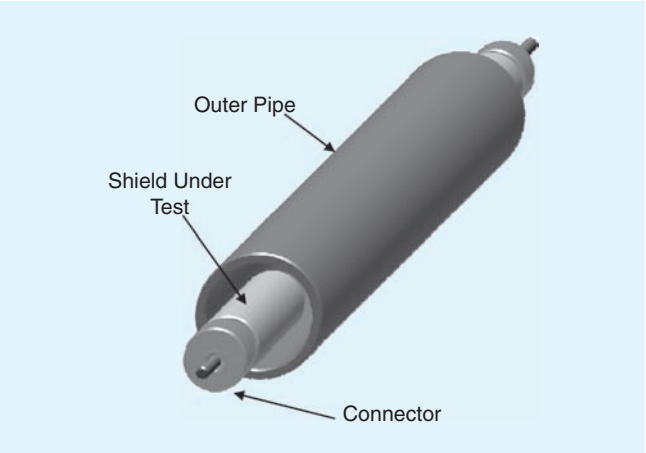

Fig. 3. Main elements of the triaxial setup.

Triaxial Matched Setup

The triaxial setup is constituted by a cylindrical pipe concentric to the cable shielding; this pipe forms a coaxial transmission line that canalizes the injected current required for the measurement. Fig. 3 shows a perspective view of the triaxial setup.

The longitudinal section of the above figure shows that this system is equivalent to a two-coupled transmission line system. Line 1 or "perturbing line", is made up of the external pipe and the cable shield under test. Line 2 consists of the cable under test coupled with the perturbing line by means of the transfer impedance. Lines 1 and 2 are represented by the following pairs of impedance and propagation constant: (Z_{c1}, γ_1) and (Z_{c2}, γ_2).

The configuration of Fig. 4 shows the measurement setup of the triaxial method, where both lines are matched. The crosstalk voltages produced at the near and far terminations are expressed by

$$V_c(0) = \frac{1}{2} Z_t I_{S0} \frac{1 - e^{-(\gamma_1+\gamma_2)L_0}}{\gamma_1 + \gamma_2} \tag{2}$$

$$V_c(L_0) = -\frac{1}{2} Z_t I_{S0} \frac{1 - e^{-(\gamma_1-\gamma_2)L_0}}{\gamma_1 - \gamma_2} e^{-\gamma_2 L_0} \tag{3}$$

The configuration of Fig.4, with line (2) matched at both ends, has the advantage of reducing systematic errors generated by propagation phenomena. For an analytical demonstration of this fact, we neglect conductors losses. Thus propagation constants γ_1 and γ_2 reduce themselves to completely imaginary quantities, which we will express as

$$\gamma_1 = j\frac{\omega}{v_1} \qquad \gamma_2 = j\frac{\omega}{v_2} \tag{4}$$

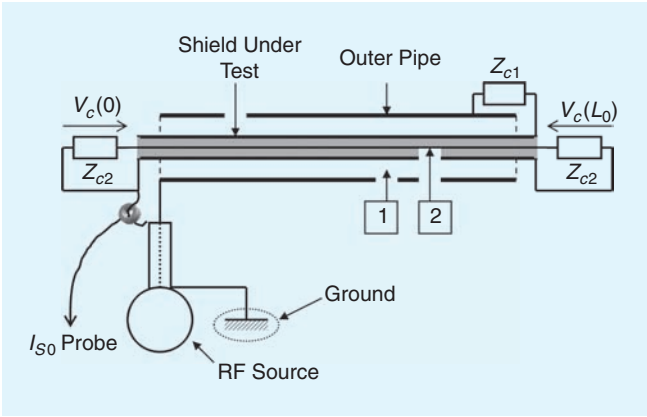

Fig. 4. Configuration of the triaxial setup for the measurement.

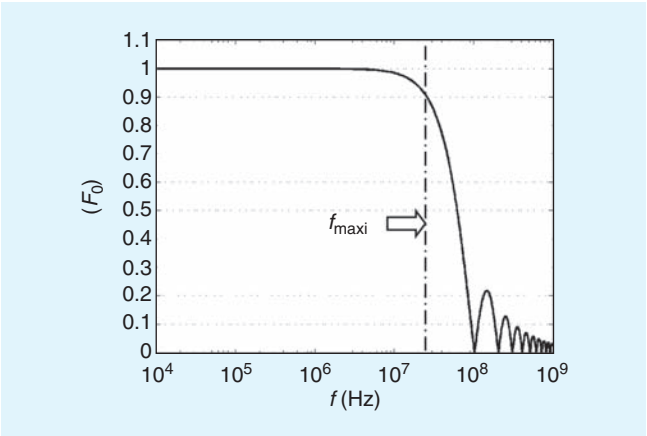

Fig. 5. Influence of propagation effects on the voltage $V_c(0)$.

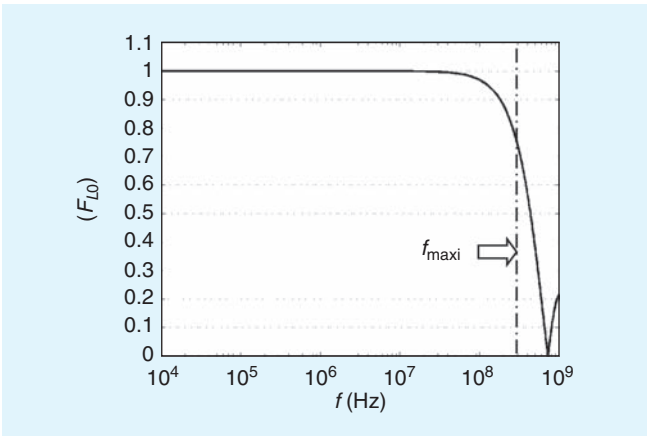

Fig. 6. Influence of propagation effects on the voltage $V_c(L_0)$.

In the above equation, v_1 and v_2 represent the propagation velocity of every line; these parameters, although not rigorously equal, usually have close values. In the low-frequency approximation, the phase angles contained in (2) and (3) are in absolute value much lower than unity, i.e., $|\gamma_1 L_0|$, $|\gamma_2 L_0| \ll 1$. Therefore we can adopt a truncated series representation of the exponential function, and the termination voltages are given by the following simplified expressions

$$[V_c(0)]_{LF} \cong \frac{1}{2} Z_t I_{S0} L_0 \tag{5}$$

$$[V_c(L_0)]_{LF} \cong -\frac{1}{2} Z_t I_{S0} L_0 \tag{6}$$

For high frequencies, the end voltages consist in the product between simplified equations (5) or (6) and a correction function dependent on propagation phenomena. Hence,

$$V_c(0) = [V_c(0)]_{LF} F_0(\omega, L_0) \tag{7}$$

$$V_c(L_0) = [V_c(L_0)]_{LF} F_{L0}(\omega, L_0) \tag{8}$$

where the correction functions F_0 and F_{L0} assume the following expressions:

$$F_0(\omega, L_0) = \frac{1 - e^{-j\omega\left(\frac{1}{v_1}+\frac{1}{v_2}\right)L_0}}{\left(\frac{1}{v_1}+\frac{1}{v_2}\right)L_0} \tag{9}$$

$$F_{L0}(\omega, L_0) = \frac{1 - e^{-j\omega\left(\frac{1}{v_1}-\frac{1}{v_2}\right)L_0}}{\left(\frac{1}{v_1}-\frac{1}{v_2}\right)L_0} e^{-j\omega\frac{L_0}{v_2}} \tag{10}$$

The following numerical example illustrates the behavior of correction functions. Let us consider that the triaxial bench length is $L_0 = 1$ m, and that the propagation velocities in the two coaxial waveguides are $v_1 = 0.8c$, $v_2 = 0.6c$ (c is the speed of light in vacuum). The curves represented in Figs 5 and 6 respectively show the evolutions of $F_0(\omega, L_0)$ and $F_{L0}(\omega, L_0)$, in a frequency band between 10 kHz and 1 GHz. Each graph contains a dashed vertical line crossing the curve at the value of 0.9. The frequency identified by this vertical line indicates the limit above which the error introduced by propagation phenomena is larger than 10 %. Consequently, this vertical line defines the maximum usable frequency for the triaxial bench. Also, this example shows that the limit for near-end crosstalk voltage measurements is around 30 MHz, while such limit moves to around 200 MHz for far-end crosstalk voltage measurements.

These figures show that, in order to reach high frequencies, it is preferable to measure far-end crosstalk voltage.

In the following section, we will examine some triaxial bench adjustments generally adopted to reduce measurement inaccuracies or to improve sensitivity.

Various Triaxial Setup Configurations

Injected Current Measurement

Fig. 7 shows three different toroidal transformers configurations that are commonly adopted to measure the current I_{S0} injected into the shielded cable under test. A discussion of the advantages and drawbacks of every solution follows.

In layout (a), the current probe is placed on the conductor connecting the RF generator and the external pipe. With this configuration, the measured current I_M is given by the vector sum of the current I_{S0} circulating into the shield and a leakage current I_R, representing the external pipe radiation (the

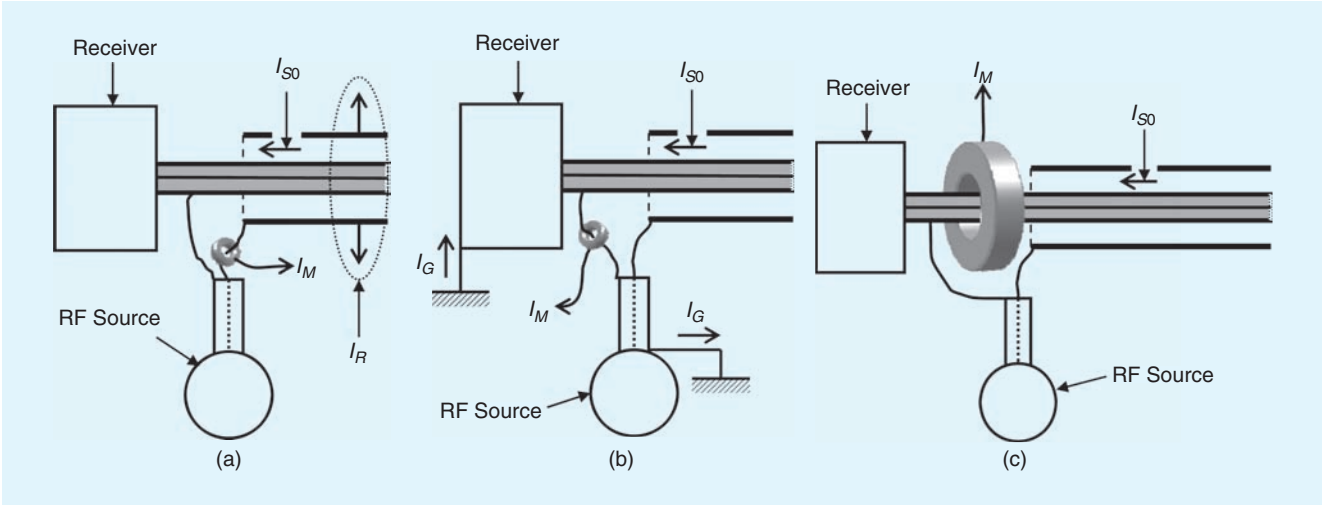

Fig. 7. Different configurations for the measurement of I_{S0}.

amplitude of I_R is generally lower than the current injected into the shield); in summary,

$$I_M = I_{S0} + I_R \tag{11}$$

The error introduced by this additional leakage current is often increasing at high frequencies or when resonances are happening on the pipe external conduit.

In layout **(b)**, the current transformer is placed on the conductor connecting the high-frequency ground connection of the source with the cable shield. With this second topology, the evaluated current is given by the sum of the current circulating into the shield and a leakage current I_G coming from the ground plane shared by the two connected instruments, that is:

$$I_M = I_{S0} + I_G \tag{12}$$

Generally, the current I_G has a lower amplitude than current I_{S0}, and their relative contribution depends on ground impedance circuits. For low frequencies under 10 kHz, the ground impedance is low, hence I_G contribution becomes significant. The effect of this phenomenon involves inaccurate determination of I_{S0}. For frequecies higher than 10 kHz, this error is negligible.

Layout **(c)** uses a toroidal transformer directly placed on the cable shield. Theoretically, only this configuration can give us the actual value of the current injected in the shield, i.e.

$$I_M = I_{S0} \tag{13}$$

Contrary to previous configurations, the installation of the transformer on the shield needs a more extensive magnetic circuit as regards to the probes previously used.

Voltage Measurement at the Termination of the Sample Under Test

In order to perform this measurement, several procedures are possible. The setup suggested in Fig. 4 does not allow for a great sensitivity; this configuration reduces the measurement amplitude dynamics below 100 $\mu\Omega$/m. The loss of sensitivity comes from the electromagnetic coupling between the external pipe and the receiver, as shown in Fig. 8. We may say that this

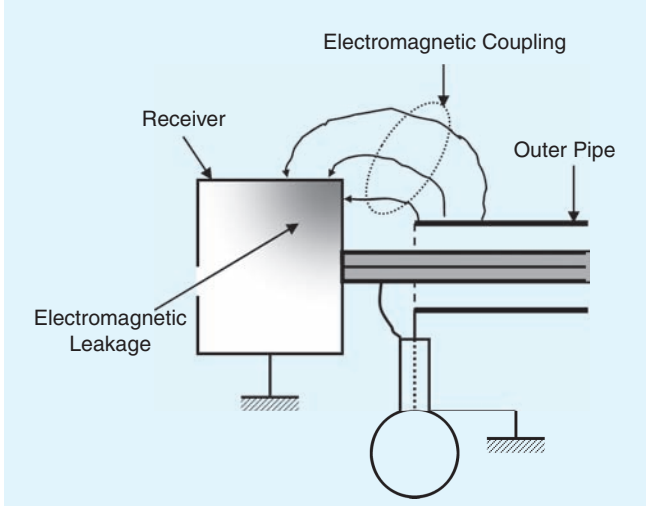

Fig. 8. Illustration of the undesirable coupling between the outer tube and the receiver.

parasitic coupling produces a current induction on the metallic structure of the receiver, whose electromagnetic radiation is captured by the internal circuits processing the low amplitude voltage detected on the test pipe termination. A second coupling path, not mentioned in the figure, comes from parasitic conduction on the receiver cables (e.g., the power cable or the multiwire bus linking the measurement unit with the monitoring computer). In order to reduce the effects of undesired electromagnetic coupling, the receiver must be protected by a shield connected according to the diagram in Fig. 9.

With this layout, the termination of the cable under test is connected to the receiver by means of a highly shielded connector placed on the metallic wall of the shielded cage. The transfer impedance must be weak enough to allow the residual voltage due to the ground current I_G to be much lower than the voltage that we intend to measure.

The power supply of the receiver placed in the cage can be battery-operated, or fed from mains through a lowpass filter placed outside the metal shield enclosing the measurement setup. Digital data transmission from/to computer and receiver need to be transferred via an optical fiber link. In order

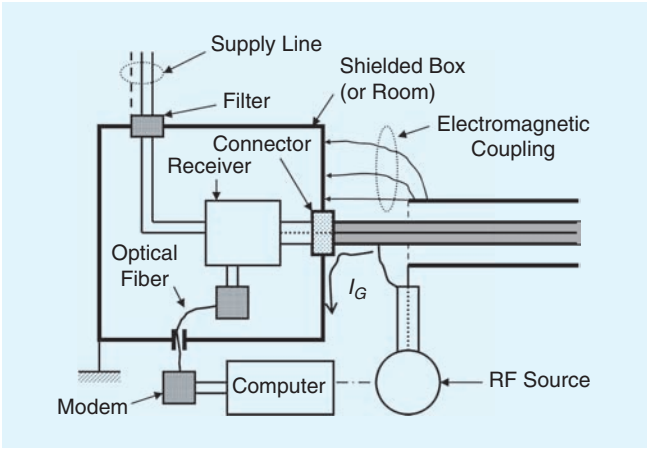

Fig. 9. Possible electromagnetic protections of the receiver.

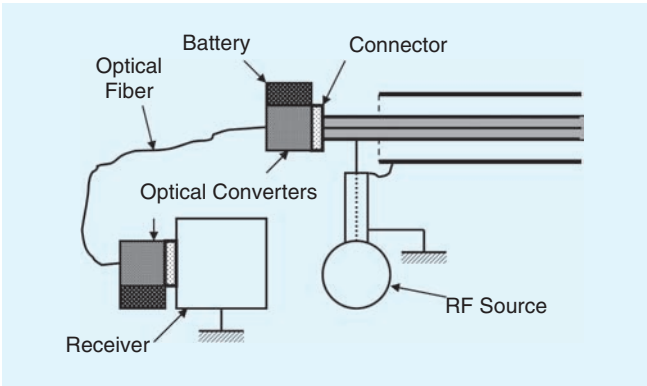

Fig. 10. Suppression of the parasitic electromagnetic coupling by the use of an optical transducer.

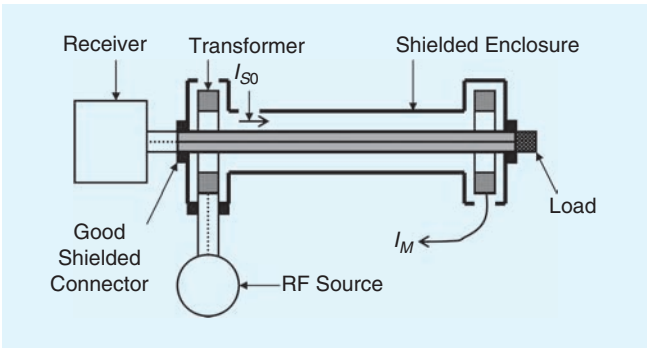

Fig. 11. Triaxial set up confined area by means of current transformers at both ends.

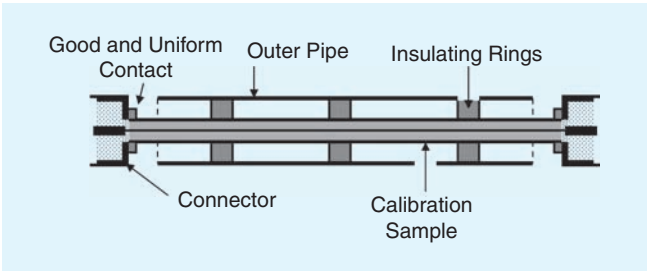

Fig. 12. Configuration used for the calibration of the triaxial setup.

to further improve measurement immunity, the voltage at the sample termination must be picked up when the current probe is disconnected from the Faraday cage. This precaution avoids a self-disturbance due to very low amplitude signals captured by the test tube.

Other solutions consist in bringing the external pipe to ground potential, in order to remove its own radiation. Fig. 10 shows a configuration where the contact points of the high-frequency source on the triaxial structure have been swapped. In this case, we avoid that the receiver ground network short circuits the source; the separation is done through an optical transducer, as shown in the figure.

To achieve the maximum electromagnetic immunity, transducers need to be equipped with autonomous power-supplies. Also, connectors with very low transfer impedance must be employed. After fulfillment of all these rules, triaxial setup sensitivity is only limited by the noise generated by the spectrum analyzer during signal amplification. This phenomenon can be reduced adopting a resolution bandwidth near or below 10 Hz.

With other topologies, we may reduce the external pipe radiation with an indirect current injection obtained by means of a magnetic coupler, which is a large-band high-frequency toroidal transformer. This device is shown in Fig. 11. With this configuration, the perturbing line must be short-circuited at both terminations; this function is accomplished by the external pipe. At the end of the perturbing line opposite to the emitting transformer, another transformer designed for the measurement of the induced current on the cable shield is located; hence $I_M = I_{S0}$.

The terminations of the cable under test are connected to the load impedance and to the receiver by highly shielded connectors. A narrow-bandwidth voltage amplifier inserted between the cable termination and the spectrum analyzer allows the transfer impedance evaluation with a sensitivity below the $\mu\Omega$/m (typically: $Z_t < 0.1\ \mu\Omega$/m). Contrary to the previously examined triaxial setup, the perturbing line of Fig.11, which ends with two short circuits, may enhance the influence of propagation phenomena and harm the measurements accuracy already above 10 MHz.

Transfer Impedance Measurement Setup and Calibration

The sample of the cable under test is centered in the external pipe by insulated spacers (see Fig. 12), and the external pipe diameter is set in order to have the perturbing line characteristic impedance ranging between 60 Ω and 40 Ω. The connections at the ends of the cable under test must make good contact with the outer side of the shield; a welded connection is recommended. The measurements quality highly depends on the care taken to mount the connectors.

The calibration of the transfer impedance measurement setup is performed by a test tube made up of a good conductor material (steel or copper). In fact, the advantage of having a homogeneus pipe reflects in an accurate prediction of the transfer impedance, whose expression is

$$Z_t = R_0 \frac{(1+j)\dfrac{E}{\delta}}{sh\left[(1+j)\dfrac{E}{\delta}\right]} \qquad (14)$$

where E is the pipe thickness, R_0 is the per unit length resistance and δ is the skin depth.

In the following numerical example, we study three different calibration samples with different thicknesses, in the frequency band between 10 kHz and 1 GHz, and with an amplitude dynamics from 10 mΩ/m to 0.01 $\mu\Omega$/m. Let us consider three samples with the same diameter $D = 12$ mm and thicknesses $E_1 = 0.5$ mm, $E_2 = 0.1$ mm, $E_3 = 0.05$ mm, made of copper (electrical conductivity $\sigma = 5.8 \cdot 10^7$ S/m). The plots of Fig. 13 show the transfer impedance frequency behavior of the three samples under consideration. The horizontal dotted lines indicate the sensitivity theresholds of the different measurements procedures: the line situated at 0.1 mΩ/m corresponds to the ordinary triaxial setup shown in Fig. 8; the line situated at 1.0 $\mu\Omega$/m shows the sensitivity of the sophisticated test benches shown in Figs 9, 10 and 11. Fig. 14 shows that the sensitivity threshold observed during calibration appears in the rising part of the characteristics.

The falling continuous line corresponds to the theoretical transfer impedance variation, as predicted by (14). The slope change starting at approximately 1.5 MHz is due to setup imperfections related to the transfer inductance of end connectors; the pure effect of this inductance is represented by the extrapolation shown by the oblique dotted line. According to this example, the parasitic transfer impedance is estimated to be $L_t \cong 0.2$ pH. Consequently, this imperfection limits the minimum measurable transfer impedance at $Z_{t\,min} \cong 2\ \mu\Omega$/m, and beyond this minimum, the sensitivity limit increases with frequency until it reaches 0.1 mΩ/m at 100 MHz. Above 100 MHz other limitations take over, due to amplitude variations generated by propagation mechanisms, as predicted by (9) and (10).

This example demonstrates that the realization of a sensitive measurement setup requires to mount high immunity connectors at the terminations.

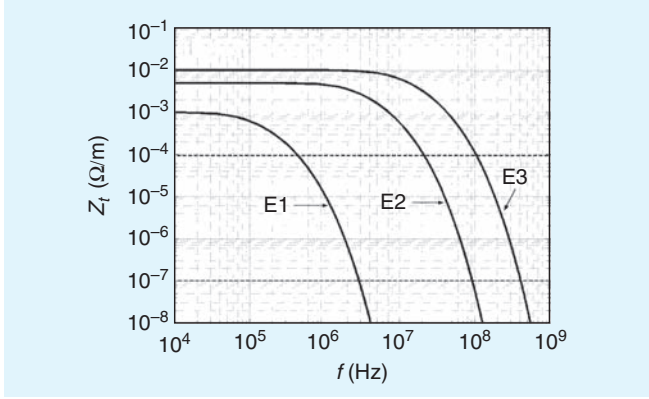

Fig. 13. Transfer impedance of the calibration sample as a function of frequency, for decreasing thicknesses E1, E2, E3 of the copper pipe.

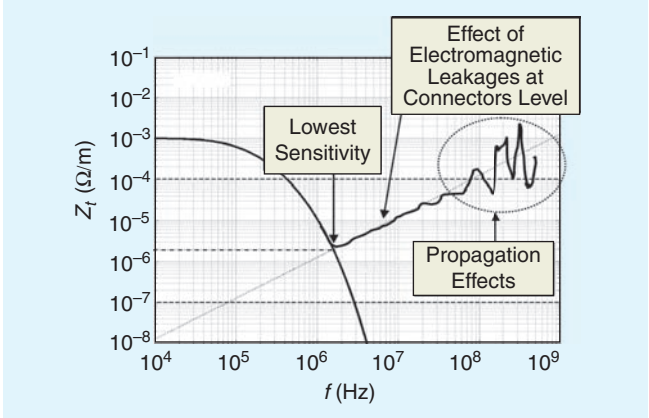

Fig. 14. Correlation of the transfer impedance curve for the calibration sample with the sensitivity threshold of measurements for the triaxial setup.

