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2012 EMC Symposium Guide
August 5-10 Pittsburgh

YOUR COMPREHENSIVE GUIDE TO THE IEEE INTERNATIONAL SYMPOSIUM ON EMC

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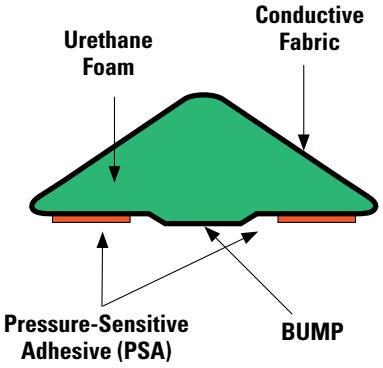
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DEAR EMC SOCIETY MEMBERS, EMC COLLEAGUES, AND VISITORS



Michael J. Oliver
Chairman, 2012
IEEE International
EMC Symposium
emi@majr.com

WELCOME TO THE 2012 IEEE International Symposium on Electromagnetic Compatibility in Pittsburgh, Pennsylvania. Along with the many bridges and wonderful skyline of Pittsburgh, our locals are inviting and technically savvy. I would also like to extend a welcome to the Pittsburgh Section of the IEEE and to our local Electromagnetic Compatibility Society Chapter.

Our Symposium Organizing Committee has skillfully conducted the planning and execution of the 2012 EMC Symposium. Our focused goal is to ensure the most networking opportunities possible through multiple exhibits, technical and companion programs, a job fair, and many social events throughout the week.

The essence of the EMC Symposium every year is the technical program, and this year is no exception. We are offering three days of top-rated, peer-reviewed technical papers presented by experts in multi-track sessions and two days of practical workshops and tutorials, experiments, and demonstrations presented by leading experts in the EMC Community. In addition, there will be collateral industry meetings, a job fair, and a full exhibit hall to learn about the latest offerings in EMC products and services.

New this year is the addition of Signal Integrity (SI) to the Global University program and a job fair with many local, cutting-edge research and technology companies looking for qualified individuals to fill positions both locally and nationwide. Back for a second year, Henry Ott will teach the fundamentals of EMC based on his book, *Electromagnetic Compatibility Engineering*. Henry is considered by many to be the nation's leading EMC educator, and has over forty years of experience in the field of EMC. We'll also have another special Graduate of the Last Decade (GOLD) program.

The host hotels are the Westin, attached to the convention center, and the historic Omni William Penn Hotel, located only three blocks away. Since the social events are within walking distance from the convention center, it will be convenient for attendees and exhibitors to enjoy the welcome reception at the John Heinz History Museum and the gala event on the Gateway Clipper ships without concern for transportation.

We hope you enjoy the networking, education, and hospitality of Pittsburgh during the 2012 IEEE International Symposium on Electromagnetic Compatibility. Visit us on the web at: www.2012emc.org.

Michael J. Oliver



Chairman, 2012 IEEE International EMC Symposium

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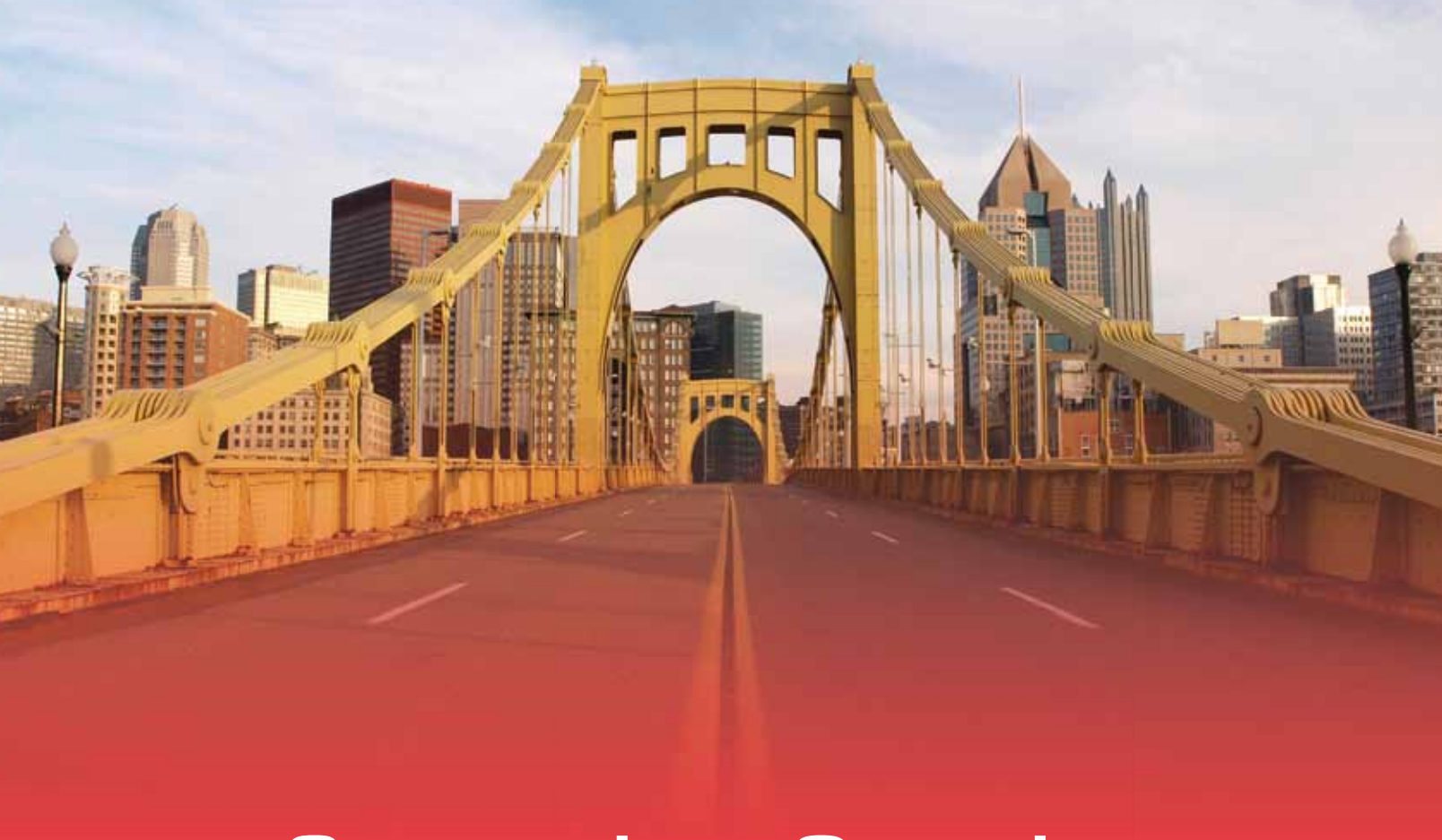
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EVERYTHING YOU NEED TO KNOW ABOUT PITTSBURGH