Examples of Transfer Impedance Measurements

Physical Illustration of Propagation Phenomena

The curves of Fig. 15 were obtained by means of the measurement procedure described in Fig. 10: the cable under test is a 10-m long braided coax of type KX-4, and the frequency range of the test is between 10 kHz and 100 MHz. This experiment has mainly an educational purpose, because it evidences the propagation phenomena expressed in (7) and (8), and the impact of the terms $F_0(\omega, L_0)$ and $F_{L0}(\omega, L_0)$ plotted in Figs. 5 and 6. From Fig. 15, we can observe that, below 1 MHz, the transfer impedance obtained as the ratio between voltage and current normalized by the length L_0 coincides with the transfer impedance of the cable. For the remainder of our reasoning, we assume that the transfer impedance of a braided cable [3] can be expressed as

$$Z_t = R_0 + j\omega L_t \qquad (15)$$

where R_0 is the per-unit-length resistance of the braiding and L_t is the transfer inductance, which comes from the magnetic coupling through the small apertures on the surface of the braided shield.

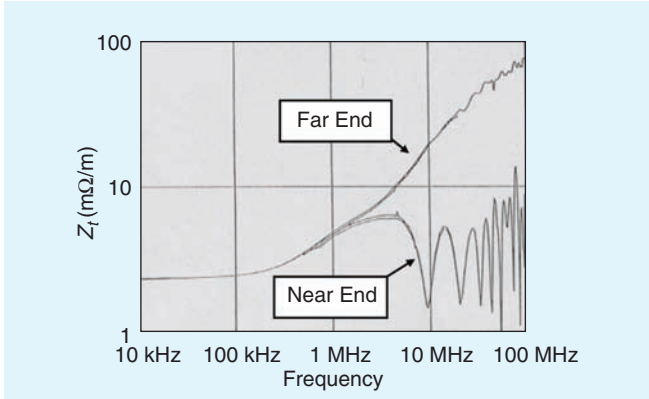

Fig. 15. Propagation phenomena affecting transfer impedance measurement in a 10-m long cable with single braid.

If we consider a measurement performed on a sample length on the order of 10 m, the influence of the propagation phenomena described by Figs. 5 and 6 should appear for frequencies in the vicinity of 2 MHz, if one measures the near-end voltage, and above 20 MHz for measurements of the far-end voltage. The experiment confirms very well the change of the behaviour vs frequency [4]; in fact, the curve produced by the near-end measurement shows a change of the slope above 2 MHz with alternate maxima and minima of the amplitude as predicted

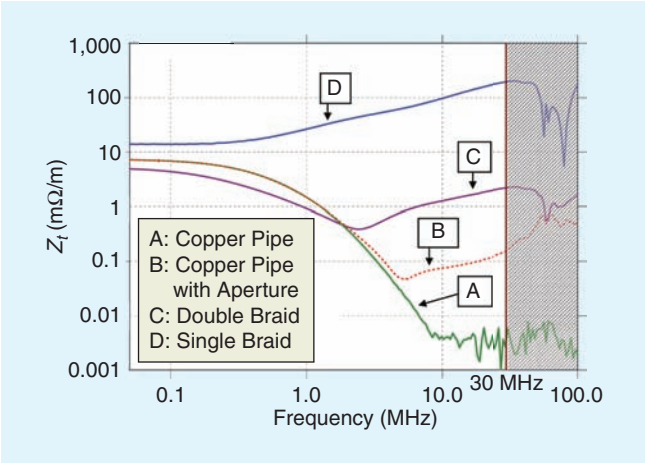

Fig. 16. Examples of transfer impedance measurements for cables A, B, C, D with different characteristics. The hatched area indicates the region influenced by propagation phenomena and by the noise level of the receiver.

by (9). According to the behaviour of the transfer function as predicted by eq. (15), the amplitude of maxima should be independent of frequency. In practice, the apparently random fluctuations of the level of maxima depends on the mismatch of the line injecting the current I_S in the shield. The mismatch is mainly due to parasitic inductance of the load and of the cable connecting the RF source to the injection line. As expected from (8) and (10), the use of far-end voltage seems more appropriate, since the slope of the curve remains unaltered up to 50 MHz.

Dynamic Range of Transfer Impedance

Fig. 16 collects four curves of transfer impedance of four cable samples with different physical structure. Measurements were done by means of a matched triaxial setup, according to the arrangement described in Fig. 9. The length of all cables under test was 1 m, hence the usable frequency range is below 30 MHz. Nevertheless, results are displayed up to 100 MHz, in order to point out the measurement artefacts due propagation effects. Hatching on the right-hand side of Fig. 16 indicates the unusable part of the graphs affected by propagation phenomena. The lowest frequency of measurement is located at 50 kHz, due to the current sensor low cut off. The dynamics of the vertical axis extends from 1 $\mu\Omega$/m to 1 Ω/m, i.e., 120 dB. The following subsections refer to each of the samples and provide a physical interpretation of the respective transfer impedance curves.

Sample A

This sample is a coaxial cable with a solid tubular copper shield with a diameter of 3.6 mm and a thickness of 250 μm. The transfer impedance model of (14) applies to this cable, and the the down trend of the curve reveals the contribution of skin effect behaviour predicted by Schelkunoff [5]. The lowest frequency (50 kHz) of the measurement is such that the penetration depth of the electric field is larger than the shield thickness, which determines a per-unit-length resistance of the shield approximately equal to 7 mΩ/m. From 200 kHz, the transfer impedance starts lowering down to a minimum value of 3 $\mu\Omega$/m at 8 MHz. We can conclude that the previous value represents the minimum sensitivity of the measurement setup, determined by the noise floor of the receiver, which in this case was a spectrum analyser.

Sample B

Sample B is identical to A, except that the operator has purposedly reduced the torque on the SMA connector at the terminations of the sample itself. This anomaly produces an increase of the transfer impedance, visible above the frequency of 2 MHz. In fact, the consequence of the torque reduction is a leakage of magnetic flux, as illustrated by Fig. 14.

Sample C

The cable under test in this case is the type RG214 with a shield made of two tinned copper braids in uniform contact along their length [6]. The increase of the shield cross-section results in a reduction of the per-unit-length resistance; moreover, the juxtaposition of the two braids produces a reduction of the total transfer inductance due to magnetic leakage through a large amount of uniformly distributed small apertures appearing at crossing points of the woven wires. The reason of decreasing values of the transfer impedance up a frequency of 3 MHz is then similar to the case of a homogeneous tubular shield. However, the change of slope of the curve above 3 MHz indicates that magnetic leakage becomes predominant. Between 30 and 100 MHz, the curve fluctuations must be related to propagation phenomena. A measurement of the far-end voltage allows us to move the upper frequency to 100 MHz.

Sample D

This sample is made by a coaxial cable with a simple braided shield, of type KX15 (RG58). The measurement shows a behaviour very similar to the model of (15). However, a careful look at the transfer impedance curve in the frequency range between 300 kHz and 10 MHz shows that the increase is proportional to the square root of the frequency, which is in contrast to the linear prediction of (15). This behaviour finds an explanation in electromagnetic coupling phenomena, as illustrated by previous work [7], [8]. Above 10 MHz, the curve changes again its shape, and tends to a linear behaviour, but—contrary to the result of (15)—implies a minus sign for the transfer inductance [9]. The choice of a negative sign is implied by the orientation of the magnetic leakage flux penetrating in the cable and depending on the braid pitch angle. It ought to be remarked that such behaviour is specially related to pitch angles lower than 30 deg, while in the other cases the transfer impedance follows rigorously the model of (15) with a positive transfer inductance.

Conclusion

Contrary to other measurements of electromagnetic compatibility, the determination of the transfer impedance of shielded cables and connectors provides in general a relative accuracy lower than 20%. This is certainly due to a calibration process using a sample made of a solid homogeneous tubular shield. In fact, the transfer impedance of a copper pipe monotonically decreases with frequency, and it is well adapted to detect the weaknesses of the measurement chain. The coupling region between the setup and the high-sensitivity receiver needed to

measure the voltage at the sample terminations is very often responsible for such weaknesses. On the other hand, the measurement reproducibility is independent both of the setup arrangement and of the acquisition chain, since the care in samples preparation and the operator skill play a significant role. Evidently, the practical manner by which terminal connectors carrying low-level signals are mounted on the sample, makes the difference. Hence, a good practice is to repeat the measurement for several installations of the sample in the setup, in order to appreciate the level of uncertainty.

As described in the fifth Section, propagation phenomena produce a systematic uncertainty, appearing when the dimension of the sample under test with respect to wavelength exceeds 10%. Using the far-end voltage measurement allows to shift this limitation by approximately a decade in frequency, i.e., towards an almost unitary ratio between the sample dimension and wavelength. However, only very specialized test setups allow to reduce more effectively the propagation effects.

It ought to be mentioned that the description of bench setup for the transfer impedance measurements is the object of an international standard released by IEC [10]. Moreover, the present article only mentions the measurement technique based on the injection of a sinusoidal current. Impulsive currents can also be adopted, with the advantage of a faster interpretation of results; in addition, by means of the Fourier Transform technique, the transfer impedance phase is readily extracted [7].

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Biographies

Bernard Démoulin *was born in 1946. He received his Ph.D in 1981 and until 2008, was head of the EMC group at the IEMN-TELICE Laboratory. He is presently professor emeritus at the University of Lille, France. His domain of expertise is mainly related to the effect of electromagnetic coupling through cables, transfer impedance measurement and the study of Mode Stirred Reverberation Chambers. He is a senior member of the French society of electrical engineers (SEE) and an URSI correspondent member.*

Lamine Koné *was born in 1956, he received his Ph.D degree in 1989. Since 1990, he has been working as engineer in the IEMN-TELICE laboratory at the University of Lille, France. His domain of expertise deals with EMC measurements, especially concerning the transfer impedance on shielded cables or connectors and tests carried out in mode-stirred reverberation chambers.*

EMI Failure Analysis Techniques: III. Correlation Analysis

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Introduction

Locating the emission source can be the most challenging part in EMI failure analysis. In the second article [1], a measurement sequence for source identification in complex systems was recommended. A variety of methods can be used to find the correlation between the far-field and a near-field signal. The correlation can be a similarity either in frequency spectrum or in time domain, or in joint time-frequency spectrogram. When multiple near-field sources potentially cause the emission at the same frequency and the near-field spectra cannot be visually correlated to far-field sideband signature, a mathematical correlation analysis can be performed [2]. Some commercial systems are also available [3][4]. The correlation analysis is an advanced measurement and data analysis method, which requires complex hardware for multi-channel time-synchronized measurement and extensive post-processing of measured data. Therefore it is not meant to provide immediate result for quick EMI troubleshooting.

Mathematical Correlation Methods

The EUT used in this article to illustrate the methodology had broadband emission centered at 667 MHz (also discussed in Zero Span Measurement in [5]). This radiated emission frequency is one of harmonics of the clock and data signals. It is generated from several ICs and modules. Several suspected EMI sources and their coupling paths were located, e.g., ICs with a heat sink, high speed signal cable bundles and a USB connector.

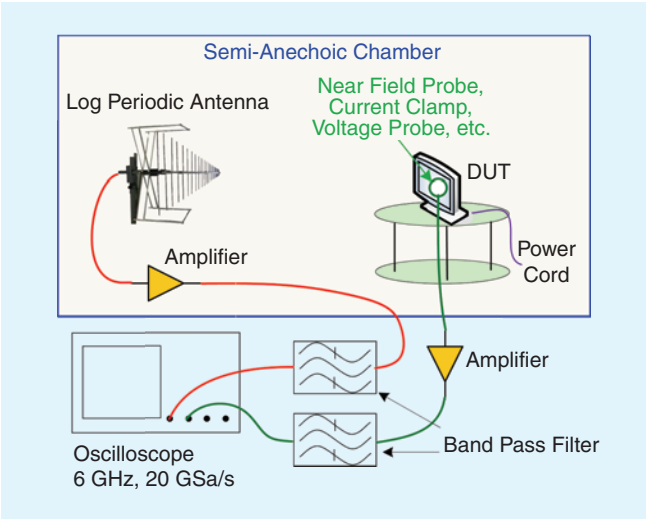

Fig. 1. Time-synchronized measurement of far-field and near-field for correlation analysis.

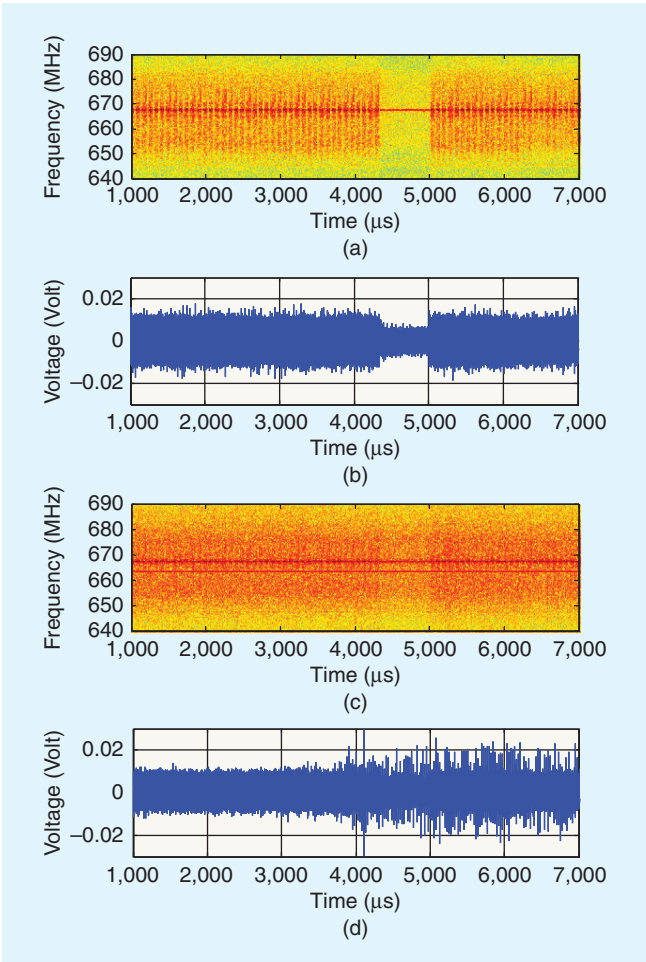

Fig. 2. STFFT spectrograms (1st and 3rd plots) and time domain waveforms (2nd and 4th plots) of near-field and far-field signals.

The correlation analysis requires time-synchronized measurement of the far-field and near-field signals. This can usually be implemented using multi-channels on an oscilloscope, as shown in Figure 1. The use of band pass filters is advised to attenuate signals that are not of interest and to achieve a better signal to noise ratio.

Depending on the local quantity, a variety of test accessories can be used. E-field or H-field probes are for measuring near field, current clamps for common mode current on cables, oscilloscope voltage probes for direct voltage measurement at a port defined between "grounds" or metal parts.

Listed in Table 1, there are several correlation analysis methods that have been in practice in our EMC lab. Some of them are introduced in this article.

STFFT Correlation

As introduced in the second article [1], the STFFT displays the spectral content of a signal in time domain. The correlation between the STFFT spectrograms of the near-field and far-field signal is a good indication of the likeliness of a near-field signal to be the EMI source. The STFFT result of a near-field signal and the far-field is shown in Figure 2. The near-field signal was the output from a current clamp around the high speed signal cable. The first and second plot show that the near-field signal is amplitude modulated by pulses of different width. Its spectrum is symmetrical. The far-field signal in the third and fourth plots is very noisy. It is a combination of three signals: an amplitude modulated signal similar to the near-field signal, a clock signal at 663.5 MHz, and a noise-resembling signal with a wide spread spectrum. There is a noticeable dropout of the near-field signal in the time waveform between 4300~5000 μs. However, the corresponding dropout in the far-field signal is overwhelmed by other signals and can barely be seen. The STFFT analysis indicates the measured near-field signal constitutes only a small fraction of the total radiated emission centered at 667 MHz. The correlation between this near-field signal and the far-field signal is weak. Other analysis techniques will be used to identify the correlation to this complicated far-field signal.

Envelope Correlation

As it has already been seen, amplitude modulated signals are very common in EMI problems. The envelope of the time domain amplitude is an important attribute of the amplitude modulated signals. Here the envelope is defined on a specified carrier frequency. It's the spectrum amplitude at that frequency versus time. After capturing the time domain data, their envelopes need to be determined. One way to do so is to extract the envelope from the amplitude data of the STFFT spectrogram at the carrier frequency, i.e., to plot one row of data in the STFFT spectrogram. This can also be achieved by using zero span measurement on a spectrum analyzer. However, if the envelope changes randomly, time-synchronized measurement of two channels is necessary, which cannot be done on most spectrum analyzers.

Cross-correlation function can be used to compare the envelopes of two signals. The cross-correlation of two discrete signal sequences is defined as:

$$R_{xy}(m) = E\{x_{n+m}\, y_n^*\} = E\{x_n\, y_{n-m}^*\} \qquad (1)$$

where x and y are jointly stationary random processes and $E\{\}$ is the expected value operator. R_{xy} is zero when x and y are uncorrelated. If the two processes are correlated, R_{xy} will reach its maximum when m is equal to the time difference between

TABLE 1. OVERVIEW OF THE CORRELATION METHODS.

Correlation Method	Brief description
short-term Fast Fourier Transform (STFFT)	Correlate the time changes of the spectral composition.
Direct correlation	Determine the correlation coefficient between two time vectors.
Envelope correlation	Determine the signal's envelope first and then analyze the correlation between the time changing envelopes.
Amplitude density distribution	Compare the amplitude density distribution of near-field and far-field signals.
Sideband analysis	Compare phase noise or sideband of signals in the near-field to the far-field signal.
Timing analysis	Compare the timing of events in the near-field to timing observed in the far-field signal.

the two processes. In practice, only a finite segment of the infinite long random process is available. The cross-correlation [6] of two discrete signal segments, x and y, each with a length of N is defined as:

$$\hat{R}_{xy}(m) = \begin{cases} \sum_{n=0}^{N-m-1} x_{n+m} y_n^* & 0 \le m \le N-1 \\ \hat{R}_{xy}^*(-m) & 1-N \le m < 0 \end{cases} \quad (2)$$

Extract the envelopes at 667 MHz from the far-field and a near-field signal, as shown in Figure 3. They are both amplitude modulated by periodical signals. The correlation function in the bottom plot indicates that the two envelopes have the same periodicity of about 15 µs. This confirms that this near-field signal and the far-field signal are amplitude modulated by one same signal.

Time synchronization gives timing information between signals. In this case, although the cross-correlation appears to be periodic, the offset of the peak position from zero shows the lead or lag of one signal to the other. This can help find the most relevant near-field signal among others, as demonstrated in Direct Correlation.

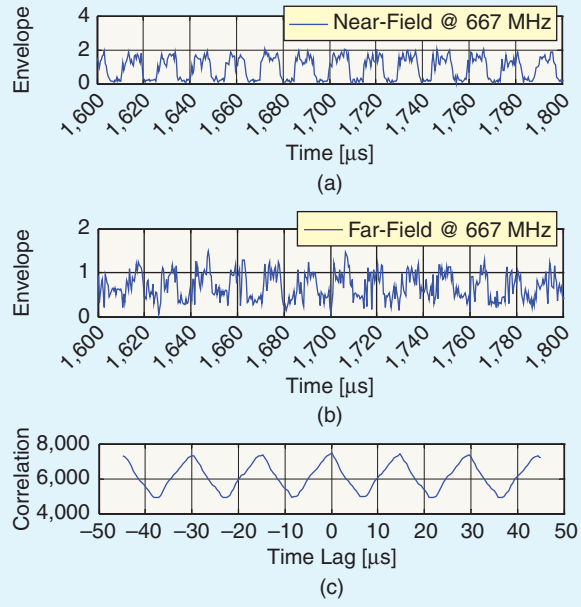

Fig. 3. Envelope at 667 MHz of a near-field signal (top) and the far-field (middle). Bottom: the cross-correlation of these two signals.

Coherence Factor

A more direct way to find the relation between two signals is to calculate the coherence factor of their frequency spectra. The coherence factor [7] is defined as:

$$C_{xy}(f) = \frac{|P_{xy}(f)|}{\sqrt{P_{xx}(f)P_{yy}(f)}} \quad (3)$$

where P_{xy} is the cross power spectral density of sequences x and y; P_{xx} and P_{yy} are the power spectral density of sequence x and y respectively. Coherence factor is a function of frequency, with a value between 0 and 1. If two signals are linearly related, the coherence factor will be "1" at any frequency. A coherence factor of "0" indicates that two signals are not related at that frequency.

The result of coherence factor analysis is shown in Figure 4. The Y axis is in log scale. Because band-pass filters centered at 667 MHz were used in these measurements, the peaks outside the pass-band are a result of random noise. A fairly strong coherence can be observed in the narrow frequency band around 667 MHz. While a quantitative threshold for determining coherence is difficult to define, a coherence factor between 0.8 and 1 usually indicates a good correlation. But more important is the relative value between near-field data measured at different locations of suspected EMI sources. The coherence factor can be used to determine which near-field signal best correlates to the far-field signal.

Direct Correlation

Direct correlation is to do a cross-correlation calculation between two time-synchronized waveforms. Figure 5 shows the

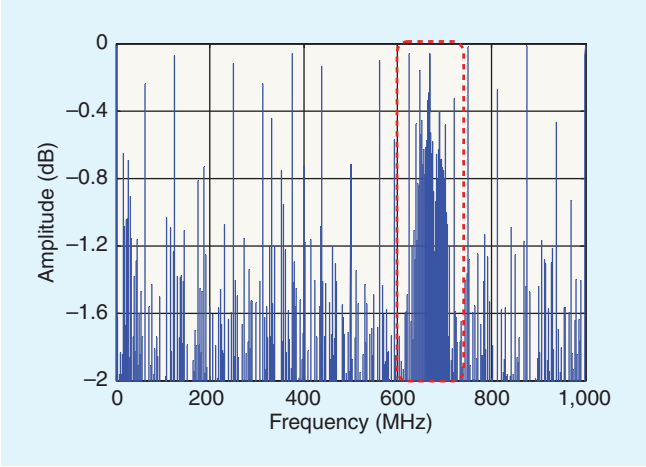

Fig. 4. Coherence factor between a near-field signal and the far-field signal.

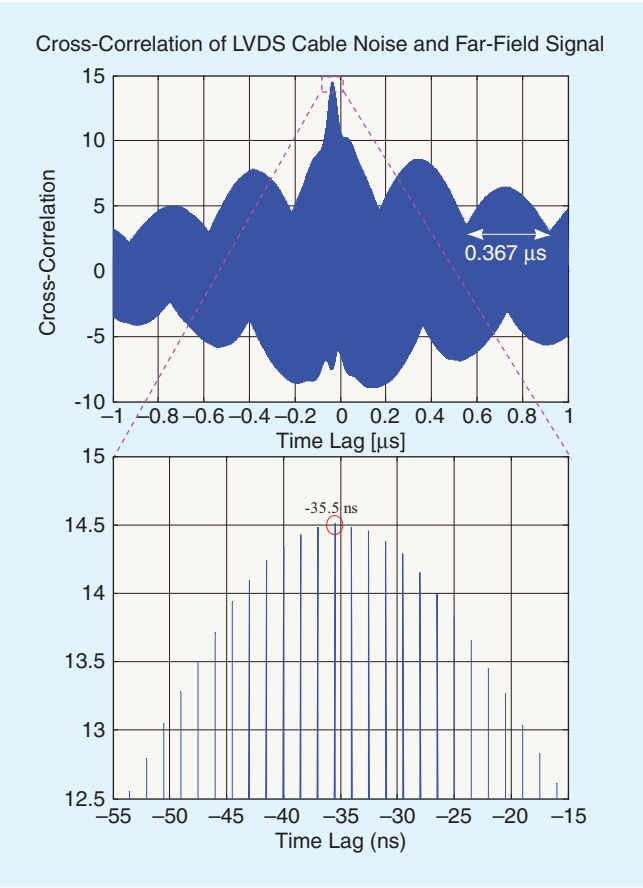

Fig. 5. Direct correlation of a near-field signal and the far-field.

direct correlation between a near-field signal and the far-field. The maximum peak is at −35.5 ns, which suggests the near-field leads 35.5 ns to the far-field. The delay is caused by different signal paths of the near and far-field measurement, which include cables, distance to antenna, and devices such as filters and amplifiers. In the case where several near-field signals are found to be correlated to the far-field, the signal which precedes all others in time has the best chance to be the EMI source.

The separation between the peaks in the bottom plot of Figure 5 is about 15 ns, corresponding to the main signal at

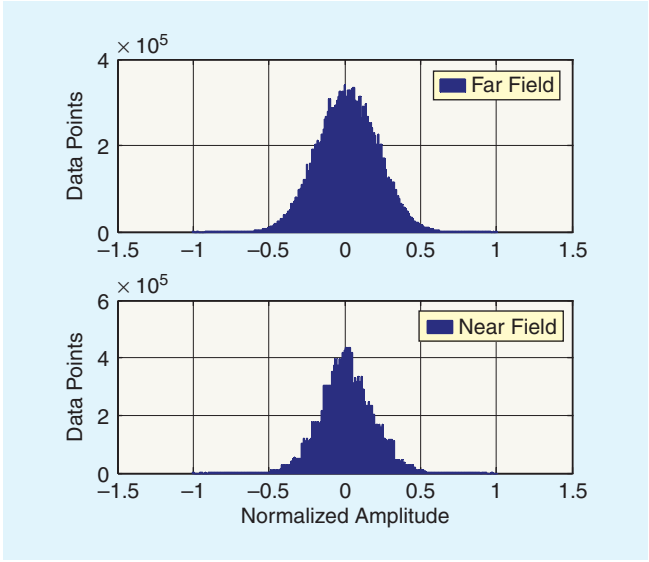

Fig. 6. Comparing the amplitude density distribution of far-field and a near-field signal. Both have Gaussian-shaped distributions.

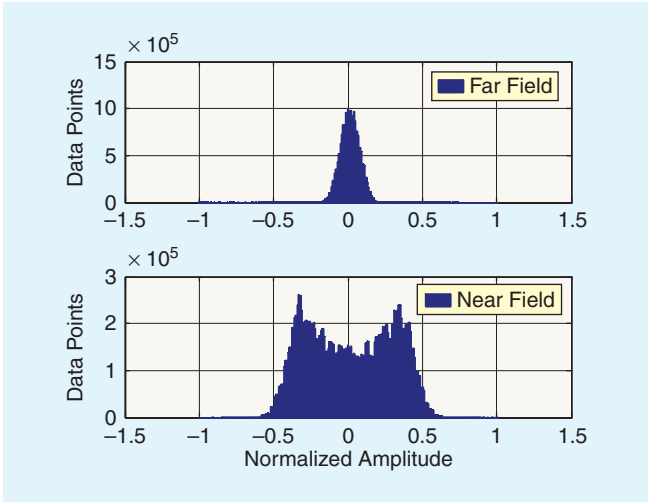

Fig. 7. Amplitude density distribution of the far-field and from a signal captured by current clamp.

667 MHz in both near and far-field. The envelope of the cross-correlation also has a repetition of 0.367 µs, corresponding to the 2.7 MHz amplitude modulating signal in both near and far-field. In summary, the direct cross-correlation of two time domain waveforms effectively reveals the delay and periodicity information of two correlated signals.

Amplitude Density Distribution

The amplitude density distribution shows the probability for the amplitude of a time domain waveform to occur at a certain value. In general, two well correlated signals should have the similar amplitude density distribution. Exceptions to this can occur in non-linear systems, where the input and output signals can have similar spectral information, but totally different amplitude distributions. Further, one cannot remind often enough that correlation is not a measure for causality. Two similar amplitude distributions do not necessarily mean two

signals are well correlated. It requires further information to show causality. In our experience the amplitude density distribution turns out to be useful for excluding causality.

The amplitude distribution comparison between the far-field signal and a near-field signal in Figure 6 shows a good similarity. Both are somewhat Gaussian-shaped. Of course, it should be ensured that the time domain data has sufficiently good signal to noise ratio. Otherwise the amplitude density distribution of the noise, which is also Gaussian-shaped, would dominate.

In another case presented in Figure 7, the amplitude density distribution of a near-field signal is very different to that of the far-field signal. This indicates that the emission from this source contributes very little, if any, to the far-field.

Conclusion

Correlation analysis is an important step in the recommended measurement sequence [1] for EMI source identification. It helps determine the inter-relation between multiple near-field signals and the far-field signal. This paper introduced five essential mathematical correlation analysis techniques for identifying EMI source and coupling path. When applicable, multiple correlation techniques should be used to reveal more information of the correlation between the signals.

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Biographies

Weifeng Pan *is currently an EMC design engineer at Google Inc., in Mountain View, California. He received the PhD degree in 2009 from the Electromagnetic Compatibility Lab at the Missouri University of Science and Technology. In 2008, he was an intern at IBM, Research Triangle Park, North Carolina. He worked as an RF design engineer at UTStarcom (China) from 2002 to 2005. He received the BSEE degree in 1999 and the MSEE degree in 2002 from Tsinghua University, in Beijing, China. His interests include electromagnetics, EMC and signal integrity.*

David Pommerenke *received the Ph.D. degree from the Technical University Berlin, Germany in 1996. After working at Hewlett Packard for five years, he joined the Electromagnetic Compatibility Lab at the University of Missouri-Rolla (now Missouri S&T) in 2001 where he is currently a tenured professor. He has published more than 100 papers and is an inventor on nine patents. In addition to other professional activities, he is the US representative of the ESD standard working group within the IEC TC77b. He is a past Distinguished Lecturer for the IEEE EMC Society (2006–2007). His research interests include system level ESD, numerical simulations, EMC measurement methods, and instrumentations.* **EMC**

CALL FOR PAPERS

IEEE Transactions on Electromagnetic Compatibility

Special Issue on

Applications of Nanotechnology in Electromagnetic Compatibility (nano-EMC)

PAPERS DUE: May 1, 2011

In the past few years, there has been an exploding interest in nanoscale science and technology. Nanotechnology is functional engineering on an extremely small scale that can be used to develop innovative materials and devices, and implants for numerous industrial applications. It involves the control of materials with a nanoscale fine structure, and with the manipulation of tiny objects at the dimension of molecules and atoms. The potential benefits of nanotechnology are revolutionary. Nanotechnology is truly multidisciplinary: research at the nanoscale frontier is unified by the need to share knowledge, tools and techniques, and expertise on atomic and molecular interactions. Nanotechnology is currently exploited in electronics, optoelectronics, photonics, sensors, material science, medicine and biology, but its application in EMC is still not very wide.

This Special Issue is intended to present recent research advances in nanoscale science and nanotechnology with applications of interest for the EMC community. The Special Issue is aimed to bridge the gap between nanoscale science and technology and EMC; to present new materials, devices and processes for EMC applications exploiting the powerful of nanotechnology; to investigate EMC issues related to the integration of nanocomponents in micro and macro electrical and electronic systems.

Suggested topics to be covered in this Issue include:

- Electromagnetic modeling and characterization of nanostructured materials, devices and systems for EMC;
- Nanostructured materials for EMC applications, like EM shielding, EM energy absorption, antistatics, surge suppression and protection, novel devices;
- Electrical and EM properties of nanocomposites for EMC;
- Nanointerconnects for next generation ICs;
- Signal integrity in nanocomponents and nanodevices;
- Nanostructured sensors for EMC;
- MEMS-based technology for smart antennas arrays and frequency-selective surfaces for EMC;
- Nanometrology for EMC.

Please submit your manuscript on-line to the IEEE TEMC Manuscript Central at the web site http://mc.manuscriptcentral.com\tems-ieee, making it clear that it is for this Special Issue, before **May 1, 2011**. All manuscripts should conform to IEEE Transactions on EMC Guidelines (see "Information for Authors"). Papers should not exceed 8 pages in length, due to editorial limitations. The publication of the Special Issue is scheduled for **November 2011**.

Guest Editors:

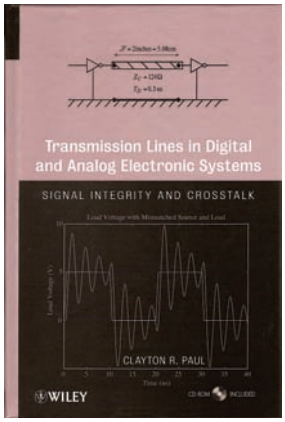
M. D'Amore, Research Center on Nanotechnology Applied to Engineering, Sapienza University of Rome, Rome, Italy (marcello.damore@uniroma1.it) – **M. S. Sarto,** Research Center on Nanotechnology Applied to Engineering, Sapienza University of Rome, Rome, Italy (mariasabrina.sarto@uniroma1.it) - **G. W. Hanson,** College of Engineering and Applied Science, Department of Electrical Engineering and Computer Science, the University of Wisconsin, Milwaukee, USA (george@uwm.edu) - **A. Naeemi,** Microelectronics Research Center, School of Electrical and Computer Engineering, Georgia Institute of Technology, Atlanta, Georgia, USA (azad@ece.gatech.edu) – **T. B. Kang,** Nanyang Technological University Singapore, School of Electrical & Electronic Engineering, Singapore (ebktay@ntu.edu.sg).

Book Review

Antonio Orlandi, Associate Editor

Title: Transmission Lines in Digital and Analog Electronic Systems—Signal Integrity and Crosstalk
Author: Clayton R. Paul
Publisher: John Wiley, 2010
ISBN: 978-0-470-59230-4

Today, clock and data speeds have moved into the gigahertz range. As the demand for faster data processing continues to escalate, these speeds will no doubt continue to increase. In addition, analog communication frequencies have also moved steadily into the gigahertz range. Although the physical dimensions of the signal's interconnection and the PCBs supporting them have not changed significantly over these intervening years, the spectral content of the signals they carry has increased. Because of this, the electrical dimensions (in wavelengths) of the interconnections have a significant effect on the signals they are carrying; thus, getting the systems to work properly has become a major design problem. As many of us know very well, this scenario has generated a new design problem, referred to as Signal Integrity (SI). Good signal integrity means that the interconnect conductors should not adversely affect the operation of the modules that the conductors interconnect and most interconnect conductors must now be treated as distributed-circuit transmission lines.



This very new book of Professor Clayton R. Paul is intended as a textbook for a senior/first-year graduate-level course on transmission lines in electrical engineering (EE) and computer engineering (CpE) curricula. It is, in my opinion, also essential for industry professionals as a compact review of transmission-line fundamentals that is very well oriented and focused on the SI world.

The book has six chapters, divided in two main parts, plus one appendix for a total of 298 pages. A CD is included with the book and contains:

- Several computer programs described and used in the book for computing the per-unit-length parameter matrices
- A computer program for the automatic generation of sub circuit models for three-conductor lines
- Two MATLAB programs for computing the Fourier components of a digital waveform
- Two versions of PSPICE

Part I contains two chapters covering two-conductor transmission lines and designing for signal integrity. Chapter 1 gives the fundamental concepts of waves, wavelength, time delay, and electrical dimensions. In addition, the bandwidth of digital signals and its relation to pulse rise and fall times is discussed. A preliminary overview of the electromagnetic phenomena associated with signal integrity and crosstalk is also given.

Chapter 2 covers the time-domain analysis of those transmission lines. The transmission-line equations are derived and solved, and the important concept of characteristic impedance is covered. The important per-unit-length parameters of inductance and capacitance that distinguish one line from another are obtained for typical lines. The terminal voltages and currents of lines with various source waveforms and resistive terminations are computed by hand via wave tracing. This gives considerable insight into the general behavior of transmission lines in terms of forward- and backward-traveling waves and their reflections. The SPICE computer program and its personal computer version, PSPICE, contain an exact model for a two-conductor lossless line and are discussed as a computational aid in solving for transmission-line terminal voltages and currents. SPICE is an important computational tool since it provides a determination of the terminal voltages and currents for practical linear and nonlinear terminations such as CMOS and bipolar devices, for which hand analysis is very formidable. Matching schemes for achieving signal integrity are covered, as are the effects of line discontinuities.

Chapter 3 covers the corresponding analysis in the frequency domain. The important analog concepts of input impedance to the line, VSWR and the Smith chart (which provides considerable insight), are also discussed. The effect of line losses, including skin effect in the line conductors and dielectric losses in the surrounding dielectric, are addressed in this chapter. They are becoming increasingly critical and their detrimental effects are discussed.

Part II repeats these topics for three-conductor lines in terms of the crosstalk between transmission lines. In Chapter 4, the transmission-line equations for three conductor lossless lines are derived, and the important per-unit-length matrices of the inductance and capacitance of the lines are reviewed. Numerical methods for computing the per-unit-length parameter matrices of inductance and capacitance are studied, and computer programs are given that compute these numerically for ribbon cables and various structures commonly found on PCBs. Chapter 5 covers the solution of three-conductor lossless lines via mode decoupling. A SPICE sub circuit model is determined via this decoupling and implemented in the computer program SPICEMTL.EXE offered in the CD. This program performs the tedious diagonalization of the per-unit-length parameter matrices and gives as output a SPICE sub circuit for modeling lossless coupled lines. As in the case of two-conductor lines, this allows the study of line responses not only for resistive loads but, more importantly for SI purposes, nonlinear and/or reactive loads such as CMOS and bipolar devices that are common line terminations in today's digital systems. How to incorporate the frequency-dependent losses of the line conductors and the surrounding dielectric into a solution for the crosstalk voltages is discussed in Chapter 6. The frequency-domain solution of the MTL equations is again given in terms of similarity transformations in the frequency domain. The time-domain solution for the crosstalk voltages is obtained in terms of the frequency-domain transfer function, which is obtained by superimposing the responses to the Fourier components of Vs(t).

The appendix gives a brief tutorial of SPICE (PSPICE), which is used extensively throughout the book.

In conclusion, I wish to quote the author, Professor Paul: "It does little good to write sophisticated software if the hardware is unable to process the instructions." This technological problem will increase as the speeds and frequencies of the digital and analog systems continue to increase, seemingly without limit. This book is a significant contribution to correct that basic deficiency. **EMC**

WANTED: EMC Books to Review!

Dear IEEE EMC Society Members,

The "Book Review" columns that are published in the EMC Newsletter are a great treasure for all of us. They give us the possibility to be informed of the existence and contents of published books that are of interest in the wide range of topics covered by our common technical and scientific interest: Electromagnetic Compatibility.

The large number of books published on EMC related topics per year makes it impossible for a mortal Associate Editor to be acquainted with all of them. Because of this, I wish to ask you for your help.

Please contact me if you:

- Have read a technical book that you consider worthy to be shared with members of our community
- Have noticed a book that could be of interest to the IEEE EMC Society members
- Are an author of a technical book on EMC related issues

Please indicate the author(s), the book title, the publisher, the ISBN and a brief description and/or your comments on why you feel the book should be considered for review in the EMC Newsletter.

This will help me very much in considering books for review and hopefully increase the number of book reviews made available to our community.

Thank you in advance for your help and time!

Antonio Orlandi
Book Review Associate Editor
antonio.orlandi@univaq.it

Our Four New Distinguished Lecturers for 2011

Bruce Archambeault, Ph.D., IEEE Fellow
EMC Society Distinguished Lecturer Chair

Professor Chuck Bunting, Jerry Meyerhoff, Professor Wen-Yan Yin, and Jerry Ramie will begin their two-year terms as the newest Distinguished Lecturers (DLs) of the IEEE EMC Society on 1 January 2011. They replace Professor Ji Chen, Dr. Sergiu Radu, and Professor Joungho Kim whose terms expired at the end of 2010 after many successful presentations to local chapters around the globe. Our other three DLs, Professor Giulio Antonini, Mark Steffka and Professor Omar Ramahi continue their terms through December of 2011.

Before introducing the newest DLs, I want to acknowledge the contributions of Ji, Sergiu and Joungho over the past two years. During their respective terms, they volunteered to spend many days away from home, family, familiar food, and familiar people. They traveled by airplane, by car, and by bus in order to give presentations in the Unites States, the Americas, Asia and Europe. Our Society's local chapter meetings have benefited from the in-person contributions of these bright and learned volunteers. For those of you who have attended one of their presentations, I am sure you know what a very fun and educational experience these folks provide. Please join me in thanking our retiring DLs, and welcoming our new expert speakers.

If you haven't seen a DL at your chapter meeting, you are really missing one of the most popular benefits that our Society offers. I am certain that this year's new speakers will continue the DL tradition of offering excellent technical education, advice, and entertainment. Chapter Chairs can request any of the Distinguished Lecturer's to come to their local chapter meeting. Once the schedule details are agreed to by both parties, the EMC Society pays for the travel costs, so the local chapter gets expert speakers, on a wide range of topics, at no cost to the local chapter!

Following are our new Distinguished Lecturers for 2011–2012. Please feel free to contact them directly by phone or email to discuss hosting them at your next chapter meeting, university class, or other special event. You can find contact information for each speaker under the Distinguished Lecturer section of the EMC Society web site (www.emcs.org).

Chuck Bunting is a Professor at the Oklahoma State University in Stillwater, OK. He is well known as an expert in computational EMC and Reverberation Chambers and has many publications in the area of EMC.

Chuck's topics will be:

1) **Overview of Numerical Methods for Electromagnetic Compatibility**
This talk provides an overview to many of the commonly used numerical EMC modeling techniques. It is intended to provide EMC engineers who are interested in learning the basics of these modeling techniques a fundamental understanding of all the different techniques, with plenty of applications to EMC problems.

2) **Why Use Reverberation Chambers for Radiated Emissions?**
Unlike a semi-anechoic chamber, a reverberation chamber provides a test electromagnetic environment, as a superposition of plane waves with random phase, resulting from repeated reflections from conducting surfaces intentionally formed to create a complex environment. The statistical isotropy, random polarization, and uniform electromagnetic environment of a reverberation chamber permit a robust, all aspect angle test without the requirement for rotation or translation of the equipment-under-test. This talk will discuss the potential benefits of EMC testing in a reverberation chamber.

3) **Reverberation Chamber Theory/Statistical Overview**
To understand the application of reverberation chambers, EMC engineers must delve into the scary world of statistics and applied random variables. This talk provides a discussion of the statistical electromagnetic environment in a reverberation chamber and the method by which the equipment under test can be tested to a given peak (or average) component (or total) field (or power) level with a definable uncertainty.

Jerry Meyerhoff is currently the Principal of JDM LABS LLC, a consultancy assisting clients to optimize designs for Electromagnetic Compatibility (EMC).

Previously Jerry was a Distinguished Member of the Technical Staff of Continental Automotive Systems, Deer Park, Illinois as a result of the acquisition of the former Motorola Automotive Group in 2006. He acted as a group-wide consultant in EMC design, serving multiple projects technologies and customers.

Jerry's topics include:

1) **What's the Resonant Frequency of a Truck?**
When an automotive electronic control module shows narrowband susceptibility, what is the cause and what can be done about it? The truck cab structure is analyzed using NEC-MoM on a simplified wireframe model.
2) **Issues in CISPR 25 Radiated Emissions Setups**
Why do many different electronic control modules show excessive emissions in the same repeatable bands of frequencies in a given CISPR 25 setup? The problem is analyzed in a modern 3D CAE Electromagnetic Solver. Model simplification and fitting to the tool's methodology is discussed. Correlation to measured data is presented.
3) **Why Does My Module Fail EMC?**
Case studies drawn from multiple designs are used to demonstrate the underlying EMC physics for causes and cures. Solutions are generalized for applicability to multiple future designs.

Professor Wen-Yan Yin is currently a "Qiu Shi" Chair Professor at Zhejiang University, and Adjunct Professor at Shanghai Jiao Tong University of China. He is well known for his work in electromagnetic compatibility and electromagnetic nanoelectronics as well as computational multiphysics and their applications.

Professor Wen-Yan Yin's topics include:

1) **Multiphysics Method for High-Power Electromagnetics**
We are now facing considerable concerns on intentional and non-intentional electromagnetic interferences (IEMI & EMI) issues related to various communication platforms, which can cause serious degradation in reliability of devices, circuits and systems. In this talk, multiphysics-based time–domain finite element method will be introduced and implemented for fast capturing transient electro-thermo-mechanical responses of various on-chip interconnects, devices and circuits under the impact of an (I)EMI signal, such as double-exponential high-power EMP and electrostatic discharge (ESD), etc.
2) **Multiphysics Solution for Nanoelectronics**
Recently, significant progress has been achieved in the development of carbon nanotube (CNT)-based interconnects and CNT field effect transistors (CNTFET). In order to thoroughly understand signal transmission characteristics of single-, double-, and multi-walled carbon nanotube (SWCNT & DWCNT& MWCNT) transmission lines and cables, we have to take quantum effects into account appropriately. In this talk, multiphysics solutions to various SWCNT, DWCNT, and MWCNT transmission lines and active devices will be addressed, with both frequency- and temperature- dependent quantum effects treated in detail.

Jerry Ramie is a 30-year veteran of regulatory compliance and Electromagnetic Compatibility (EMC). He has been writing and teaching about power and EMC since 2001 and is well known for his work on Smart Grid.

Jerry's topics include:

1) **EMC Testing of Substation Products**
This talk covers an introduction to EMC with emphasis on power installations, then walks through each of the IEC 60255 tests as well as IEEE-C37.90.1 and NEMA ICS-1 showering arc testing.
2) **Green Power and the Modern Grid**
This talk is a general presentation on the Smart Grid. It describes the seven attributes of the smart grid, presents the DOE's modern grid strategy and some typical architectures. It covers the choices in wired and wireless utility communications media that will be needed for deploying the Advanced Metering Infrastructure and presents standards testing to address physical (including EMC) threats to the infrastructure. **EMC**

The EMC Society's Distinguished Lecturer Program provides speakers for Society chapter meetings and similar functions. Each Distinguished Lecturer (DL) can offer one of several pre-prepared presentations on various EMC topics. DLs are appointed by the EMC Society Board of Directors for a two-year term. In 2011, the EMC Society will have seven Distinguished Lecturers serving on alternating terms.

Distinguished Lecturers may give up to six talks per year under the Program, which reimburses the DL for their approved traveling expenses up to a recommended limit of $1,000 per US engagement, or $1,250 for international engagements. To provide as many opportunities to as many members as possible, the Society encourages hosting chapters whenever possible to absorb some part of the speaker's costs, such as by providing or paying for local transportation, meals, and lodging.

For more information about the EMC Society's Distinguished Lecturer Program, visit our web site at www.emcs.org/lectur.html. You can also contact Bruce Archambeault at 919-486-0120, or via email at bruce.arch@ieee.org.

Please also note the Respected Speaker Bureau (RSB) which is comprised of past DLs and other notable speakers. Information on the RSB can be found on the DL web site.

And, remember to take a look at the *Video DL Program* information. These DVDs can be used at chapter meetings. Information is available on www.emcs.org.

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Quell

Scenes from the 2010 IEEE International Symposium on EMC

The exhibit by In Compliance magazine was ably staffed by (from left) Barbara Kovalchek, Erin C. Feeney, Sharon Smith and Lorie Nichols.

It's a who's who of EMC in Germany, including (from left) Frank Sabath of German MoD, Heyno Garbe of Leibniz University Hannover, Robert Kebel of Airbus and Michael Koch of FH Hannover.

Old friends were reacquainted at EMC 2010, including (from left) Tom Woods and Kevin Baldwin of ETS-Lindgren, Rob Kado of Chrysler, Keith Frazier of Ford, and Mike Bosley of Denso International America.

*(From left) Mike Kunkel of Spira Manufacturing Corp, Erping Li of A*STAR Institute of High Performance Computing, Jinliang He and Yaqi Chen of Tsinghua University in Beijing enjoyed the Awards Luncheon.*

Exhibitors Chris Leach (left) and Karl-Heinz Weidner of Rohde & Schwarz warmly greeted visitors to their booth at EMC 2010.

Sabrina Sarto (left) – to the delight of her son Alessio – received the Fellow Award from EMC Society President Francesca Maradei. Professors Sarto and Maradei are with the University of Rome, "La Sapienza."

ALL PHOTOS BY KEN WYATT

It was a full house at the Awards Luncheon in Fort Lauderdale on July 29, 2010.

Bob Hofmann (seated rear left) of Hofmann EMC Engineering and Martin Wright (standing far right) of British Telecom led one of the many well-attended technical sessions at EMC 2010.

Dave Staggs, Chair of EMC 2009 in Austin, received the well-deserved Symposium Chair Award from EMC Society President Francesca Maradei.

The Espresso Engineering booth was staffed by perky Steve Ferguson (left). Fred Heather, EMC 2010 Symposium Chair with the Navy at Pax River, stopped by for "a latte" knowledge offered by their educational videos.

ALL PHOTOS BY KEN WYATT UNLESS OTHERWISE NOTED

Morten Sorensen (left) and Knud Baltsen of Bang & Olufsen in Denmark enjoyed socializing in Fort Lauderdale.

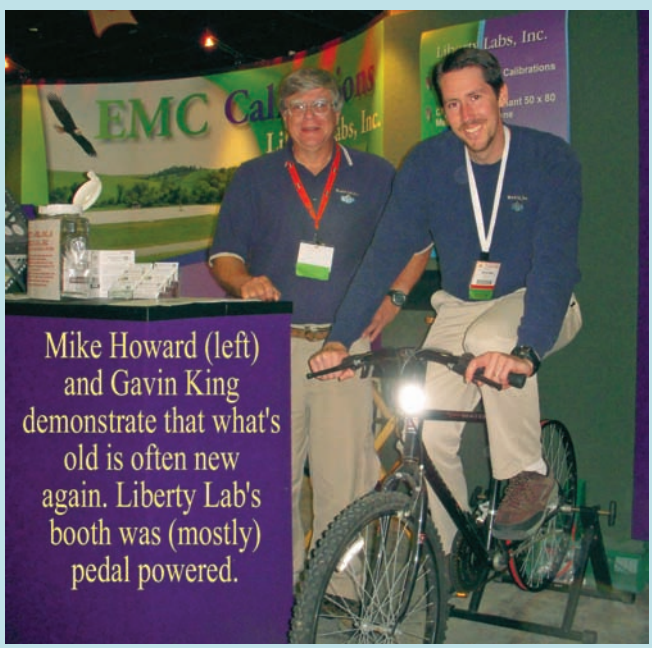
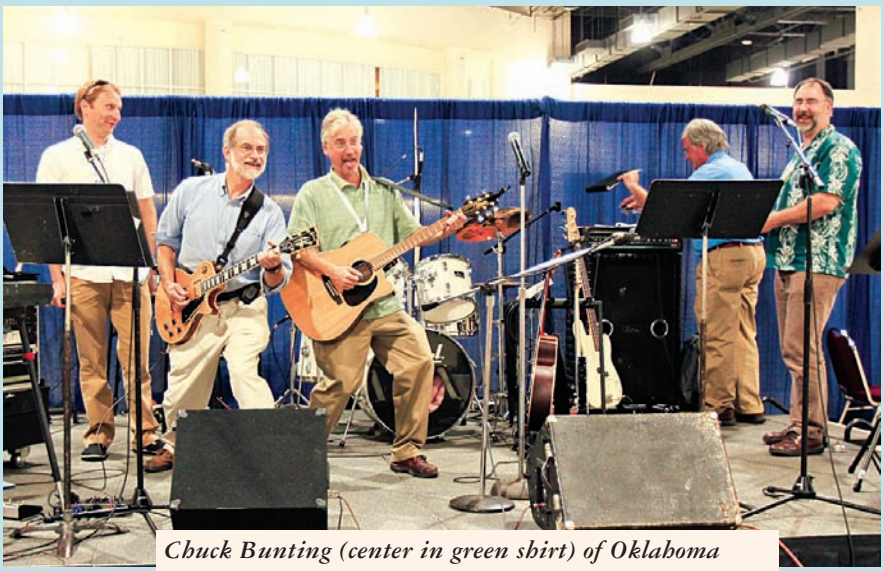


PHOTO BY DICK FORD

(From left) Greg Kiemel and Dean Ghizzone of Northwest EMC joined Bob DeLisi of Underwriters Laboratories at the annual dB Society party held in Fort Lauderdale.

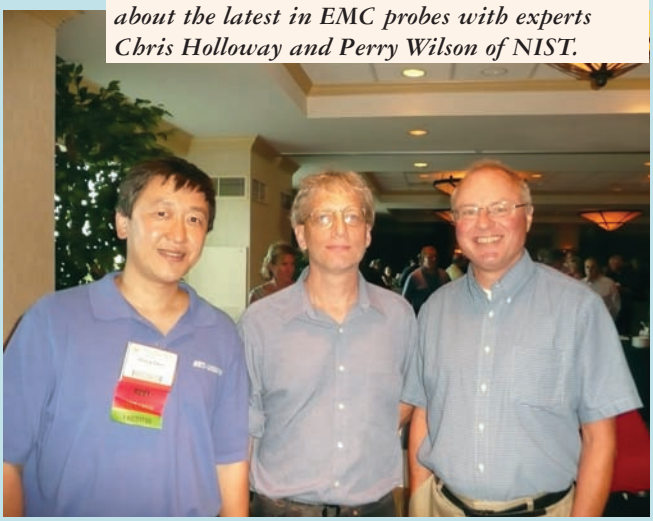
Techcelerant sent their best and brightest to staff their exhibit at EMC 2010, including Jessica and Archibald Fraser.

Sarah Seguin of the University of Kansas enjoyed her first EMC Symposium with her husband, John Seguin.



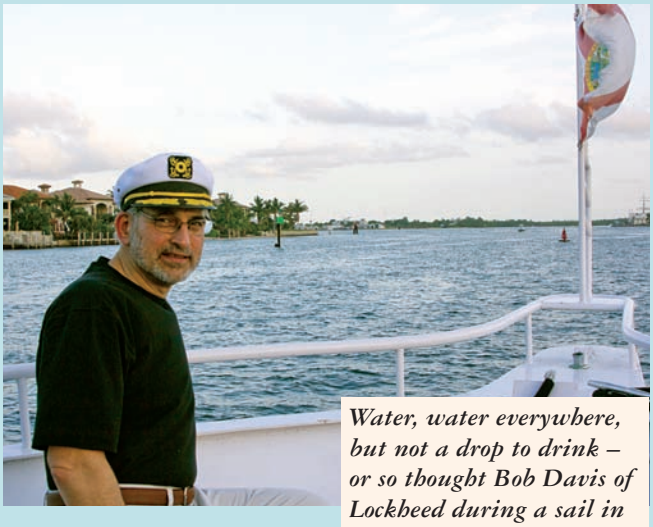
Chuck Bunting (center in green shirt) of Oklahoma State University kicked off a jam session in the exhibit hall at the Fort Lauderdale Convention Center.

(From left) Zhong Chen of ETS-Lindgren talked about the latest in EMC probes with experts Chris Holloway and Perry Wilson of NIST.



When he's not busy chairing the Technical Advisory Committee, you will find Bruce Archambeault and his wife Sue ready to set sail – as they did in Florida, of course!

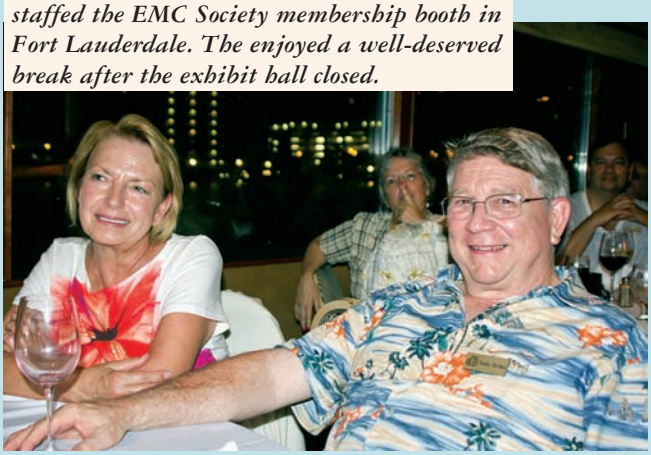
ALL PHOTOS BY KEN WYATT

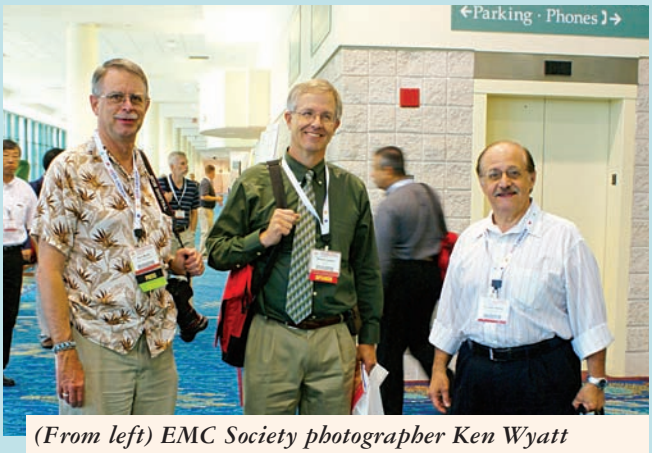


Water, water everywhere, but not a drop to drink – or so thought Bob Davis of Lockheed during a sail in Fort Lauderdale.

Hilton Garcia is shown receiving an award for his considerable efforts in planning the social events for EMC 2010. Kudos to Hilton for a job well done!

Denise Hall and Bob Dockey cheerfully staffed the EMC Society membership booth in Fort Lauderdale. The enjoyed a well-deserved break after the exhibit hall closed.





(From left) EMC Society photographer Ken Wyatt visited with his colleagues from Colorado, Bob Johnk of NTIA/ITS and Charles Grasso of Echostar Technologies (Hi Barry!)

The exhibit hall provided many educational opportunities, including a demonstration of equipment by Ken Javor (left) of Pearson Electronics for Olof Lunden of Swedish Defence Research Agency FOI.

ALL PHOTOS BY KEN WYATT

A "pirate" was ready to pounce at the Symposium gala event on the beach in Fort Lauderdale. This scary fellow, Magnus Hoijer of the Swedish Defence Research Agency FOI, was actually quite nice!

EMC Annual Awards

EMC Society President Francesca Maradei presented numerous awards at the Annual Awards Luncheon held during the 2010 IEEE International Symposium on EMC in Fort Lauderdale, Florida. She is shown below with some of the awards recipients. For a complete listing of the awards presented in Fort Lauderdale, please see pages 62-63.

Francesco de Paulis received the President's Memorial Award for his outstanding work in the area of EMC associated with high-speed digital systems. He received the award in memory of the late Ken Hall. Mr. de Paulis was also one of the winners of the Best Symposium Paper Award.

Professor Heyno Garbe received the Richard R. Stoddart Award for outstanding service as a technical leader and innovator in the development of TEM waveguide analysis and test methodology.

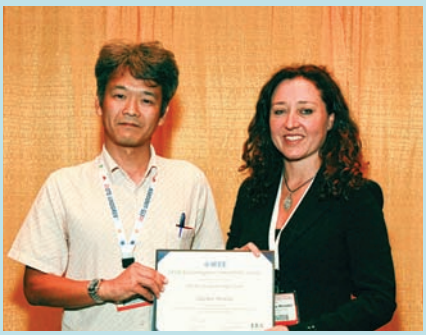
Todd Hubing received the Laurence G. Cumming Award for outstanding service to the EMC Society Board of Directors over the last 15 years.

Donald E. Clark received the Hall of Fame Award for significant contributions to the EMC Society as President, IEEE Fellow and Laurence G. Cumming Award recipient.

Mike Kunkel accepted his father's Honored Member Award. The award recognized George Kunkel for his service to the EMC Society for over 45 years.

Tom Van Doren received the Honored Member Award for his outstanding work in the area of EMC education and the understanding of the fundamentals of EMC.

Robert Kebel received the Technical Achievement Award for outstanding contributions as a technical leader in the lightning protection of aviation systems, EMC assessment of wireless cabin services, and aeronautic EMC standardization.



T. Morioka of the National Institute of Advanced Industrial Science and Technology in Tsukuba, Japan accepted the Best Symposium Paper Award for the paper, "Effects of a Wire beneath the Ground Plane on Antenna Coupling through a Slot."

Michael Koch of the Fachhochschule Hannover/University of Applied Science received the Richard B. Schulz Transactions Prize Paper Award for the paper titled, "Pulse Propagation in Gigahertz Transverse Electromagnetic Cells."

PHOTOS BY KEN WYATT

Jinliang He received the Technical Achievement Award for significant contributions to the lightning protection and grounding of power systems.

Perry Wilson received the Technical Achievement Award for significant contributions to the development of EMC technology.

Marcos Rubinstein received the Technical Achievement Award for outstanding contributions to the modeling of lightning discharge and its electromagnetic effects.

William (Bill) G. Duff received the Hall of Fame Award for significant contributions to the EMC Society as President, IEEE Fellow, IEEE Division IV Director, EMC Symposium Chair, and Associate Editor of the EMC Newsletter.

Yoshio Kami received the Technical Achievement Award for significant contributions to analytical modeling methods of transmission-lines for cross-talk, EMI, and immunity characterization in printed circuit boards and cables.

Joungho Kim received the Technical Achievement Award for significant contributions to the modeling and co-design of power distribution networks in packages and multi-layer printed circuit boards.

Christopher K. Holloway, Maria Sabrina Sarto and Farhad Rachidi (from left) received the IEEE Fellow Award for "for the application of new materials in the field of electromagnetic compatibility," "for contributions to advanced materials in electromagnetic compatibility applications" and "for contributions to electromagnetic modeling of lightning and coupling to transmission lines," respectively.

J. Park, S. Pan and J. Kim (from left) of the Missouri University of Science and Technology accepted the Best Symposium Paper Award for their paper, "An Equivalent Three-Dipole Model for IC Radiated Emissions Based on TEM Cell Measurements."

PHOTOS BY KEN WYATT

EMC Society President's Memorial Award
(Presented in memory of Ken Hall)

Francesco de Paulis
For his outstanding work in the area of EMC associated with high-speed digital systems in the classroom and laboratory as well as his positive impact on the students around him as a team contributor and team leader.

Richard R. Stoddart Award for Outstanding Performance

Prof. Dr. Heyno Garbe
For outstanding service as a technical leader and innovator in the development of TEM waveguide analysis and test methodology.

Laurence G. Cumming Award for Outstanding Service

Todd Hubing
For outstanding service to the EMC Society Board of Directors over the last 15 years including a term as President of the Society and terms as Director of Member Services and Vice-President of Communication Services.

Hall of Fame Award

Donald E. Clark
For significant contributions to the EMC Society as President of the EMCS (1988-1989), Member of the EMCS Board for over 12 years, IEEE Fellow (1993), Winner of the Laurence G. Cumming Award (1990), Member of the Planning Committees for the Atlanta IEEE International EMC Symposiums, and Member of the Atlanta IEEE Section and EMC Chapter since 1979.

William (Bill) G. Duff
For significant contributions to the EMC Society as President of the EMCS (1982-1983), Member of the EMCS Board for over 12 years, IEEE Fellow (1981), IEEE Division IV Director (1996-1998), Chair of the 2000 IEEE International EMC Symposium, Chair of Fellows Evaluation for over 20 years and Associate Editor of the EMCS Newsletter.

IEEE Fellow Presentations

Christopher K. Holloway
Elected IEEE Fellow "for the application of new materials in the field of electromagnetic compatibility."

Farhad Rachidi
Elected IEEE Fellow "for contributions to electromagnetic modeling of lightning and coupling to transmission lines."

Maria Sabrina Sarto
Elected IEEE Fellow "for contributions to advanced materials in electromagnetic compatibility applications."

Technical Achievement Award

Jinliang He
For significant contributions to the lightning protection and grounding of power systems.

Christopher K. Holloway
For significant contributions to the understanding of shielding effectiveness.

Yoshio Kami
For significant contributions to analytical modeling methods of transmission-lines for cross-talk, EMI, and immunity characterization in printed circuit boards and cables.

Robert Kebel
For outstanding contributions as a technical leader in the lightning protection of aviation systems, EMC assessment of wireless cabin services, and aeronautic EMC standardization.

Joungho Kim
For significant contributions to the modeling and co-design of power distribution networks in packages and multi-layer printed circuit boards.

Marcos Rubinstein
For outstanding contributions to the modeling of lightning discharge and its electromagnetic effects.

Perry Wilson
For significant contributions to the development of EMC technology.

Honored Member Award

George Kunkel
For service to the EMC Society over a period of 45 years, including service as a member of the EMCS Board (1977-1979); for his contributions to the Los Angeles EMC Chapter; for his support of numerous IEEE EMC Symposiums through his company's (Spira) support of the exhibition; for his technical contributions to EMC standards and advancement of the engineering aspects of EMC shielding; and for his service as chairman of the Technical Committee on Interference Control from 1975-1987.

Tom Van Doren
For his outstanding work in the area of EMC education and the understanding of the fundamentals of EMC.

Richard B. Schulz Transactions Prize Paper Award

H. Thye[1], G. Armbrecht[1], and M. Koch[2] for "Pulse Propogation in Gigahertz Transverse Electromagnetic Cells", No. 3, pp. 592-603.
[1]Leibniz University of Hannover, [2]Fachhochschule Hannover/University of Applied Science

Best Symposium Paper Award

"An Equivalent Three-Dipole Model for IC Radiated Emissions Based on TEM Cell Measurements"
S. Pan[1], J. Kim[1], S. Kim[2], J. Park[2], H. Oh[2], J. Fan[1]; [1]Missouri University of Science and Technology, Rolla, United States; [2]LG PRI, Pyungtaek-si, Republic of Korea

"Effects of a Wire beneath the Ground Plane on Antenna Coupling through a Slot"
T. Morioka[1], K. Hirasawa[2]; [1]National Institute of Advanced Industrial Science and Technology, Tsukuba, Japan; [2]University of Tsukuba, Tsukuba, Japan

"Experimental Validation of Common-Mode Filtering Performances of Planar Electromagnetic Band-gap Structures"
F. de Paulis[1], L. Raimondo[1], D. Di Febo[1], B. Archambeault[2], S. Connor[2], A. Orlandi[1]; [1]UAQ EMC Laboratory, L'Aquila, Italy; [2]IBM, Research Triangle Park, United States

Best Symposium Student Paper Award

"Equivalent Transmission-Line Model for Vias Connected to Striplines in Multilayer Print Circuit Boards"
S. Pan[1], J. Zhang[2], Q. B. Chen[2], J. Fan[1]; [1]Missouri University of Science and Technology, Rolla, United States; [2]Cisco Systems, Inc., San Jose, United States

Special Poster Paper Awards

Don Heirman
Board of Directors Top Communicator Award

Zhenwei Yu
Technical Content Award

Ricardo Jauregui
Creativity and Style Award

Certificate of Acknowledgement

Achim Enders
For outstanding service to the German EMC Chapter as chair of the working group on biological effects.

Ryuji Koga
For outstanding service as the Chairman of the 2009 International Symposium on Electromagnetic Compatibility, Kyoto, Japan.

Chapter Founder Award

Riana Geschke
For her efforts in founding the joint IEEE AP/MTT/EMC South Africa Chapter (June 2009).

Steven McClain
For his efforts in founding the joint IEEE AES/GRS/RL/PSE/MTT/EMC Vancouver BC Chapter (November 2009).

AWARDS LUNCHEON

July 29, 2010
Fort Lauderdale Convention Center

emc 2010

Chapter of the Year Award

Singapore

Most Improved Chapter Award

Nanjing

Special Symposium Recognition Award

In recognition of the vision and contribution of the founders of the Wroclaw International Symposium and Exhibition on Electromagnetic Compatibility: Jan Holownia, Tadeusz Babij, Romuald Nowicki, Ryszard Zarko, Wladyslaw Moron, Wlodzimierz Stawski, and Ryszard Struzak. Held for the first time September 14 to 16, 1972, at the Wroclaw University of Technology, it was the first regular International Symposium and Exhibition on Electromagnetic Compatibility held in Europe.

Ryszard Struzak & Wladyslaw Moron
In recognition of the vision and outstanding contribution of these founders in the establishment of the Wroclaw International Symposium and Exhibition on Electromagnetic Compatibility and for 40 years of continued dedication to the high quality of the Symposium.

Symposium Chair Award

David Staggs
For his leadership and dedication as General Chairman of the 2009 IEEE International Symposium on Electromagnetic Compatibility.

Certificate of Recognition

Hilton Garcia
For outstanding service planning the social events for the 2010 IEEE International Symposium on EMC.

Lorie Nichols & Sharon Smith
For outstanding service as the 2010 IEEE International Symposium on EMC Attendee Connection/Patron Program Coordinators.

Craig Simmons
For outstanding service as the 2010 IEEE International Symposium on EMC Arrangements Chair.

Sue Heather
For outstanding service as the 2010 IEEE International Symposium on EMC Companion Club Coordinator.

Caroline Chan
For outstanding service as the 2010 IEEE International Symposium on EMC Networking Activities Coordinator.

Gayla Burns
For outstanding service as the 2010 IEEE International Symposium on EMC Junior Technical Program Chair.

Tammy Cox
For outstanding service as the 2010 IEEE International Symposium on EMC Registration Co-Chair.

Kristin Case
For outstanding service as the 2010 IEEE International Symposium on EMC METE Program Coordinator.

Ketchiozo "Terri" Wandji
For outstanding service as the 2010 IEEE International Symposium on EMC Survival Guide Coordinator.

Certificate of Recognition (cont'd)

Ted Rothman
For outstanding service behind the scenes for the 2010 IEEE International Symposium on EMC.

Brenda Woodburn & Lillian Smith
For outstanding service creating countless signs for the 2010 IEEE International Symposium on EMC.

Travis Flanagan
For outstanding service creating countless signs for the 2010 IEEE International Symposium on EMC.

Kath Brewer
For outstanding service in the Companion Club for the 2010 IEEE International Symposium on EMC.

Certificate of Appreciation

Jan Luiken ter Haseborg
For outstanding service to the EMC Society for service as vice-chair of the IEEE German EMC Chapter for more than a decade.

Eric Schumann
For serving as the chairman of the Eastern North Carolina Chapter of the IEEE EMC Society for the last two years, actively participating in the organization of all meetings, and bringing industry experts to the Raleigh area to present on subjects of importance to the community.

Eric Bogatin
For outstanding service to the EMC Society as a Distinguished Lecturer, 2008-2009.

Alistair Duffy
For outstanding service to the EMC Society as a Distinguished Lecturer, 2008-2009.

Stephan Frei
For outstanding service to the EMC Society as a Distinguished Lecturer, 2008-2009.

Tzong-Lin Wu
For outstanding service to the EMC Society as a Distinguished Lecturer, 2008-2009.

Dave Staggs
For outstanding service to the EMC Society as a Member of the Board of Directors, 2007-2009.

Don Sweeney
For outstanding service to the EMC Society as a Member of the Board of Directors, 2007-2009.

Bob Goldblum
For outstanding service to the EMC Society as a Member of the Board of Directors, 2007-2009.

Kurt Sebacher
For outstanding service as the Vice Chair for the 2010 IEEE International Symposium on EMC.

Irina Kasperovich
For outstanding service as the Registration Chair for the 2010 IEEE International Symposium on EMC.

Steve Ferguson
For outstanding service as the Special Sessions Coordinator for the 2010 IEEE International Symposium on EMC.

Certificate of Appreciation [cont'd]

Ross Carlton
For outstanding service as the Special Sessions Coordinator for the 2010 IEEE International Symposium on EMC.

Colin Brench
For outstanding service as the Demonstrations/ Experiments Coordinator for the 2010 IEEE International Symposium on EMC.

Steve Koster
For outstanding service as the Demonstrations/ Experiments Coordinator for the 2010 IEEE International Symposium on EMC.

Ronald Brewer
For outstanding service as the Publications & Promotions Coordinator for the 2010 IEEE International Symposium on EMC.

John Wyncott
For outstanding service as the Job Fair Coordinator for the 2010 IEEE International Symposium on EMC.

Andrew Drozd & Cliff Carroll
For outstanding service as the Exhibits Chairs for the 2010 IEEE International Symposium on EMC.

Mike Oliver
For outstanding service as the Signage Coordinator for the 2010 IEEE International Symposium on EMC.

Amy Pinchuk
For outstanding service as the Junior Technical Program Coordinator for the 2010 IEEE International Symposium on EMC.

Robert Davis
For outstanding service as the Secretary for the 2010 IEEE International Symposium on EMC.

John LaSalle
For outstanding service as the Treasurer for the 2010 IEEE International Symposium on EMC.

Mike Violette
For outstanding service as the Program Chair for the 2010 IEEE International Symposium on EMC.

Bruce Archambeault
For outstanding service as the Technical Program Chair for the 2010 IEEE International Symposium on EMC.

John Maas
For outstanding service as the Workshops/Tutorial Coordinator for the 2010 IEEE International Symposium on EMC.

Mark Steffka
For outstanding service as the Workshops/Tutorial Coordinator for the 2010 IEEE International Symposium on EMC.

Gary Fenical
For outstanding service as the Marketing Coordinator for the 2010 IEEE International Symposium on EMC.

In Memoriam

Ralph Calcavecchio
1929 - 2009

Doug Robertson
1924 - 2010

EMC Standards Activity

Don Heirman, Associate Editor

Another Busy Standards Time in Fort Lauderdale

We could hardly take a breath without running into a standards discussion at our annual EMC symposium in Fort Lauderdale. Some came from workshops, some from scheduled meetings, and some from ad hoc chats.

The standards activity started even before the start of the symposium; in fact, the Friday and Saturday before. The Accredited Standards Committee C63® held its usual workshops on July 23–24. This year it was again a Friday workshop on ANSI C63.4 which is the FCC referenced emission measurement standard for information technology equipment. On Saturday, the workshop addressed ANSI C63.5 on antenna calibration and provided an introduction to using time domain techniques for antenna calibration as well as investigating test site anomalies in the site validation process. For more info on C63®, visit www.c63.org

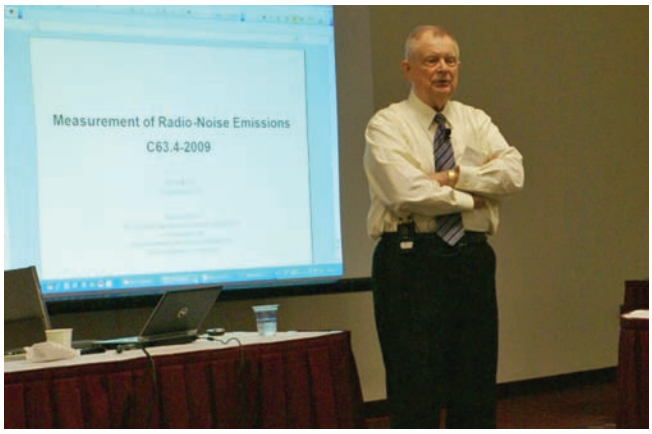
The C63.4 workshop was presented by Don Heirman of Don HEIRMAN Consultants and Bob Hofmann of Hofmann EMC Engineering. It focused on the differences between the 2003 and 2009 editions. The 2009 edition adds the following:

- Tables of LISN impedances (in addition to the plots in the 2003 edition) with and without the use of extension cords between the EUT power connection of the LISN and the end of the extension cord where the EUT connects its power plug
- Clarifying in Annex B the LISN calibration process
- What must appear on video displays during emission testing
- Variation in antenna cable loss as a function of significant temperature variation at the test site
- Precautions in using spectrum analyzers, which appear in clause 4.2.2 and Annex H
- Informative annexes for step-by-step testing procedures have been omitted, because those were mostly duplicative of the normative procedures in the main text
- Ensured that the standards not under the control of Accredited Standards Committee (ASC) C63® were dated to guarantee the acceptance of the versions that are referenced, whereas the ASC C63® standards were undated because ASC C63® would be voting their acceptance
- Added information on the effects of materials used to construct EUT support tables and antenna masts
- Condensed the information about absorbing clamp calibration and use, as well as the artificial hand, as these continue to be in limited use
- Retained the Clause 13 requirements for emission measurements of intentional radiators
- Introduced site validation specifications above 1 GHz from CISPR 16-1-4:2007, while still allowing use of absorber material on the ground plane for an open area test site (OATS) and semi-anechoic chambers in a particular configuration and

PHOTOS BY RICHARD GEORGERIAN

Team problem solving during the ANSI C63.4 workshop held in Fort Lauderdale, prior to the EMC 2010 Symposium.

Instructor Bob Hofmann presents the ANSI C63.4 workshop session on instrumentation.



Lead instructor Don Heirman presents the ANSI C63.4 measurements session during the workshop.

with particular absorber performance without any further site validation measurements

- For measurement methods above 1 GHz, retain the provisions of ANSI C63.4-2003 with no change

Changes being considered for the next edition of ANSI C63.4 in 2012 include the following:

- Remove measurement methods for intentional radiators (clause 13) since they are now covered by C63.10
- Revise the measurement method for emissions above 1 GHz; this would be limited to unintentional radiators
- Revisit site validation methods above 1 GHz
- Further describe scrolling H pattern requirements for large screen TV receivers as well as those used as computer monitors
- Add measurement uncertainty based on C63.23 if published
- Move antenna calibration requirements to C63.5
- Move site validation requirements to new standard if one is published covering different approaches (potential publication is C63.25)
- Add information on the various versions of the average detectors and review average measurement method using a reduced VBW

The next day Don, Zhong Chen of ETS-Lindgren and Mike Windler of UL presented what is covered in ANSI C63.5 on antenna calibration, the proposed changes for a 2012 edition and the use of time domain techniques to determine test site qualifications, especially above 1 GHz. This last session also showed the efficacy in finding where necessary improvements must be made to meet the site validation requirements.

Topics covered in the C63.5 portion of the workshop included:

- General test conditions for calibrating an antenna
- Standard site method (SSM) also known as the three antenna method
- Reference antenna method where specific construction techniques give predictable antenna factors
- Calibration geometry specifics that differ for antennas calibrated for use in compliance testing and those used in test site validation
- Specific biconical antenna calibration and the differences in those with 50 or 200 ohm baluns
- Determining the measurement uncertainty for the various antenna calibration methods in the standard

Also reviewed were the areas being investigated for the next edition of the standard ANSI C63.5. Below is a sample of those considerations:

- Clarify text as needed in annex H in section 5.1 on the use of free space antenna factor (FSAF) and near-FSAF in section 5 and annex G
- New text covering standard gain horn antennas above 1 GHz where either use the physical dimensions for reference with some S11 electrical check to assure working horn antennas or

Lead instructor Don Heirman reviews an ANSI C63.4 problem solution with a student.

Zhong Chen presents general test conditions for antenna calibration during the ANSI C63.5 workshop.

Mike Windler (seated with back to camera) and Zhong Chen (standing far left) demonstrate the way in which site anomalies affect validation using time domain techniques in the C63.5/Time Domain workshop.

incorporate what cal labs use for horn antennas above 1 GHz (extrapolation, etc)
- Add free space corrections for dipole antennas similar to the Japan Voluntary Control for Interference (VCCI) and the International Electrotechnical Commission (IEC)
- Add vertical Ed_max to annex A
- Add limits to vertical vs. horizontal 1m ratio for hybrid antennas
- Add minimum frequency resolution for calibrations
- Reinstate sentence on biconical antennas - "Antenna factors obtained for biconical dipole antennas using the SSM that are used for either product testing or NSA testing shall be corrected to free space values using the correction factors provided in Annex G," as in the 2004 edition
- Develop text for complex fit of log periodic antennas

Students and instructors posed for a photo following the ANSI C63.5/Time Domain workshop. Instructors included (seated from left) Zhong Chen of ETS-Lindgren, Bob Hofmann of Hofmann EMC Engineering, Don Heirman of Don HEIRMAN Consultants, and Mike Windler of UL.

- Develop text for time-domain gating for free-space AFs (i.e. reduction of reflections)
- Add measurement uncertainty estimates (either in this standard or in the uncertainty standard)
- Expand reference antenna options

The time domain method portion of the workshop focused on site validation. Note that this work is now part of the standards work on the subject given the draft number of C63.25. In advance of publication, the following information was presented to show the usefulness of this technique.

- Measurements can be done with a swept frequency vector network analyzer
- Converting from frequency to time domain using the inverse Fourier transform is extremely easy and fast with modern computational hardware and software
- Conversions are done "on the fly" using time domain reflectometry (TDR) equipped Vector Network Analyzers (VNAs)
- Procedure is basically analogous to testing of products:
  - » Place a transmitting antenna on the turntable with a receiving antenna at the 3-meter measurement location
  - » Measure the response (voltage and phase converted to voltage and time) every 6 degrees of turntable azimuth
- The proposed TDR method is similar to taking a radar measurement of your site
- The results are the amplitude, distance and angle of any reflections
- The amplitude of the reflections is measured relative to the direct path thus making them a direct measurement of error introduced by the site

The workshop then concluded with the following:

- The same test site will have the same performance when measured with TDR and the IEC/CISPR Site VSWR (SVSWR) technique in CISPR 16-1-4 if the SVSWR measurement is done with continuous antenna movement (not in specific increments now in the SVSWR procedure)
- The TDR method will be faster and will yield diagnostic information (frequency, azimuth and distance to reflections—and hence show where the test site has to be improved to meet the validation specification) that SVSWR does not

On Monday, which was the start of the technical program of the Symposium in Fort Lauderdale, the morning brought together meetings on standards including a presentation to the members of the EMC Society Board of Directors that attended the luncheon sponsored this year by the Standards Advisory and Coordination Committee (SACCom). The luncheon was attended by SACCom members as well as members of the Representative Advisory Committee (RAC). RAC has other non-EMC Society committees that are not doing EMC standards work while the SACCom focuses on hearing from representatives of non-EMC Society standards committees around the world. The chair of SACCom is Werner Schaefer of CISCO and your author is the secretary. For more info on SACCom, visit http://ewh.ieee.org/soc/emcs/standards/saccomindex.html

The main EMC Society standards committee is the Standards Development Committee (SDCom). Andy Drozd is the chair and his secretary is Ed Hare of ARRL. Below is a glimpse of the list of standards. The status of each was discussed over two parts of the committee meeting (the first part was on Monday morning and the second was on Wednesday morning).

1.1 Std 139[1] – In-situ measurement of ISM equipment
1.2 Std 187[2] – Measurement of spurious radiation from FM/TV receivers
1.3 Std 299[3] – Measuring shielding effectiveness
1.4 P299.1[4] – Shielding effectiveness, dimensions 0.1-2m
1.5 Std 377[5] – Spurious emission from land-mobile transmitters
1.6 Std 473[6] – EM site survey to 10 GHz
1.7 Std 475[7] – Measurement of field disturbance sensors
1.8 Std 1128[8] – RF absorber evaluation
1.9 Std 1140[9] – Measuring emissions from video-display terminals
1.10 Std 1302[10] – Characterization of conductive gaskets
1.11 Std 1309[11] – Calibration of field sensors
1.12 P1309 Amd[12] – Calibration of field sensors

1.13 P1560[13] – Measurement of RFI filtering capability
1.14 P1597.1[14] – Validation of EM computer modeling
1.15 P1597.2[15] – EM computer modeling applications
1.16 P1642[16] – Intentional EMI
1.17 P1688[17] – Module EMI testing
1.18 P1775[18] – BPL emissions testing/immunity testing and limits
1.19. P2030 – Smart Grid Standardization
1.20. PXXX – Resolution of Power Line Gap Noise Interference

For more information on the status of each of these projects, see the SDCom web site: http://ewh.ieee.org/soc/emcs/standards/sdcom/sdcomminutes.html

An interesting discussion during the Monday meeting involved the need for a project to discuss the measurements (and limits) of power line frequency harmonics as it should apply to North America, especially that of the U. S. and Canada which share the power grid of North America. Due to the very different power grid (using a 60 Hz system) in North America, the international standards on harmonics IEC61000-3-2 (using less than or equal to 16 Amps per phase for 50 Hz systems) and IEC61000-3-12 (using more than 16 Amps and less than or equal to 75 Amps per phase) needs to be adapted. After a discussion on the need as voiced by Canadian manufacturers, an ad hoc committee was established to draft an IEEE Project Authorization Request (PAR). Subsequent to the meeting, an SDCom electronic ballot was conducted and PARs for the study on adapting the 3-2 and 3-12 work were approved and given the IEEE numbers of P1836 and P1837, respectively. The ad hoc committee is now populating the working group as well as recommending a chair and co-chair for this work.

In addition to these standards meetings, there were project meetings on some of the above standards, including:

- P299.1 (two different four-hour meetings)
- P1309
- P1642
- P1688

There were even other international standards meetings on these topics:

- IEC 61000-4-22 (use of reverberation chamber testing techniques) task force meeting
- G46 EMC Subcommittee meeting
- IEC 61000-4-21 (use of TEM chamber testing techniques) task force meeting

In conclusion, the amount of standards activity continues to be extensive and occupies much of the time of our EMC Society symposia. That remains very encouraging for the health of EMC standards in our Society.

[1] IEEE 139 – IEEE Recommended Practice for the Measurement of Radio Frequency Emission from Industrial, Scientific, and Medical (ISM) Equipment Installed on User's Premises

[2] IEEE 187 – IEEE Standard on Radio Receivers: Open Field Method of Measurement of Spurious Radiation from FM and Television Broadcast Receivers

[3] IEEE 299 – IEEE Standard Method for Measuring the Effectiveness of Electromagnetic Shielded Enclosures

[4] P299.1 – Standard Method for Measuring the Shielding Effectiveness of Enclosures and Boxes Having All Dimensions between 0.1 m and 2 m

[5] IEEE 377 – IEEE Recommended Practice for Measurement of Spurious Emission from Land-Mobile Communication Transmitters

[6] IEEE 473 – IEEE Practice for an Electromagnetic Site Survey (10 kHz to 10 GHz)

[7] IEEE 475 – IEEE Standard Measurement Procedure for Field Disturbance Sensors, 300 MHz to 40 GHz

[8] IEEE 1128 – IEEE Recommended Practice for RF Absorber Evaluation in the Range of 30 MHz to 5 GHz

[9] IEEE 1140 –1994 (R1999) - IEEE Standard for the Measurement of Electric and Magnetic Fields from Video Display Terminals (VDTs) from 5 Hz to 400 kHz

[10] IEEE 1302 – IEEE Guide for the Electromagnetic Characterization of Conductive Gaskets in the Frequency Range DC to 18 GHz

[11] IEEE 1309 – IEEE Standard Method for the Calibration of Electromagnetic Field Sensors and Field Probes, Excluding Antennas, from 9 kHz to 40 GHz

[12] Amendment 1 to IEEE Standard Method for the Calibration of Electromagnetic Field Sensors and Field Probes, Excluding Antennas, from 9 kHz to 40 GHz: Probe Characteristics, Use and Measurement Uncertainty: Probe Use

[13] IEEE P1560 – Methods of Measurement of Radio Frequency Interference Filter Suppression Capability in the Range of 100 Hz to 40 GHz

[14] P1597.1 – Standard for Validation of Computational Electromagnetics (CEM) Computer Modeling and Simulation

[15] P1597.2 – Recommended Practice for Computational Electromagnetics (CEM) Computer Modeling and Simulation Applications

[16] P1642 – Recommended Practice for Protecting Public Accessible Computer Systems from Intentional EMI

[17] P1688 – Standard for Module Electromagnetic Interference (EMI) Testing

[18] P1775 – Standard for Broadband Powerline Communication Equipment – Electromagnetic Compatibility (EMC) Requirements – Testing and Measurements Methods **EMC**

Please check the C63® website – www.C63.org – after January 2011 for more information about scheduled ANSI C63® workshops in 2011.

Call for Participants for EMC Society Smart Grid Activity

The EMC Society Technical Advisory Committee (TAC) at its Fort Lauderdale meeting approved the establishment of a focus committee on Smart Grid EMC. It is called Special Committee 1 and can be found on the EMC Society web site at: http://ewh.ieee.org/soc/emcs/committees/sc01/index.html

As stated on the web site, the charter is as follows:
This special committee is concerned with coordinating the EMC Society activity on providing EMC principles for those organizations and associated documentation and specifications that address the efficient use of the AC power grid including the control of power entering a house or building. Such control may be from a meter at the point of power entry into these facilities, to control incorporated into appliances and other electronic devices in these facilities. Such controllers may be sources of undesirable RF emissions and at the same time vulnerable to the RF environment which speaks to the need for EMC. It is expected that the coordination aspect of this special committee will involve several EMC Society Technical Committees, including:

TC 2: EMC Measurements
TC 3: EM Environments
TC 4: EMC Design
TC 5: High Power EM
TC 9: Computational EM

Members are needed who can bring their expertise to bear on the subject. We are asking for volunteers to join the special committee.

Interested in Joining?

If you are an IEEE EMC Society member and would like to join this special committee, please contact one of the committee officers shown below with your name and IEEE membership number. The committee primarily will communicate electronically and using teleconferencing. It will also meet face to face as needed and at the annual IEEE EMC Symposium.

Contact information:

Please contact the chair Don Heirman on d.heirman@ieee.org and the secretary Kermit Phipps on kphipps@epri.org

Don't wait as this activity is moving ahead with a lot of energy. Our interest is in a successful Smart Grid system. We have indicated already that for the Smart Grid to have interoperability, you need to first operate - and that will require proper EMC design.

iNARTE Activity at EMC 2010

Brian Lawrence, Executive Director, iNARTE

This year at the EMC 2010 Symposium in Fort Lauderdale, iNARTE did not have as many examination candidates as in recent years. In fact, we ended the week with just 11 candidates, although during the exhibition hours we had the usual level of booth activity and general interest.

Of course, we understand that the economic climate could have prevented many companies from supporting their younger engineers' travel budgets, and this may have been a contributing factor.

However, it is also a sign of the times that by the end of 2010, or at the latest by Spring of 2011, the iNARTE membership in Asia will be almost the same as that in the USA; in fact, we expect more than half of our EMC Certificate holders will be from Japan alone.

Perhaps in the USA our traditional EMC Certification program is focused too much on EMC Test Engineering and Mitigating Engineering, skills that are needed at, or close to, manufacturing centers. And, as the manufacturing jobs are lost from the US, so too will these support functions be lost.

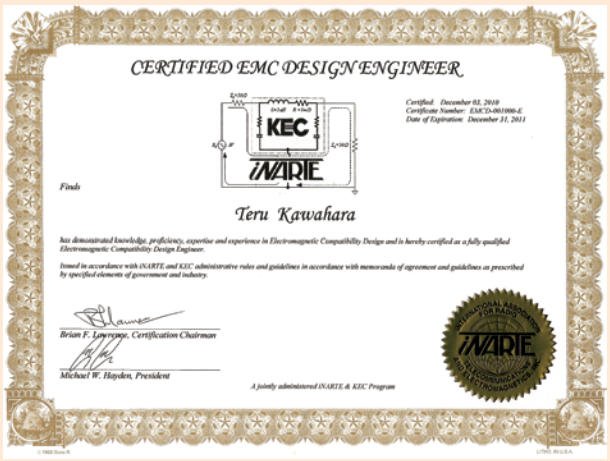
Having this in mind, iNARTE will be introducing a new EMC Certification program in 2011, one that we hope we will have ready to launch with examinations at the EMC 2011 Symposium in Long Beach. "**EMC Design Engineering**", the new iNARTE program, is intended for those working at the design and development end of the electronics industry. We think that these skills have more likely been retained at corporate headquarters facilities and not dispersed globally with the manufacturing. We also think that these skills have become more attractive to the younger engineering graduates.

Skill sets for the **EMC Design Engineer**, and the details as to the administration of the new program are in preparation now. In defining these details, we are working with our Regional Partners in Japan and we now have Program Development Teams working both in Japan and in the USA. Each Team is made up of experts and senior engineers from major global corporations, from academia and from supporting institutes and associations.

Our sparsely populated examination room at Fort Lauderdale.

As compared to one of three test centers, (Tokyo, Osaka, Nagoya), where a total of 215 iNARTE Certification candidates were examined in 2010.

iNARTE will publish more complete details about this exciting new certification program during the next two months. The best way to keep informed on our progress and to determine if this new credential is something that could be of value to you, is to regularly visit our web site, www.narte.org. We think that many of our existing members will also want to add this new credential to their armory. It will complement our current EMC certification program, and could be the tool you need to boost your professional development. **EMC**


CERTIFIED EMC DESIGN ENGINEER

KEC

iNARTE

Finds

Teru Kawahara

has demonstrated knowledge, proficiency, expertise and experience in Electromagnetic Compatibility Design and is hereby certified as a fully qualified Electromagnetic Compatibility Design Engineer.

Issued in accordance with iNARTE and KEC administrative rules and guidelines in accordance with memoranda of agreement and guidelines as prescribed by specified elements of government and industry.

Brian F. Lawrence, Certification Chairman

Michael W. Hayden, President

A jointly administered iNARTE & KEC Program

Save the Date!

The following iNARTE events will take place during the 2011 IEEE International Symposium on EMC in Long Beach, California:

August 15, 2011
iNARTE Exam Prep Workshop

August 19, 2011
iNARTE Exam

For more information: www.narte.org

Global EMC University (4th Edition) at EMC 2010

By Andy Marvin, Global EMC University Program Chair, University of York, UK

The Global EMC University was held in conjunction with the 2010 IEEE International Symposium on EMC in Fort Lauderdale, Florida. This was the fourth consecutive time that the Global EMC University was held during the Symposium. It offers higher level instruction to engineers with some experience in EMC and also attracts attendance from EMC experts with many years experience who still retain their intellectual curiosity and the will to share in others' expertise.

Classes are taught by an international panel of educators, whose selection is based upon their reputation for excellence in areas of practical importance to EMC engineers and their demonstrated ability to communicate. Students receive Continuing Education Units (CEUs) for their participation in the class and are encouraged to attend symposium workshops, exhibits and social activities when they are not in class.

Each year the curriculum is refreshed and this year new lectures on Reverberation Chambers and Novel Materials with EMC applications were introduced. A "Meet and Greet" reception was also introduced this year where participants could get together with the lecturers for snacks and a drink on the evening before the lectures started.

The 2010 lectures presented during the Global EMC University included:

- *Capacitance and Inductance* – Al Ruehli, IBM
- *Transmission Lines: Time-Domain and Signal Integrity* – Jim Drewniak, Missouri University of Science and Technology
- *Transmission Lines: Frequency-Domain and Crosstalk* – Marco Leone, University of Magdeburg
- *Conducted Emissions and Power Supply Filters* – Mark Steffka, GM and University of Michigan - Dearborn
- *Antennas and Radiation EMC Standards* – Andy Marvin, University of York, Chair of Faculty
- *Mode-Stirred Chambers* – Frank Leferink, Thales & Twente University

PHOTO BY KEN WYATT

Global EMC University instructor Todd Hubing (far left) of Clemson University enjoys visiting with the students during a "Meet and Greet" reception.

PHOTO BY KEN WYATT

Al Ruehli (left) of IBM joins Andy Marvin of the University of York at the "Meet and Greet" reception held for the Global EMC University students.

PHOTO BY RICHARD GEORGERIAN

Mark Steffka of GM and the University of Michigan-Deaborn lectures during the Global EMC University program on the topic "Conducted Emissions and Power Supply Filters."

- *Electromagnetic Shielding* – Chris Holloway, NIST
- *EMC Applications of Composite and other Novel Materials* – Sabrina Sarto, University of Rome 'La Sapienza'
- *Overview of Numerical Methods* – Chuck Bunting, Oklahoma State University, Vice-Chair of Faculty
- *PCB Layout and System Configuration for EMC* – Todd Hubing, Clemson University

This year the attendance was 40 students and the feedback received was at its usual high level.

Each year the Chair of the Global EMC University is passed on to the former Vice-Chair. Next year's Global EMC University for 2011 will be chaired by Professor Chuck Bunting with assistance by Professor Mark Steffka as Vice-Chair. I understand that they are planning some exciting innovations in the Global University format, moving away from the traditional lecture series and involving greater student participation. Look out for an exciting Global EMC University in 2011.

EMC

Save the Date!

Global EMC University Offered in 2011

The Global EMC University will be offered again over August 14-19 at the 2011 IEEE International Symposium on EMC in Long Beach, California. The Chair is Chuck Bunting from Oklahoma State University. Participants are encouraged to register early, because enrollment is limited.

The Global EMC University is several hours of instruction on basic EMC-related topics that is run in parallel with the traditional technical sessions at the annual IEEE EMC Symposium. Classes are taught by an international panel of educators, who are selected for this program based on their reputation for excellence in areas of practical importance to EMC engineers and their demonstrated ability to communicate effectively with students who are new to the field.

Continuing Education Units (CEUs) are awarded to the students who successfully complete the course.

For more information, visit www.emc2011.org

Education and Student Activities Committee (ESAC)

Tom Jerse, Associate Editor, ESAC Chair
Professor of Electrical and Computer Engineering
The Citadel, Charleston, South Carolina

The Education and Student Activities Committee (ESAC) held its annual meeting at the Symposium this summer which was attended by educators and other engineers with an interest in EMC education. The committee seeks foster programs that develop EMC skills in those entering the profession and those practitioners working to broaden their knowledge.

Part of our efforts has been directed at facilitating the establishment of EMC courses at the university level. A set of EMC experiments was originally collected by Dr. Clayton Paul beginning 20 years ago in order to assist professors in developing courses that reinforce the theory with practice. The experiments manual can be located under the ESAC page on the EMC Society website and is now maintained by Dr. Ed Wheeler of Rose-Hulman Institute of Technology. Dr. Wheeler reported that several new experiments have been received, and a number of additional ones developed at the University of Michigan Dearborn based on Henry Ott's new book will be added (see the Summer 2010 issue of the EMC Newsletter for more information).

The EMC Society University Grant program was established to promote the development of original university-level courses in the principles of EMC. The funds made available for the last grant period were $5,000. Several excellent proposals were received and evaluated by the University Grant Committee. The award for this year went to Farmingdale State College in New York for the development of an EMC fundamentals course by Dr. Uma Balaji who also received recognition at the annual EMC Society awards luncheon in Fort Lauderdale. The grant this year marks the 15th such course developed in the 14-year history of the program. Well over 1,000 students have completed a full-semester course on EMC principles that was fostered by this program. Anyone interested in applying for a future course development grant is encouraged to visit the ESAC page of the EMC Society website or contact the chairman at jerset@citadel.edu.

ESAC sponsors various events to encourage student interest in EMC. The student paper competition this year had 32 entrants, the largest number in memory, and was won by S. Pan of the Missouri University of Science and Technology for his paper, "Equivalent Transmission-Line Model for Vias Connected to Striplines in Multilayer Print Circuit Boards." The paper coauthors were J. Zhang, Q. B. Chen, and J. Fan. The work described used modal decomposition to derive a transmission line model for printed circuit board vias that can be implemented in circuit simulators in order to speed analysis and facilitate optimization.

ESAC has also traditionally sponsored a hardware design contest, although a lack of resources have precluded this competition during the past two years. At this year's meeting concrete plans for reinstating this event for the EMC 2011 Symposium were described. Check the ESAC page of the EMC Society website for details and the rules of this renewed competition.

ESAC sponsors a Workshop on the Fundamentals of EMC at each Symposium to aid engineering professionals entering the EMC field. The well-attended workshop for this year was organized by Professor Daryl Beetner of the Missouri University of Science and Technology. Six speakers

S. Pan of the Missouri University of Science and Technology won the Best Student Paper Award for his paper, "Equivalent Transmission-Line Model for Vias Connected to Striplines in Multilayer Print Circuit Boards." The paper coauthors were J. Zhang, Q. B. Chen, and J. Fan. Mr. Pan (left) received the award from EMC Society President, Francesca Maradei.

Dr. Uma Balaji (left) of Farmingdale State College in New York received the 2010 EMC University Grant Award from EMC Society President, Francesca Maradei.

presented tutorials on partial inductance, PCB design techniques, grounding, shielding, crosstalk, and EMC measurements and modeling.

Last year ESAC established a subcommittee on grades K-12 outreach to investigate ways of presenting EMC concepts to pre-college students, starting with how EMI can affect everyday life. This year the committee, headed by Elya Joffe, reported on their work and the experiences of several individuals who have made such presentations at the high school and elementary school level. This ESAC subcommittee intends to develop and collect material that could assist others in reaching these young student audiences.

ESAC invites anyone with an interest in EMC education to join us at our next annual meeting during the 2011 IEEE International symposium on EMC in Long Beach, California.

EMC

PHOTOS BY KEN WYATT

Professor Daryl Beetner (foreground far left) of the Missouri University of Science and Technology organized the well-attended EMC 2010 Fundamentals of EMC Workshop.

More Fun than Ohm's Law Allows: Experiments & Demos at the Symposium

By Mike Violette and Steve Koster, Washington Laboratories

Electrons were spinning and spilling into the aisles as the Experiments and Demos session held rapt the attention of EMC symposium attendees. Now in its 18th year (!), the topics ranged from hands-on practical to exploration of the new notions of EMC. All that chalk talk in school is fine for a theoretical understanding of fields and waves, but putting theory to practice is the goal of this important "hands-on" part of the symposium.

A baker's dozen of experts, recruited from industry and academia, held forth from Tuesday to Thursday in sizzling Fort Lauderdale. The Experiments and Demos sessions are organized by the Education and Student Activities Committee (ESAC), under the auspices of the recently-installed Chair of the ESAC, Tom Jerse, who is a Professor of Electrical and Computer Engineering at The Citadel in Charleston, South Carolina. The Experiments and Demos feature of the symposium enhances EMC education by reinforcing the theory with practice. This well-received program continues to be one of the most interactive forums at the symposium with many in the audience taking the opportunity to ask questions and gain additional insight.

Both hardware and software demonstrations were featured with several favorite key presentations from years-prior *redux anno domini* 2010. Steve Koster and Colin Brench get the organizational kudos.

The popularity of the Experiments and Demos is to "show how, in most cases, fairly simple test hardware can be used to measure a wide range of electromagnetic effects." Bench-level, core concepts can be worth a thousand words (or more); here are a few words about that action.

EMC Troubleshooting techniques were demonstrated by Ken Wyatt (he of photo and snare drum fame). Ken's practical and hands-on advice has been leveraged by many engineers who have either attended his demonstrations or discovered enlightenment in his seminars. Ken hails from Woodland Park, CO, on the edge of Pike National Forest—a one-second flight west of the US Air Force Academy (in a T1A Jayhawk, that is).

EMI at the PCB Level. Isn't this where all the trouble starts: at the PCB Level? If you get a grip on the volts, amp and hertz (or microvolts, milliamps and megahertz), you're a long way towards avoiding problems at the device and system level. Insight was provided by Mr. Frank Leferink, University of Twente ("Developing high tech, with a human touch"), Enschede, The Netherlands.

MIL-STD-461: Demonstration of Test Methods CS115 and CS116. Pow! Lightning and EMP can ruin your day, if you haven't done enough testing to make sure your conductors are properly protected. Steve Ferguson, Washington Laboratories and Tom Revesz, HV Technologies, Manassas, VA, have teamed up for the third straight year showing how to properly whack your equipment to make sure it stands up to the rigors of real life.

Improving EMC Test Productivity with Automated EMC Test Software. Faster and better, right? Isn't that what the world wants? In the quickened-pace of product development, getting results with better efficiency, ease and comprehension shortens the test, leans development time and improves product delivery. Techniques demonstrated by Joe Tannehill, EMC Software Engineer, ETS-Lindgren, Cedar Park, Texas prove how.

Demonstration of Antenna Design Tools for EMC Applications. Complex, multi-transmitter platforms are the norm. Take the ubiquitous SmartPhone in all of its forms – and all of its communications modes: CDMA, Bluetooth, Wi-Fi and multiple types of antennas: wire, patch, integrated antenna systems – the need for informed antenna placement is critical. Dr. C. J. Reddy, EM Software & Systems (USA) Inc out of Hampton, VA discussed the use of tools to optimize the design process.

Grounding Strategy Effect on Video and Audio Circuitry. As old as the crystal radio, proper grounding is paramount to low-noise operation. Professor Bogdan Adamczyk, Grand Valley State University, Grand Rapids, MI joined Jim Teune, Lead EMC Engineer, Gentex Corporation, Zeeland, MI to root out the devil-in-the-details in the oft-confusing topic of "ground."

IC-EMC: A Freeware Tool for EMC Assessment in ICs. Mohamed Ramdani, ESEO, Angers, Maine et loire 49000 France introduced a freeware tool, named "IC-EMC," which aims at simulating parasitic emission and susceptibility of integrated circuits. The full package can be downloaded from www.ic-emc.org, a non-profit site dedicated to EMC of integrated circuits. Free? We'll take free and all the better for improving our designs before we cut steel (or silicon, in this case).

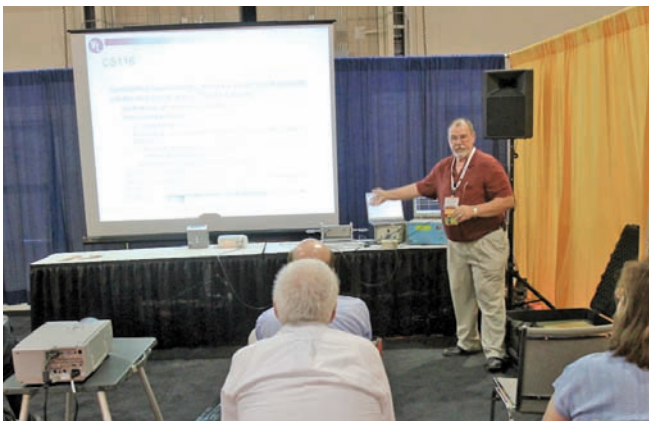
PHOTO BY DICK FORD

A NAVAIR Engineer demonstrates to a volunteer what can happen if an airplane and its fuel tanks are not properly designed to withstand a lightning strike. Yes, the exhibit hall was a pretty exciting and noisey place!

PHOTOS BY KEN WYATT

An experiment showing novel methods for high speed EMI testing and time domain measurements by Dr. Wolfgang Winter, of emv GmbH, Bavaria Taufkirchen, Germany drew a large audience.

Professor Bogdan Adamczyk (left) of Grand Valley State University joined Jim Teune of Gentex Corporation for a hardware experiment showing grounding strategy effect on video and audio circuitry.

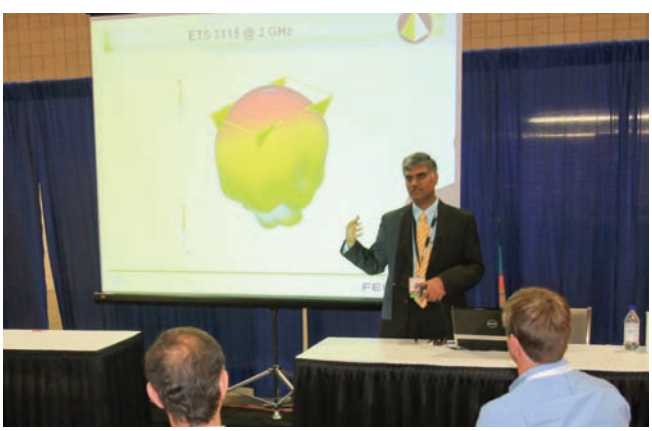


Steve Ferguson (right) of Washington Laboratories and Tom Revesz (not pictured) of HV Technologies provided a MIL-STD-461 demonstration on CS115 and CS116 test methods.

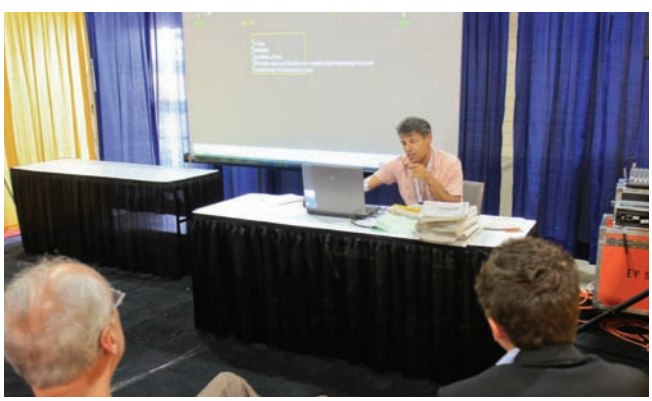
Faster and better emission tests using an antenna-mounted receiver with a digital fiber optic link was demonstrated by Domenico Festa (standing far right).

Automated Measurement of RF System Performance for Co-Site Interference Evaluation. Co-site issues are sprouting like dandelions – or more like cell towers. The overlap of physical space on crowded transmission platforms means that system-to-system interference is more likely. Fred German, Delcross Technologies, Champaign, IL, demonstrated an automated measurement system for obtaining wideband system performance characteristics and showed how these data can be used for co-site interference evaluations. As with any metric, once you can measure it, you can correct it.

Faster and Better Emission Tests Using Antenna-Mounted Receiver with Digital Fiber Optic Link. Domenico G. Festa, IBD, Chiari, Italy brings a novel bent on emission testing: using a receiver mounted on the antenna, controlled



Dr. C. J. Reddy of EM Software & Systems (USA) Inc. provided a software demonstration of antenna design tools for EMC applications.



Mohamed Ramdani of ESEO, Angers, Maine and France introduced a freeware tool, named "IC-EMC," which aims at simulating parasitic emission and susceptibility of integrated circuits.

PHOTOS BY RICHARD GEORGERIAN

Ken Wyatt provided some helpful advice with his "EMC Troubleshooting Techniques" experiment.

Frank Leferink (far right) of the University of Twente in Enschede, The Netherlands, demonstrated EMI issues at the PCB level.

via a digital fiber optic link. Some of bennies are certainly improved sensitivity. Other good advantages were detailed by Sr. Festa. Fantastico!

Performance of Real Components. When is a capacitor not a capacitor? Mike Violette, Washington Laboratories Ltd. Gaithersburg, MD answered this question with a visual demonstration using a swept network analyzer. Conditions of resonance, parasitic quantities and when not to use an 18 gauge green wire were aptly demonstrated. In the audience: audio techs from the Broward County Convention Center, who weighed in on their own challenges.

Novel Methods for High Speed EMI Testing, Time Domain Measurements. Dr. Wolfgang Winter, emv GmbH, Bavaria Taufkirchen, Germany demonstrated the use of Time Domain Measurement Techniques applied to traditional radiated and conducted emissions testing. With the wide spread use of RF communication systems to transmit data, audio and TV signals, new challenges are born for product development in industrial, home and automotive applications. To capture transient and time-limited complex RF signals is difficult, because they are often closely related to the operation of the DUT. New methods were fleshed out by Dr. Winter in this demonstration.

By all measures, the Experiments and Demonstrations brought a nice cross-section of practical and developing methodologies to the EMC symposium. The organizers are to be congratulated and the presenters adorned with EMC laurels.

EMC

Call for Hardware Experiments and Software Demonstrations

For Presentation at the 2011 IEEE International Symposium on EMC

Long Beach, California

August 14–19

Proposals Due: May 1, 2011

For more information: www.emc2011.org

EMC Europe 2011

26-30 September, York

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C Christopoulos, Vice-Chairman
J F Dawson
L Dawson
C Marshman
D W P Thomas
A Nothofer
S Greedy

Important Dates:

17 January 2011:
Preliminary Paper Submission.

1 March 2011:
Proposals for Workshops, Tutorials and Special Sessions.

1 March 2011:
Experimental and Practical Demonstrations.

8 April 2011:
Notification of Acceptance

9 May 2011:
Submission of Final Paper

FIRST CALL FOR PAPERS

The Conference:

EMC Europe is the pre-eminent EMC Conference in Europe and will be held at the University of York in the UK in 2011. We wish to invite and encourage all those working in electromagnetic compatibility to participate in this prestigious event in 2011.

EMC research and conferences in Europe have a long tradition. From the series of independent EMC conferences based in Wroclaw, Zurich and Rome running every second year, has now emerged EMC Europe which will be organised every year in a European city to provide an international forum for the exchange of technical information on EMC. The 2010 EMC Europe Conference was in Wroclaw and in 2011 it will be at York.

Technical Scope:

Authors are invited to submit original contributions on all aspects of EMC. Only full papers 4-6 pages in length, in IEEE, format, will be considered by the deadlines shown below. In addition, Workshop, Tutorial and other Special sessions will be organised to provide up-to-date practical help to those new to the subject or requiring an update, as well as to address in more depth topical subjects. Normal preliminary paper submission should be done electronically through the EMC Europe 2011 website (www.emceurope2011.york.ac.uk).

Proposals for Workshops, Tutorials and Special sessions will be coordinated by Dr D W P Thomas and the experimental and other practical presentations by Dr Angela Nothofer. There will be a technical exhibition held in parallel with the conference coordinated by Mr Chris Marshman. Sponsorship opportunities will also be available. Conference registration will be done at www.emceurope2011.york.ac.uk where further details will become available in due course.

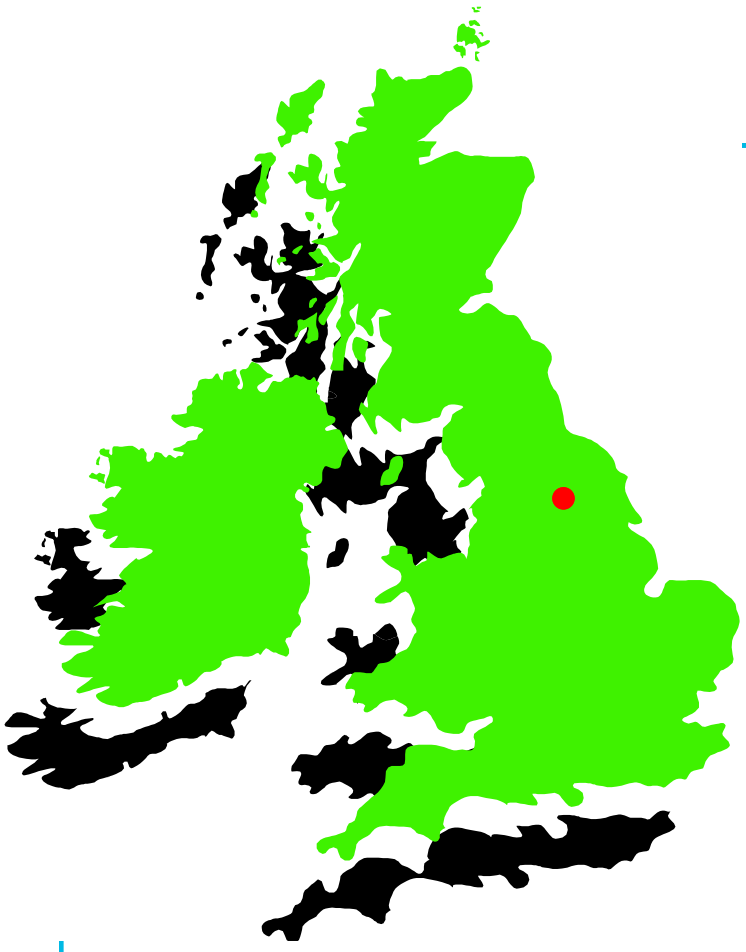
All queries to: conference@emceurope2011.york.ac.uk

The Organisers aim at making this a technically rewarding conference and your stay in the historic city of York a very pleasant one.

A C Marvin, University of York
C Christopoulos, University of Nottingham

http://www.emceurope2011.york.ac.uk

EMC EUROPE 2011
YORK, UK



The Venue

In the last century King George V said that "The History of York is the History of England". York was founded in AD70 by the Romans as Eboracum and became their capital city in the Northern part of England. It retained this status through medieval times as England's second city and the seat of government for the North.

Constantine was declared Roman Emperor in York in 306AD. After the fall of Rome in 410AD, Eboracum became the Anglo-Saxon trading city of Eorforwic, then the Anglo-Danish city of Jorvik, finally emerging with its modern name York in later medieval times. Evidence of all these phases of its life is still visible today. Today York is dominated by its 13th century cathedral York Minster, the largest gothic cathedral North of the Alps, and by its 13th century city walls and castle. The inner street plan is still that of the 10th century Anglo-Danish city.

The University of York is a surprisingly recent foundation dating back only to 1963. The Electronics Department at the University along with colleagues from the University of Nottingham are pleased to be hosting EMC Europe 2011 in this fascinating city.

York is within easy reach of five national parks, the Yorkshire Dales, the North Yorkshire Moors, The Peak District, The Lake District and the Northumbria National Park with Hadrian's Wall.

Scotland is less than three hours away by train.

York is well served by air with direct rail connection to Manchester airport served by flights from all over the world. Regional airports, Newcastle, Leeds/Bradford, Doncaster/Sheffield, Humberside and East Midlands (Nottingham) are also in easy reach. The most convenient intercontinental hub is Amsterdam Schiphol with connections to all the regional airports around York. It is less than two hours to London by rail with connections via Eurostar trains to Paris and Brussels. The port of Hull is one hour away by road with direct ferry connections to Rotterdam and Zeebrugge.

York has many hotels and guest houses. We have also reserved accommodation at the University with single rooms en-suite with breakfast available for only £38.50 per night (€46 or $58 at current exchange rates).

http://en.wikipedia.org/wiki/York
http://www.visityork.org/

EMCABS

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"How Can I Get a Copy of an Abstracted Article?"

Engineering college/university libraries, public libraries, company or corporate libraries, National Technical Information Services (NTIS), or the Defense Technical Information Center (DTIC) are all possible sources for copies of abstracted articles or papers. If the library you visit does not own the source document, the librarian can probably request the material or a copy from another library through interlibrary loan, or for a small fee, you can order it from NTIS or DTIC. Recently it became clear that EMCABs were more timely than publications which were being listed in data files. Therefore, additional information will be included, when available, to assist in obtaining desired articles or papers. Examples are: IEEE, SAE, ISBN, and Library of Congress identification numbers.

As the EMC Society becomes more international, we will be adding additional worldwide abstractors who will be reviewing articles and papers in many languages. We will continue to set up these informal cooperation networks to assist members in getting the information or contacting the author(s). We are particularly interested in symposium proceedings which have not been available for review in the past. Thank you for any assistance you can give to expand the EMCS knowledge base. **EMC**

EMCABS: 01-11-2010

A BROADBAND TIME-DOMAIN EMI MEASUREMENT SYSTEM FOR MEASUREMENTS UP TO 18 GHZ

+ Christian Hoffmann, ++ Stephan Braun and +++ Peter Russer
+ Technische Universität München, Lehrstuhl für Hochfrequenztechnik, Munich, Germany
++ GAUSS INSTRUMENTS GmbH, Munich, Germany
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Proceedings of 9th International Symposium on EMC Joint with 20th International Wroclaw Symposium on EMC, EMC Europe 2010, Wroclaw, Poland, September 13–17, 2010, pp. 34–37.

Abstract: Using time-domain methods, emission measurements can be accelerated by several orders of magnitude in comparison to measurements with traditional EMI-receivers. In this paper, a novel time-domain EMI measurement system for the frequency range from 9 kHz to 18 GHz is presented. It combines ultra-fast analog-to-digital-conversion and real-time digital signal processing on a field-programmable-gate-array (FPGA) with ultra-broadband multi-stage down-conversion. With a 9 kHz IF-filter, a measurement over the whole frequency range can be performed in approximately three minutes with the highest sensitivity. The results of the noise-floor measurements imply that the system, with its low noise figure of 6–8 dB, meets the enhanced sensitivity requirements over the whole frequency range up to 18 GHz.
Index terms: EMI, time-domain measurements, FPGA, multi-stage down-conversion.

EMCABS: 02-11-2010

WHOLE-BODY AVERAGED SAR MEASUREMENT FOR POSTURED JAPANESE HUMAN MODELS USING CYLINDRICAL-EXTERNAL FIELD SCANNING

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Proceedings of 9th International Symposium on EMC Joint with 20th International Wroclaw Symposium on EMC, EMC Europe 2010, Wroclaw, Poland, September 13–17, 2010, pp. 73–76.

Abstract: The purpose of this study is to establish a whole-body averaged specific absorption rate (WB-SAR) experimental estimation method using the total power absorbed by humans; a cylindrical-external field scanning technique is used to measure the radiated RF (radio-frequency) power. This technique is adopted with the goal of simplifying the exposure dosimetry of humans of different postures and/or sizes. We have carried out

experimental estimations using a constructed SAR measurement system for standing and sitting human models.
Index terms: Whole-body averaged SAR, human exposure, FDTD technique, cylindrical fields scanning, silicone rubber phantom.

EMCABS: 03-11-2010

FIELD COUPLING TO RANDOMLY-ROUTED WIRES: THEORETICAL AND EXPERIMENTAL COMPARISON

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Proceedings of 9th International Symposium on EMC Joint with 20th International Wroclaw Symposium on EMC, EMC Europe 2010, Wroclaw, Poland, September 13–17, 2010, pp. 113–118.

Abstract: The coupling of electromagnetic fields to randomly routed wires is studied in this article. Random wire configurations are generated through a stochastic model and estimations of the output currents are based on Transmission Lines Theory. Several random configurations are manually reproduced with a copper wire and used for measurements in a GTEM cell and a Fully Anechoic Chamber. Comparisons between theoretical and experimental results are provided. Statistical behaviors of the randomly-routed wires according to the incident field polarization angle are shown. Likewise, a fast method to estimate the wires' statistical parameters and maximum interference values is presented.

Index terms: NUTL, randomly-routed wire, GTEM cell, fully anechoic chamber, Monte-Carlo simulations, stochastic collocation method, maximum interference.

EMCABS: 04-11-2010

MODELING OF BULK CURRENT INJECTION (BCI) SETUPS FOR VIRTUAL AUTOMOTIVE IC TESTS

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Proceedings of 9th International Symposium on EMC Joint with 20th International Wroclaw Symposium on EMC, EMC Europe 2010, Wroclaw, Poland, September 13–17, 2010, pp. 123–128.

Abstract: The Bulk Current Injection (BCI) method is widely used for RF immunity testing of automotive systems and ICs in the electronics industry. During testing, detected IC failures may lead to expensive redesigns and cause seriously delays of a product launch. To evaluate the chip immunity in early design stages, it is desired to perform virtual tests based on accurate models. In this paper, an accurate and fast to simulate behavioral model of a BCI injection clamp is presented. The applicability is shown with an RF immunity investigation of a sample DUT. Several different configurations of the BCI test setup with different wire lengths and application-dependent line terminations are analyzed. Specific attention is paid to test setup configurations where supply and ground cables are subject to injection. The common and differential mode disturbances and PCB ground shifts are measured and modeled. The simulations show good correlation to measurements and allow performing RF immunity investigations of the designed DUTs on earlier design stages.

Index terms: Automotive EMC, IC EMC, bulk current injection (BCI), common and differential mode disturbances.

EMCABS: 05-11-2010

K-FACTOR AS AN ACCURATE ESTIMATOR OF THE STIRRING EFFICIENCY IN REVERBERATION CHAMBER

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Proceedings of 9th International Symposium on EMC Joint with 20th International Wroclaw Symposium on EMC, EMC Europe 2010, Wroclaw, Poland, September 13–17, 2010, pp. 179–184.

Abstract: The paper aims to improve the characterization of the electromagnetic environment in a mode-stirred reverberation chamber. The ideal Rayleigh distribution of a rectangular component of the electric field requires that all the propagating paths are well stirred. That means that no unstirred energy remains during the stirring process. This work focuses on a meticulous analysis of the Rician K-factor as a potential estimate of the quality of the reverberating environment. A comparison with high power goodness-of-fit tests results show that estimating K should be highly recommended for evaluating the accuracy of the mode stirring process.

Index terms: Efficient stirring, goodness-of-fit tests, K-factor, Rayleigh, reverberation chamber, Rice.

EMCABS: 06-11-2010

BROADBAND DETERMINATION OF COMPLEX PERMITTIVITY AND PERMEABILITY OF HIGH-LOSS MATERIAL

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Proceedings of 9th International Symposium on EMC Joint with 20th International Wroclaw Symposium on EMC, EMC Europe 2010, Wroclaw, Poland, September 13–17, 2010, pp. 221–224.

Abstract: A coaxial-line-based technique is investigated to characterize the complex EM-parameters of high-loss material over a broad frequency band. To simultaneously determine complex permittivity and permeability, two complex reflection coefficients are measured from the material-under-test with two different thicknesses. After a brief discussion of the principle of the

proposed technique, uncertainty analysis is conducted to perfect this technique. Uncertainty equations in differential forms are established for the simultaneous measurement of complex electromagnetic (EM) parameters in the systematical consideration of various error factors in measurement. Worst case differential uncertainty equations were defined while the implicit partial derivation techniques were used to find the coefficients in formulation. Finally, sample materials are measured by the proposed technique from 4 to 16 GHz. Good agreement between the measured and reference data validates the effectiveness of our analysis.

Index terms: Coaxial probe, two-thickness-method, EM parameters, uncertainty analysis, high-loss material.

EMCABS: 07-11-2010

ON THE USE OF REVERBERATION CHAMBER TO SIMULATE THE POWER DELAY PROFILE OF A WIRELESS CHANNEL

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Proceedings of 9th International Symposium on EMC Joint with 20th International Wroclaw Symposium on EMC, EMC Europe 2010, Wroclaw, Poland, September 13–17, 2010, pp. 245–249.

Abstract: The purpose of this paper is to provide some further observations on the use of reverberation chambers to imitate real wireless channels. It is shown that when the RMS delay spread is calculated, an appropriate threshold has to be chosen. Based on the threshold value, the required dynamics of measurements performed for realistic wireless channels can be estimated. It is also shown that the reverberation chamber loading method allows only for representing outdoor channels.

Index terms: RMS delay spread, multipath propagation, wireless environment, reverberation chamber, power delay profile.

EMCABS: 08-11-2010

STATISTICAL PROPERTIES OF ELECTROMAGNETIC ENVIRONMENT IN WIRELESS NETWORKS, INTRA-NETWORK ELECTROMAGNETIC COMPATIBILITY AND SAFETY

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Proceedings of 9th International Symposium on EMC Joint with 20th International Wroclaw Symposium on EMC, EMC Europe 2010, Wroclaw, Poland, September 13–17, 2010, pp. 619–624.

Abstract: Statistical properties of the electromagnetic environment in wireless networks affecting its intra-network electromagnetic compatibility and safety are studied. The analysis is based on the standard propagation channel model, a Poisson model of random spatial distribution of transmitters, and a threshold-based model of the victim receptor behavior (radio receiver or human body). The distribution of the dominant interference level is derived and analyzed under various network and system configurations. The aggregate interference is dominated by the nearest transmitter one. The distribution of the unordered single-node interference is independent of the transmitters' power and their spatial density and is the same for homogeneous and non-homogeneous networks. The outage probability is used as a measure of not only the wireless link quality-of-service, but also of environmental risks induced by electromagnetic radiation. The maximum acceptable interference levels for reliable link performance and for low environmental risks are surprisingly similar.

Index terms: Electromagnetic environment, dynamic range, outage probability, wireless networks.

EMCABS: 09-11-2010

RFID SYSTEM EVALUATION AGAINST RADIATED TRANSIENT NOISE

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Proceedings of 9th International Symposium on EMC Joint with 20th International Wroclaw Symposium on EMC, EMC Europe 2010, Wroclaw, Poland, September 13–17, 2010, pp. 625–628.

Abstract: In this paper a radiofrequency identification system according to standard ISO/IEC 14443 type-B is evaluated in the presence of transient noise. This real time communication system working at 13.56 MHz is interfered in a controlled environment by different transient bursts varying their level, frequency and duration. The transient burst interference is applied in an AC main wire close to the system and the effect over the digital communication system is evaluated using two different methods. The first one is observing directly RFID equipment in the presence of transient signals, and the second one is capturing the interference in the time domain and evaluating its effect by means of simulation. The RFID system is affected by these transient noises causing different types of errors. It is shown that it is essential to measure and evaluate in time domain the transient phenomena to ensure that the RFID system do not have susceptibility problems.

Index terms: Transient, RFID, measurement, digital communications.

EMCABS: 10-11-2010

FAR-FIELD AND NEAR-FIELD ANALYSIS OF SHIELDING EFFECTIVENESS OF SLOTTED ENCLOSURE AT FREQUENCIES BELOW 1 GHz

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Proceedings of 9th International Symposium on EMC Joint with 20th International Wroclaw Symposium on EMC, EMC Europe 2010, Wroclaw, Poland, September 13–17, 2010, pp. 635–638.

Abstract: Shielding Effectiveness (SE) calculated for a metal slotted enclosure, obtained using three different software suites (FEKO [1], WIPL-D [2] and COMSOL [3]) is presented. For the

SE analysis, the electromagnetic field in both near as well as far field is considered. The effect of the spatial radiation pattern of an enclosed radiator on the results of SE calculations has been taken into account using the Poynting (S) vector integration and compared with other common methods of SE analysis. The FEKO, WIPL-D and COMSOL outputs were found to be in good agreement.

Index terms: Shielding effectiveness, slotted enclosure, far-field, near-field, numerical simulation.

EMCABS: 11-11-2010

ESTIMATION OF RISE TIME AND FREQUENCY SPECTRA OF DISCHARGE CURRENT WAVEFORMS FOR AIR DISCHARGES OF AN ESD-GUN WITH LOW CHARGE VOLTAGES

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Proceedings of 9th International Symposium on EMC Joint with 20th International Wroclaw Symposium on EMC, EMC Europe 2010, Wroclaw, Poland, September 13–17, 2010, pp. 757–761.

Abstract: The discharge current waveform for air discharges of an ESD-gun with low charge voltages onto a wideband current detector was measured for a bandwidth of 12 GHz. To grasp real rise time of the observed current waveform, input current waveform was estimated from the frequency response of the second order low pass filter of the oscilloscope, which showed that a minimum value of the estimated rise time is 17 ps. Frequency spectra of the estimated current waveforms are also compared with those of measured ones. As a result, for air discharges at several hundred volts, frequency spectra of estimated waveforms have the higher frequency components than measured ones above 2 GHz.

Index terms: Air discharge, discharge current waveform, ESD gun, frequency spectrum, IEC 61000-4-2, rise time.

EMCABS: 12-11-2010

HIGH-FREQUENCY EFFECTIVE IMPEDANCE OF MICRO-WIRES BASED ON CARBON NANOTUBE TECHNOLOGY

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Proceedings of 9th International Symposium on EMC Joint with 20th International Wroclaw Symposium on EMC, EMC Europe 2010, Wroclaw, Poland, September 13–17, 2010, pp. 857–862.

Abstract: The skin-effect modeling of isolated micro-wires with rectangular cross-section, consisting of bundles of single wall (SW) or multi-wall (MW) carbon nanotubes (CNTs) is developed. The bundles are treated as homogeneous materials with ac effective conductivity, which is evaluated using the Drude's complex expression. A new formulation is proposed for MWCNT bundles. The frequency-domain distribution of the bundle current density is used to obtain the expressions of the skin depth and of the effective inner impedance. Applications to SWCNT and MWCNT-based micro-wires having different configurations are carried out. The obtained results show the saturation behavior of the effective inner resistance and inductance above a critical frequency, which depends on the momentum relaxation time of the CNTs.

Index terms: Carbon nanotube bundle, skin effect, effective impedance, transmission lines.

The Technology Management Council

By Michael Condry

The EMC Society is one of 14 founding Member Societies of the IEEE Technology Management Council (TMC) and has a voting representative on its Board of Governors: Kimball Williams, past EMC Society president. The TMC provides an opportunity to network with leaders from the other Member Societies in their common pursuit of the mission and goals of the TMC, and to explore additional ways for the Member Societies to interact with each other and discover programs to help sponsor society membership.

All engineering disciplines, including EMC, need to understand and work with management requirements in order to operate within the business environment. This includes managers, engineers and industry researchers. As a council, TMC focuses on the elements of technology management using the specific needs of industry in the supporting societies. In this manner, the mission and goals of the TMC can enhance the experience, knowledge, and skill sets of EMC members who now also are, by virtue of the EMC Society being a TMC Member Society, members of their local TMC Chapter.

Opportunities to network will exist at societal conferences as well. Anyone with an interest in the management of technology, management principles in general, or who is a technical professional responsible for technology management, or is striving to become a manager, should have an interest in the offerings of the TMC. Corporate individual contributors will also benefit from tutorials on how to best survive in industry where employee responsibilities will require contributions to planning, budget and reviews in addition to the expected engineering design and development for products and research.

EMC Society members may want to subscribe to the TMC publications. The *Transactions on Engineering Management* is research-oriented, and the popular *Engineering Management Review (EMR)* is a compilation of papers reprinted from the most respected engineering and technology management journals in the world, as selected by its editorial board. The EMR is targeted more for the practicing professional. TMC has conferences that are attracting business needs of its society members and is developing tutorials and distinguished speakers that can be used within society conferences.

Information about the TMC can be found at http://www.ieeetmc.org/. **EMC**

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Francesca Maradei
IEEE EMC Society President (2010-2011)

EMC Society Board of Directors Meeting

The Fort Lauderdale Convention Center
Fort Lauderdale, FL
July 25 and 29, 2010

The President's Opening Remarks

President Maradei called the meeting to order at 9:00 am on July 25. A round of introductions was made. Board members present included H. Benitez, C. Brench, L. Cohen, R. Davis, A. Duffy, R. Ford, F. Heather, D. Heirman, D. Hoolihan, T. Hubing, E. Joffe, R. Jost, J. LaSalle, F. Maradei, A. Marvin, J. Norgard, M. Oliver, J. O'Neil, G. Pettit, R. Scully, V. Roje, K. Williams, and T. Yoshino. Members absent included W. Schaefer and Andre Pavas (Gold Member). Guests present included B. Archambeault, M. Bosley, H. Garbe, R. Hofmann, M. Montrose, S. Pignari, F. Sabath, and Q. Ye. Ms. Maradei reviewed Board meeting protocol, the IEEE code of ethics, and upcoming activities. Roger Sudbury, IEEE Division IV Director, gave a brief presentation on the IEEE organization. He noted that membership is increasing in IEEE and the overall outlook is positive. Membership growth is increasing in Asia such that the IEEE is opening an office in India. Regarding Global Outreach activity, Ms. Maradei noted she attended the Asia Pacific EMC (APEMC) conference in Beijing and then traveled to Shanghai to give a presentation at the inaugural EMC Chapter there. She visited the Seattle EMC Chapter in June and gave a presentation at the Chapter's one day colloquium and exhibition. Finally, she will attend EMC Europe and the Poland Chapter meeting in Wroclaw in September. She will present at the Pittsburgh Chapter meeting in November and potentially at the new Nigeria Chapter this fall. Ms. Maradei then presented a summary of the recent activity at the IEEE TAB meeting in Montreal. The report included information on IEEE "Out of House" publishing and the issue of documents not being in the proper format for publication on *Xplore*. There will be a new charge of $500 for technically co-sponsored conferences that do not publish with IEEE on *Xplore*. TAB approved a maximum 75 words for the Field of Interest statement for all Societies. TAB approved the branding of non sponsored conference content on *Xplore*. New templates were provided for IEEE websites. The five year review of the EMC Society will take place during the IEEE TAB meeting series in Miami over February 15–20, 2011.

Consent Agenda Motions

The agenda was presented for review. The Board approved the consent agenda which included the August 2010 meeting agenda and the March 2010 Board meeting minutes. The approved March 2010 Board minutes will be posted to the EMC Society website. Secretary O'Neil provided a summary of e-motions made subsequent to the March 12, 2010 Board meeting and prior to the July 24, 2010 Board meeting. These included approval of the MoU Cooperation with CEM 2011, the 2011 01900 committee and other budget, and a loan of $50,000 to the EMC 2011 Symposium Committee.

Treasurer's Report

John LaSalle presented a report the EMC Society finances. Regarding the 2010 budget through June 2010, operations are considered to be "normal" with a surplus of $147,600. The Society is tracking toward the budgeted net of $18,700. Committee expenditures are minimal, operating toward an approved budget of $255.4k (deficit). Travel expenses were reviewed with the major expenses being the Distinguished Lecturer program and the Board AdCom operations. Under miscellaneous activity, he noted that the Board approved the $50k loan to the 2011 Symposium Committee (a transfer request was made to IEEE Conference Finance and deposited

The EMC Society Board of Directors held a meeting on Sunday, July 25 for the first of two Board meetings planned for the symposium week.

Board member Elya Joffe (left) of KTM Project Engineering enjoyed some musical moments in the exhibit hall. Jeff Silberberg of the FDA accompanied Elya for a jam session.

The poster sessions attracted those who were interested in speaking one on one with the presenters, including Board member Mike Oliver (right) of MAJR Products.

to the 2011 Concentration Bank Account on June 15, 2010); Angel funds approved included a payment to Dr. Jamal Shafii, Rock River Valley, North Central Illinois; Wong Tsz Ching Patrick, Hong Kong Chapter and the New England Chapter. The University Grant is in-process to Dr. Uma Balaji of Farmingdale State College. Mr. LaSalle discussed the second pass budget for 2011 in detail and concluded his report with a summary statement of the budget as of May 2010.

Communication Services

Todd Hubing, Vice-President for Communication Services, presented his report. Newsletter Editor Janet O'Neil reported on Newsletter finances for the past two issues. The Spring 2010 issue of 92 pages cost $17,553 for the printing and mailing of 4,768 Newsletters. There were 18 advertisers in the issue that generated $24,822.96 in billed ad revenue, of which the EMC Society received a net of $13,663.63. The Winter 2010 issue of 96 pages cost $20,260 for the printing and mailing of 5,552 Newsletters (extras were ordered for distribution from the EMC Society membership booth at conferences earlier this year). There were 14 advertisers in the issue that generated $16,184.50 in billed ad revenue, of which the EMC Society received a net of $8,901. Ms. O'Neil attended the IEEE Panel of Editors meeting in New Jersey in April and met with IEEE personnel about outsourcing the composition of the EMC Newsletter outside IEEE. She attended the TAB meetings in Montreal in June to present Phase 1 of a proposal to transition the Newsletter to a Magazine. The proposal passed and she will present Phase 2 of the proposal at the TAB meetings in New Brunswick this November. If Phase 2 is approved, the new EMC Magazine will formally launch in 2012. The EMC Newsletter will cease production at that time. Ms. Maradei reported on the IEEE review of the *Transactions on EMC* conducted at the TAB meetings in Montreal this past June. In general, the review was positive as the Impact Factor (IF) has increased from 1.083 to 1.294 which is a significant increase. She summarized the recommendations for improvements to the *Transactions on EMC*. Professor Heyno Garbe, the Editor-in-Chief of the *Transactions on EMC*, will address these recommendations moving forward. Dick Ford volunteered to be a member of the committee that conducts the survey of members on their publishing needs. On the suggestion to publish six issues per year, Professor Garbe will look at this carefully and make a recommendation to the Board. Initially he is looking at six issues per year at fewer pages per issue. For example, currently there are four issues per year at some 250-300 pages each. He envisions six issues at some 150-200 pages each. This will expedite the publishing of papers; however, production costs will increase. He will look into this and report to the Board at the next meeting. Dan Hoolihan, Chair of the EMC Society's History Committee, reported that several articles were submitted on historical stories and personalities for the Spring 2010 issue. Mr. Hoolihan attended his first meeting with the IEEE History Committee on March 7, 2010 in Newark, New Jersey. Preliminary discussions have been held with the EMC Society Awards Committee about revising the display of EMC Society Hall of Fame Award winners on the IEEE EMC Society web page. The goal is to make it more of a "virtual museum" with the winners' pictures, certificates, and achievements. Work continues on defining which EMC Society historical documents should be targeted for digitization in 2010. The primary goal is to digitize the EMC Society Newsletters. Additional suggestions are welcomed from members of the Board of Directors. Mr. Hubing talked about improvements to the EMC Society website. In the past few months, he has worked on cleaning up, organizing and updating the website. Any comments on the website should be sent to Professor Hubing. Lastly, Ray Perez, Chair of the IEEE Press committee, reviewed his ideas to formalize a process for reviewing and accepting/rejecting proposed books to be published under the IEEE Press banner. Currently there are no guidelines for this process.

The symposium provided a great opportunity for reconnecting old friends with past and current Board members, including (from left) David Arnett of HP, Bob Johnk of the Institute for Telecommunication Sciences (NTIA/ITS), Elizabeth Scully, Dave and Barbara Staggs, Don Heirman of Don HEIRMAN Consultants, and Bob Scully of NASA.

Technical Services

Bob Scully, Vice-President for Technical Services, presented his report. The number of student papers submitted was the highest ever at 33 papers. For EMC 2010, the total number of papers submitted was 163, with 131 accepted, 20 rejected,

Kimball Williams (far left) of Denso International America stopped by the ANSI ASC C63® booth to say hello to Don Heirman and Bridgett Hoolihan. In the EMC Society membership booth nearby, EMC Society Founder Milton Kant (in rear) looks on.

EMC Society Treasurer John LaSalle of Northrop Grumman brought his wife Diane and son Ryan to the 2010 IEEE International Symposium on EMC in Fort Lauderdale.

and seven withdrawn. Bruce Archambeault, Technical Advisory Committee (TAC) Chair, reported on the activities of his committee. A TAC meeting was held on 17–18 May 2010 at the Naval Research Lab and was hosted by Larry Cohen. During this meeting, the accepted papers for EMC 2010 were assigned into sessions. Of the papers submitted, TC2 (EMC Measurements) had the highest number of papers accepted at 31 papers; TC4 (EMI Control) accepted 22 papers; TC9 (Computational EMC) accepted 16 papers and TC10 (Signal Integrity) accepted 11 papers. Dr. Archambeault noted 34 papers were submitted for special sessions, 19 papers were submitted for posters (plus an additional 16 posters by BoD members), and 17 workshop/tutorials were approved. Clear Technical Committee (TC) policies and procedures are still not available to TAC; Dr. Archambeault will elaborate on this further at the Thursday evening Board meeting. Kimball Williams, the EMC Society Liaison to the Society on the Social Implications of Technology (SSIT), presented a report on the history and current activity of the SSIT. He noted the SSIT provides a forum where people from many disciplines can come together to discuss wide-ranging topics about technology and society. The SSIT focuses on the impact of technology (as embodied by the fields of interest of IEEE) on society, including both positive and negative effects; the impact of society on the engineering profession; on the history of the societal aspects of electrotechnology; and professional, social and economic responsibility in the practice of engineering and its related technology. The SSIT currently has about 2,000 members worldwide. It publishes the Technology and Society Magazine, and sponsors a periodic conference. Currently, the SSIT is active in Humanitarian Technology, Smart Grid, Plug-in Electric Vehicles, and Green Engineering. Mr. Williams concluded his report by noting that the SSIT receives an increasing proportion of its revenues from its share of charges that libraries and other institutional users pay for receiving print and electronic publications from IEEE. However, changes recently made in the way this income is allocated within IEEE threaten to reduce SSIT's revenues to the point that its fiscal stability may be in doubt in the future. The Board should be aware of this development.

Member Services Report

Bob Davis, Vice-President for Member Services, presented his report. He would like to see a Sections Coordinator position created to improve the relationship between the Society and the Society Chapters with the Sections. This person would help coordinate our local activities with the Sections and could serve as our EMC Society representative to the Sections Congress, if so designated by the VP for Member Services and the President. The Board approved the establishment of a Section Coordinator position under the VP for Member Services and the appointment of Henry Benitez as the new Sections Coordinator. On the EMC Society "Sister Society" committee, Mr. Davis noted the Sister Society coordinator, Chuck Bunting, would like to send draft agreements to potential candidates for sister societies. He presented a Sister Society Agreement (SSA) that would need to be filled in with the candidate society's information and particular details. This document would serve as the platform for discussions in negotiating implementation details. The Board approved the use of the "Draft SSA Main Agreement" as the basis for discussion with candidate sister societies, retaining the "Draft" designation until preparation for a motion for full approval granting Sister Society Status. Next, Dr. Archambeault asked the Board to review and approve four new DL candidates for a two year term beginning January 1, 2011. The Board approved Chuck Bunting, Wen-Yan Yin, Jerry Ramie and Jerry Meyerhoff as Distinguished Lecturers for 2011–2012. The DLs for 2010–2011 include Dr. Giulio Antonini, Mark Steffka, and Dr. Omar Ramahi. From the DL surveys, approximately 39% of the meeting attendees are IEEE members, approximately 17% are EMC Society members and 91% of the attendees claim to be technical. When asked how often the person attends a chapter meeting, 45% responded that the DL meeting was their first meeting attended while 30% responded that they rarely attend chapter meetings. Dr. Archambeault noted four Respected Speaker Bureau (RSB) talks have been presented in 2010. The current speaker list includes Colin Brench, Alistair Duffy, Jim Drewniak, Tzong-Lin Wu, Cheung-Wei Lam, Eric Bogatin, Werner Schaefer, David Pommerenke, Bruce Archambeault, Elya B. Joffe, Jun Fan and Chris Holloway. Next, Membership Coordinator Colin Brench advised 22 members have been elevated from member

(From left) EMC Society President Francesca Maradei of the University of Rome "La Sapienza" joined Board members Vesna Roje of the University of Split in Croatia and Janet O'Neil of ETS-Lindgren at the symposium Gala event in Fort Lauderdale.

to senior member this year to date. Current membership is at 3,797 (without affiliates); this is a decline of 27 members or 0.7% since this time last year. EMC Society Student membership is down 15.45% from this time last year to 66 student members. There still remain issues with the database, which is currently affecting the Completed Careers Committee from identifying if deceased individuals were IEEE EMC Society members. Bruce Archambeault then reported on Awards. Photos for the major award recipients have been collected and will be seen as posters in the registration area. Don Heirman reported on the "Completed Careers" committee (CCC) activity. Doug Robertson was honored in the Spring 2010 EMC Newsletter. The CCC continues to process the EMC Society major contributors that have passed away. They are looking for new CCC members that can be active. A letter of condolence along with three copies of the Winter 2010 EMC Newsletter were sent to the widow of Ralph Calcavecchio who was profiled in that issue. Frank Sabath provided a detailed report for Region 8. Currently there are 1,225 active members (87 less than his last report); 124 members are in arears (e.g. member who has not paid the membership fee) and there are 124 inactive

Board member Ghery Pettit of Intel also enjoyed the symposium Gala, along with his wife Marilyn and a friendly pirate.

members. Within 17 sections there are 12 EMC Chapters and six joint/EMC Chapters. An analysis of active member distribution shows that six sections (Denmark, Greece, Iran, Nigeria, Serbia and Montenegro) have enough active members to form an EMC chapter. Dr. Sabath plans to send an email to the chairs of these sections in order to get their support for the formation of a new EMC Chapter. Maria Alejandra Mora reports that since her last membership report, EMC Society membership in Region 9 has been stable, with a slight increase in South Brazil, Argentina, and Venezuela. The top five sections in Region 9 include the largest being South Brazil, followed by Argentina, Columbia, Mexico and Venezuela. The goal is to create EMC Chapters in Mexico and Venezuela; however, it has been difficult to work with the Section's chairs, as they don't respond to e-mail. Takeo Yoshino reported on Region 10 activity. He attended the Asia-Pacific EMC Week held April 12–16 in Beijing, China. The IEEE China Section, IEEE EMC and MTT Societies were co-sponsors of the symposium. The scale of this symposium was similar to our usual IEEE EMC Society International Symposium with approximately 500 attendees. He manned the IEEE EMC Society membership booth and received over 50 membership applications. Over a 100 students visited our booth, however, he doesn't expect more than 5 - 10% of the applications will result in new EMC Society members due to financial constraints. EMC Newsletters and EMC 2010 Symposium information were distributed from the membership booth. Professor Yoshino also attended the 4th Pan Pacific EMC Joint Meeting (PPEMC'10) held May 27–28 at the Cyberscience Center of Tohoku University, in Sendai, Japan. He staffed the EMC Society membership booth and reported receiving three membership applications from Taiwanese and Malaysian students. There were 190 attendees at this conference. For future activity, Professor Yoshino will work to increase membership in the new highly industrialized developing countries in Region 10. He would like to establish new chapters in Australia, Thailand, Philippines, Vietnam, Cambodia, Indonesia, Myanmar, Pakistan, Nepal, New Zealand and North Korea. He plans to work with Mr. Davis in developing a strategy to increase membership in China. Next, Chapter Coordinator Sergio Pignari reported there are now 73 chapters. The top regions for chapters include Regions 1–6 with 33 Chapters, Region 8 with 20 Chapters, and Region 10 with 13 Chapters. He has completed a review and update of the Chapter Chair Directory. A Chapter Chair training session with dinner will be held on Monday, July 26. The Chapter awards will be presented as announced at the March Board meeting. Kimball Williams then presented a report on PACE. He advised a significant lesson learned from the most recent economic climate upheaval is that a continuing focus must be set on the factors affecting employment, career transition planning and student professional awareness. He noted at this symposium there will be a new 'Job Fair'. Special notice and thanks should be directed to John Wyncott who has launched this significant expansion of the initial Austin EMC 2009 experiment. It is important to note that the evolving set of "Leadership" lectures sponsored by TC 1, which drew strong support in Austin at EMC 2009, and is expanded at EMC 2010, focuses on the 'Soft Skills' that relate directly to the PACE objectives of Ethics, Professional Awareness and Career transition planning. Mr. Davis noted he is having trouble communicating with Andre Pavas, the GOLD representative to the Board.

Conference Services

Ghery Pettit, Vice-President for Conferences, presented his report. He reported briefly on EMC 2010 in Fort Lauderdale, FL. He then presented several motions related to future symposium locations. The Board approved holding the 2014 IEEE International Symposium on EMC in Raleigh, NC, the 2015 IEEE International Symposium on EMC in Dresden, Germany, and the 2016 IEEE International Symposium on EMC in Ottawa, Canada. Mr. Pettit then discussed the greater Washington, DC area as the location for the 2015 IEEE National Symposium on EMC. The result of discussion was to delay voting on this location until more information could be provided.

Past President Report

Elya Joffe presented his report. He reviewed the process and required documentation for presenting motions to the Board. He then presented several motions. The Board approved the motions on Elections and Electioneering; on the Correction of Committees Structure in EMC Society Bylaws, on the Correction of Committees Structure in EMC Society Policies and Procedures; and the Amendment of the EMC Society Field of Interest to reflect grammatical corrections.

New Business

Ms. Maradei presented a tentative list of Board meeting locations and dates for 2011. There are only three Board meetings scheduled for 2011 to take into account the last meeting of the year being held in Rome, Italy.

Suspension of Meeting

Ms. Maradei suspended the meeting at 5:00 pm. The meeting will continue on Thursday evening, July 29 at 6:00 pm.

Continuation of Board Meeting on July 29, 2010, 6:00 pm

Board members present included: H. Benitez, C. Brench, L. Cohen, R. Davis, R. Ford, F. Heather, D. Heirman, D. Hoolihan, T. Hubing, E. Joffe, R. Jost, J. LaSalle, F. Maradei, A. Marvin, J. Norgard, J. O'Neil, G. Pettit, R. Scully, K. Williams, and T. Yoshino. Guests presented included: F. Sabath, E. Li, M. Bosley, B. Archambeault, D. Arnett, K. Phipps, R. Hofmann, B. Brench, K. Phipps, J. Maas, R. Adams, S. Pignari, and H. Garbe. Members absent included: W. Schaefer, M. Oliver, A. Duffy, and A. Pavas.

Standards Services

John Norgard, Vice-President for Standards Services, presented his report. From SDCom, this includes activity from Chair Andy Drozd, on SACCom from Chair Werner Schaefer and on SETCom from Chair Qiubo Ye. There was considerable activity related to the Smart Grid. SETCom is currently preparing a tutorial on this topic for EMC 2011. The committee holds bimonthly telecom meetings. Don Heirman then elaborated on the Smart Grid and general Standards related activity during the symposium week.

Bob Davis (standing) of Lockheed is shown giving his report at the second meeting of the EMC Society Board of Directors on July 29 in Fort Lauderdale.

Technical Services

Bob Scully, Vice-President for Technical Services, reported on activity during the symposium week. He noted that ESAC will be focusing on a clearer vision of EMC curriculum for the Global EMC University, Academy and ESAC Fundamentals workshop. Mr. Scully then spoke about two new awards: an award for continuing EMC engineering education and an award for an outstanding EMC engineer educator. This would be a bi-annual award with the two awards presented on alternating years. Elya Joffe discussed a new EMC Society student ethics competition. The Board approved the proposal for the EMC Society Student Ethics Competition (SEC) effective in 2011, contingent upon a budget of $800 being available. Mr. Scully then advised Larry Cohen is stepping down as the secretary of ESAC. He will be replaced by Bogdan Adamczyk of Grand Valley State University.

Member Services

Bob Davis, Vice-President for Member Services, talked about chapter development and member recruitment. He addressed the China growth initiative. He would like to publish a membership article in a Chinese EMC magazine. He noted there are two IEEE offices in Asia – Singapore and Beijing – that he will contact to solicit assistance in promoting EMC

The second Board meeting on Thursday evening, July 29, allowed up to date reporting on activity during the symposium week.

(From left) Board member Bob Davis, VP for Member Services, stops by the EMC Society Membership booth to visit with Denise Hall and Bob Dockey who ably staffed the booth and recruited several new members.

Board member Vesna Roje visits with David Britton of Hewlett-Packard during the welcome reception which began in the exhibit hall.

Society membership. He would like to have an EMC Society membership booth at the Shanghai EMC conference in November. Takeo Yoshino is available to attend and staff a membership booth.

Conference Services

Ghery Pettit, Vice-President for Conference Services, discussed the IEEE EMC Symposium in Washington DC in 2015. Since there were still questions from the Board on the dates for this symposium, it was agreed to delay discussion until the November Board meeting. Fred Heather then provided a summary of activity at EMC 2010. He showed a presentation given at the wrap up meeting held earlier that afternoon. Attendance totaled 1,701. He will email his summary report to the Board. Janet O'Neil briefly spoke about the exhibitor's breakfast held that morning. In general, the exhibitors noted they prefer a host hotel for the symposium so they can easily meet with their customers. There was a complaint about the exhibit hall layout and points system not being used to assign space. Another complaint involved the serving of alcohol in the exhibit area. The exhibitors continue to ask if there can be exhibit hours that do not compete with the technical program. The Board approved the service of alcoholic beverages by exhibitors in the exhibit hall provided this is pre-approved by the Board of Directors. Mr. Pettit then talked about technical co-sponsorship and the timeline to implement this for non EMC Society organized conferences. The committee reviewing this process includes Francesca Maradei, Bruce Archambeault, Frank Sabath, Bob Scully, and Ghery Pettit. There are basically two types of agreements – those made with conferences with which we have had a long-standing relationship and those made on a case-by-case basis. Frank Sabath, Region 8 Coordinator, will develop a form for requesting technical co-sponsorship. This must be completed in full to provide TAC with the necessary information to evaluate the level of effort needed to support, or to deny support. TAC will determine the level of support based upon their evaluation of the work required. Mr. Sabath noted that there are three applications for technical co-sponsorships waiting to be reviewed. Mr. Pettit advised that the IEEE has currently put all requests for technical co-sponsorships on hold.

Strategic Planning Update

Francesca Maradei discussed the long range versus strategic planning process. She presented a table that summarizes what has been completed and what items require attention. The VPs were challenged to address and complete one goal in 2011. She would like to see the document completed and ready for review at the November 2010 Board meeting.

Unfinished Business

Dick Ford talked about his archive of photos collected during his years as the EMC Society photographer. The Board approved increasing the budget to digitize the photos in Mr. Ford's photo archive.

New Business

The following items were discussed under New Business:

E-Membership – Francesca Maradei discussed the IEEE project to increase membership in developing countries where the GDP/Capita is less than $15,000 USD. Electronic or E-Membership is proposed for $50 annually. Print copies of IEEE magazines and journals will not be provided for e-members. The IEEE would like to see Societies develop their own models for e-membership.

TAC Forum – Bruce Archambeault noted that Jun Fan has developed a TAC Forum for improving communication within TAC. Documents can be posted, mass email blasts can be distributed, dialogue on an issue shared, etc. See www.ieee.emc-center.org for more information.

Proposal for Future Co-Sponsorship of the APEMC Week 2012 – Erping Li presented ideas for discussion of combining the APEMC conference and the IEEE EMC Symposium to have one conference in Asia.

Summary of Financial Impact of Approved Motions – Ms. Maradei noted this total amounted to $1,800 for the two motions approved at the July 29 meeting.

EMC 2010 – Technical Material Distribution - Fred Heather led a discussion on having a CD of the symposium records available for download via an FTP site versus sending the CD via regular mail as in the past. This would save considerable money. Fred will lead a discussion on this and propose a motion in the next few months.

Action Item Review

Secretary O'Neil recounted the new action items assigned during the Fort Lauderdale meetings and reviewed the status of the action items from previous meetings. The updated consolidated list of action items will be distributed following the meeting.

Arjournment

Ms. Maradei adjourned the meeting at 10:00 pm.
Submitted by:

Janet O'Neil
Secretary, EMC Society Board of Directors

New Members of the EMC Society Board of Directors Announced!

A ballot for the election of six members to the IEEE Electromagnetic Compatibility Society Board of Directors was posted and e-mailed to all members of the EMC Society in August 2010. The ballots returned have been counted, and the following candidates have been elected for a three-year term beginning 1 January 2011:

Chuck Bunting	Robert Davis
Todd Hubing	Ryuji Koga
Kermit O. Phipps	Donald L. Sweeney

We wish the newly elected members of the Board of Directors success and thank all candidates for their willingness to serve and for permitting their names to be included on the ballot.

Brief biographies of these candidates will be featured in the next issue of the EMC Newsletter.

Past Presidents of the EMC Society

PHOTO BY KEN WYATT

Past Presidents of the IEEE EMC Society convened for a group photo during the symposium, including (seated from left) Joe Fischer, Don Heirman, Bill Duff, Don Clark, Bob Hofmann and Bill Gjertson. Standing from left are Dan Hoolihan, Joe Butler, Todd Hubing, Kimball Williams, Andy Drozd, Elya Joffe and Francesca Maradei.

Nominations for IEEE Awards

The IEEE Awards Program provides peer recognition to individuals whose contributions to the art and science of electro- and information technologies worldwide have improved the quality of life.

The IEEE Electromagnetic Compatibility Society members may be particularly interested in the following Technical Field Awards, whose nomination deadlines are 31 January 2011. The awards typically consist of a bronze medal, certificate and cash honorarium.

IEEE Electromagnetics Award for outstanding contributions to electromagnetics in theory, application or education.

IEEE Joseph F. Keithley Award in Instrumentation and Measurement for outstanding contributions in electrical measurements.

IEEE Daniel E. Noble Award for Emerging Technologies for outstanding contributions to emerging technologies recognized within recent years.

IEEE Photonics Award for outstanding achievement(s) in photonics.

Awards presented by the IEEE Board of Directors fall into several categories: The Medal of Honor, Medals, Technical Field Awards, Corporate Recognitions, Service Awards, and Prize Papers. The IEEE also recognizes outstanding individuals through a special membership category: IEEE Honorary Member.

Nominations are initiated by members and the public, and then reviewed by a panel of peers. Their recommendations are submitted to the IEEE Awards Board prior to final approval by the IEEE Board of Directors.

For nomination guidelines and forms, visit http://www.ieee.org/awards. Questions? Contact IEEE Awards Activities, 445 Hoes Lane, Piscataway, NJ 08854 USA; tel.: +1 732 562 3844; fax: +1 732 981 9019; e-mail: awards@ieee.org.

Complete List of IEEE Technical Field Awards

IEEE Cledo Brunetti Award for outstanding contributions to nanotechnology and miniaturization in the electronics arts
- Award consists of a certificate and honorarium

IEEE Control Systems Award for outstanding contributions to control systems engineering, science, or technology
- Award consists of a bronze medal, certificate, and honorarium

IEEE Component Packaging Manufacturing Technology Award for meritorious contributions to, the advancement of components, electronic packaging or manufacturing technologies.
- Award consists of a bronze medal, certificate, and honorarium

IEEE Marie Sklodowska-Curie Award for outstanding contributions to the field of nuclear and plasma sciences and engineering
- Award consists of a bronze medal, certificate, and honorarium

IEEE Electromagnetics Award for outstanding contributions to electromagnetics in theory, application or education
- Award consists of a bronze medal, certificate, and honorarium

IEEE James L. Flanagan Speech and Audio Processing Award for outstanding contribution to the advancement of speech and/or audio signal processing
- Award consists of a bronze medal, certificate, and honorarium

IEEE Andrew S. Grove Award for outstanding contributions to solid-state devices and technology
- Award consists of a bronze medal, certificate, and honorarium

IEEE Herman Halperin Electric Transmission and Distribution Award for outstanding contributions to electric transmission and distribution
- Award consists of a certificate and honorarium

IEEE Masaru Ibuka Consumer Electronics Award for outstanding contributions in the field of consumer electronics technology.
- Award consists of a bronze medal, certificate, and honorarium

IEEE Internet Award for network architecture, mobility and/or end-use applications
- Award consists of a bronze medal, certificate, and honorarium

IEEE Reynold B. Johnson Information Storage Systems Award for outstanding contributions to information storage systems, with emphasis on computer storage systems.
- Award consists of a bronze medal, certificate and honorarium

IEEE Richard Harold Kaufmann Award for outstanding contributions in industrial systems engineering
- Award consists of a bronze medal, certificate, and honorarium

IEEE Joseph F. Keithley Award in Instrumentation and Measurement for outstanding contributions in electrical measurements
- Award consists of a bronze medal, certificate and cash honorarium

IEEE Gustav Robert Kirchhoff Award for outstanding contributions to the fundamentals of any aspect of electronic circuits and systems that has a long-term significance or impact
- Award consists of bronze medal, certificate, and honorarium

IEEE Leon K. Kirchmayer Award for Graduate Teaching for inspirational teaching of graduate students in the IEEE fields of interest.
- Award consists of a bronze medal, certificate and honorarium

IEEE Koji Kobayashi Computers and Communications Award for outstanding contributions to the integration of computers and communications.
- Award consists of bronze medal, certificate, and honorarium

IEEE William E. Newell Power Electronics Award for outstanding contribution(s) to the advancement of power electronics.
- Award consists of bronze medal, certificate, and honorarium

IEEE Daniel E. Noble Award for Emerging Technologies for outstanding contributions to emerging technologies recognized within recent years.
- Award consists of bronze medal, certificate, and honorarium

IEEE Donald O. Pederson Award in Solid-State Circuits for outstanding contributions to solid-state circuits.
- Award consists of bronze medal, certificate, and honorarium

IEEE Frederik Philips Award for outstanding accomplishments in the management of research and development resulting in effective innovation in the electrical and electronics industry.
- Award consists of bronze medal, certificate, and honorarium

IEEE Photonics Award for outstanding achievement(s) in photonics.
- Award consists of bronze medal, certificate, and honorarium

IEEE Emanuel R. Piore Award for outstanding contributions in the field of information processing in relation to computer science.
- Award consists of bronze medal, certificate, and honorarium

IEEE Judith A. Resnik Award for outstanding contributions to space engineering, within the fields of interest of the IEEE.
- Award consists of bronze medal, certificate, and honorarium

IEEE Robotics and Automation Award for contributions in the field of robotics and automation.
- Award consists of bronze medal, certificate, and honorarium

IEEE Frank Rosenblatt Award for outstanding contribution(s) to the advancement of the design, practice, techniques, or theory in biologically and linguistically motivated computational paradigms including but not limited to neural networks, connectionist systems, evolutionary computation, fuzzy systems, and hybrid intelligent systems in which these paradigms are contained.
- Award consists of bronze medal, certificate, and honorarium

IEEE David Sarnoff Award for exceptional contributions to electronics.
- Award consists of bronze medal, certificate, and honorarium

IEEE Charles Proteus Steinmetz Award for exceptional contributions to the development and/or advancement of standards in electrical and electronics engineering.
- Award consists of bronze medal, certificate, and honorarium

IEEE Eric E. Sumner Award for outstanding contributions to communications technology.
- Award consists of bronze medal, certificate, and honorarium

IEEE Undergraduate Teaching Award for inspirational teaching of undergraduate students in the fields of interest of IEEE.
- Award consists of bronze medal, certificate, and honorarium

IEEE Nikola Tesla Award for outstanding contributions to the generation and utilization of electric power.
- Award consists of a plaque and honorarium

IEEE Kiyo Tomiyasu Award for outstanding early to mid-career contributions to technologies holding the promise of innovative applications.
- Award consists of bronze medal, certificate, and honorarium

The Youth Program Workshop in Fort Lauderdale, Florida

Duane R. Bagdons, International Certification Services, Inc.

At the 2010 IEEE International Symposium on EMC, we built electric field antennas and magnetic pick up devices during the children's technical program. Prior to the children constructing their own antennas, a short training session was given by Duane Bagdons from International Certification Services to teach them a little about antennas and the differences between the electric fields and magnetic fields. The children were divided into teams of two people and each team created their own electric field antenna design. When all the antennas were constructed, we connected them to a spectrum analyzer that was loaned to us by Washington Labs and compared the reception of each antenna. The team with the best reception was declared the winner.

The next day, the children built magnetic field antennas. This time, each child built their own device. The pickup units were all wound on ferrite cores donated to the program by Fair-Rite Products Corp. After the children built their magnetic field antennas, we tested them using the spectrum analyzer and a noise source. Once again, the antenna with the best pick up was declared the winner.

The third and final day of the program, we took all the children for a tour of the exhibits in the exhibit hall. We stopped at various booths, including Tektronix, AR RF/Microwave Instrumentation, HV Technologies, and ETS-Lindgren, to name a few. Company personnel at each booth gave a brief description of what they were selling and why. After each booth visit, the company generously gave the children a small gift.

Thank you to the committee supporting this program, to the exhibitors who provided tours of their respective booths and donated or loaned products, and to Gayla Burns from International Certification Services for her help in getting the children started in building their antennas. This help was greatly appreciated!

Thank you all for helping make this program a success for the budding engineers at EMC 2010!

EMC

PHOTO COLLAGE BY DICK FORD

HIGH INTENSITY RADIATED FIELDS (HIRF) COURSE

Electromagnetic Effects Compliance for Aircraft
HIRF/Lightning Design, Test Methods, and Regulatory Compliance

April 12 – 15, 2011
OKLAHOMA STATE UNIVERSITY
Location: OSU-Stillwater, OK
Time: 8.00AM to 5.00PM (T, W, TR) 8.00AM to Noon (F)
Fee: $2000 if registered before March 11, 2011
$2200 if registered after March 11, 2011
2.8 CEUs/28 PDHs
http://hirf-course.okstate.edu

Host

The workshop is hosted by the School of Electrical and Computer Engineering at Oklahoma State University. Technical and equipment support is provided by the Cessna Aircraft Company, Wichita, KS.

About the course

This comprehensive workshop will provide an awareness of all aspects of systems and aircraft HIRF testing as a route to compliance. ***With the recent release of the finalized FAA rule, it is critical that anyone dealing with the EME certification understand the following concepts:***

- Why is HIRF important?
- The FAA/European requirements to demonstrate compliance – FAA/EASA Harmonized HIRF rule released in the Federal Register for comment, and will replace the interim special conditions
- Equipment qualification
- Aircraft certification and testing
- Pitfalls and problems
- Design issues
- An overview of lightning requirements and design

With emphasis on practical measurement, this workshop is particularly relevant to engineers and technicians involved in aircraft HIRF and Lightning Clearance. As part of the practical presentations, the class will be provided demonstrations concerning critical aspects of the HIRF/IEL testing.

Presenters

Dr. Nigel Carter (One of the pioneers of the low level test and BCI techniques employed in HIRF testing), ***Billy Martin*** (Regarded as one of the technical experts on HIRF and Lightning in the United States), ***Dave Walen*** (FAA's Chief Scientific and Technical Advisor for HIRF, EMC and Lightning).

Contact

Dr. Charles F. Bunting, Email: reverb@okstate.edu
Dr. Vignesh Rajamani, Email: Vignesh.rajamani@okstate.edu

Thanks to the EMC 2010 organizing committee!

EMC 2010 - Ft. Lauderdale!

www.wyattphoto.com

Calendar

EMC Related Conferences & Symposia

2011

April 12–15
High Intensity Radiated Fields (HIRF) Course
Oklahoma State University
Stillwater, Oklahoma
http://hirf-course.okstate.edu
(See ad page 95)

May 16–19
Asia Pacific EMC Symposium
Jeju Island, Korea
www.apemc2011.org
(See ad page 35)

August 12–13
ANSI C63® Workshops
Held in conjunction with the 2011 IEEE International Symposium on EMC
Northwest EMC
Irvine, California
Janet O'Neil
425.868.2558
www.c63.org

September 26–30
EMC Europe 2011
University of York
York, United Kingdom
www.emceurope.org/2011
(See ad pages 78–79)

October 16–21
AMTA 2011
The 33rd Annual Meeting of the Antenna Measurement Techniques Association (AMTA)
The Inverness Hotel and Conference Center
Englewood, Colorado
Atlanta, Georgia
www.amta2011.org

EMCS Annual Symposia Schedule

2011 **August 14–19,**
Long Beach, California
Ray Adams, 310.303.3300
(See ad pages 24–25)

2012 **August 6–10,**
Pittsburgh, Pennsylvania
Mike Oliver, 814.763.3211

2013 **August 5–9,**
Denver, Colorado
Danny Odum, 303.693.1778

2014 **August 3–7,**
Raleigh, North Carolina
Bruce Archambeault, 919.486.0120

2015 **August 17–21,**
Dresden, Germany
Hans Georg Krauthäuser,
+49 (0)351.463.33357
hans_georg.krauthaeuser@tu-dresden.de

2016 **July 25–29,**
Ottawa, Canada
Qiubo Ye, 613.998.2769

IEEE EMC Board of Directors and Standards Committee Meetings

Please note the Standards committee meetings of the IEEE EMC Society are held the day prior to the EMC Board meetings listed below. All Standards committee meetings are open to anyone with an interest in EMC standards. To attend a Standards committee meeting at one of the locations below, contact Don Heirman at d.heirman@ieee.org. Board meetings are also open to those interested in the administration of the EMC Society. For information on the Board meetings, contact Janet O'Neil, 425.868.2558, j.n.oneil@ieee.org. Your involvement is welcome!

March 28–30, 2011
Fort Lauderdale, Florida

August 14 and 18, 2011
Long Beach, California

EMC Chapter Colloquium and Exhibition "Table-Top Shows"

2011

March 22
Milwaukee, Wisconsin
With speaker Todd Hubing of Clemson University
Topic to be announced
Jim Blaha, GE Healthcare
Phone: 262-548-2978
Email: jblaha@ieee.org

May 10
Chicago, Illinois
With multiple speakers on various topics
Frank Krozel, Electronic Instruments
Phone: 630.924.1600
Email: frank@electronicinstrument.com

May 18
Detroit, Michigan
Speaker and topic to be announced
Scott Lytle, Yazaki North America
Phone: 734.983.6012
Email: scott@emcsociety.org

If you would like to add your name to the list of exhibitors to receive direct announcements in advance of these upcoming tabletop shows, please send an e-mail to j.n.oneil@ieee.org.

Please Note: For more information, IEEE-sponsored and co-sponsored symposia can be found at the following page: http://www.ieee.org/conferencesearch/. Enter the symposium name, time frame, and/or other pertinent information (partial information is also acceptable) to search for a particular symposium.

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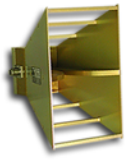
ON THE 12th DAY OF TESTING
A.H. SYSTEMS GAVE TO THEE:

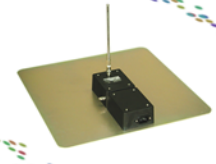



12 tripods standing
11 probes injecting
10 monopoles receiving
9 horns - a - gaining
8 dipoles testing
7 low loss cables
6 log periodics
FIVE golden loops
4 preamplifiers
3 current probes
2 portable kits
and with next-day,
on-time delivery







Happy Holiday's

and a low noise **New Year.**

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