SEE PAGE 78



Symposium Overview
PITTSBURGH
August 5-10, 2012

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IFI — A Leader in EMC Technology

WELCOME TO PITTSBURGH AND THE 2012 IEEE SYMPOSIUM on Electromagnetic Compatibility. This Symposium Overview is designed to give you a day-by-day summary of the technical, social, and educational programs available to attendees of the IEEE EMC Symposium and their families. Use it to plan your days and nights and get the maximum benefit of five days plus of non-stop immersion in everything EMC.*

SUNDAY, AUGUST 5

8:00 am – 6:00 pm

Exhibitor Move-In

MONDAY, AUGUST 6

8:00 am – 6:00 pm

Exhibitor Move-In

MORNING WORKSHOP & TUTORIALS PROGRAM

8:30 a.m. – 12:00 p.m.

MO-AM-1 FUNDEMENTALS OF EMC

MO-AM-2 How Certain Are You About Measurement Uncertainty?

MO-AM-3 Introduction to EMI Modeling Techniques

MO-AM-4 Update on the Standardization Activities for Intentional Electromagnetic Interference (IEMI) Protection

MO-AM-5 Innovations in Automotive EMC Testing

10:30 a.m. – 12:00 p.m.

GOLD Session

AFTERNOON WORKSHOP & TUTORIALS PROGRAM

1:30 p.m. – 5:30 p.m.

MO-PM-1 FUNDEMENTALS OF EMC

MO-PM-2 The Hype on Hybrid Antennas – Dispelling the Controversy for Qualification Testing

MO-PM-3 How to Break Down Complex Systems into Realistic, Solvable, and Accurate Models

MO-PM-4 Application of Reverberation Chambers

MO-PM-5 Advanced Topics in Signal and Power Integrity

2:00 p.m. – 9:00 p.m.

Chapter Chair Training Session and Dinner

12:30 p.m. – 4:30 p.m.

Phipps Conservatory and Botanical Gardens

5:30 a.m. – 7:00 p.m.

Global EMC University Welcome Reception

6:00 p.m. – 9:00 p.m.

Chapter Chair Dinner

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7:05 p.m.

Pittsburgh Pirates Game

TUESDAY, AUGUST 7

8:00 a.m. – 12:00 p.m.

Global EMC University Morning Session

8:30 a.m. – 5:00 p.m.

Exhibit Hall Open

MORNING WORKSHOP & TUTORIALS PROGRAM

8:30 a.m. – 10:00 a.m.

TU-AM-1 EMC MANAGEMENT

TU-AM-2 Modeling of Interconnects

TU-AM-3 Numerical Investigation of Reverb Chambers

TU-AM-4 Transportation Systems

9:00 a.m. – 11:00 a.m.

Computer Modeling & Simulation Demonstrations

Using Simulated Instruments to Conveniently Develop, Edit, and Validate EMC Test Routines

9:00 a.m. – 11:00 a.m.

Hardware Experiments & Demonstrations

Electromagnetic Field Containment Using the Principle of "Self-Shielding"

9:30 a.m. – 12:30 p.m.

On the Strip and Behind the Scenes

*All events are subject to change. Check www.2012emc.org and the Registration Area daily for updates.

10:00 a.m. – 11:30 a.m.

Junior Technical Program

10:30 a.m. - 12:00 p.m.

Poster Papers (meet the authors)

11:30 a.m. – 1:30 p.m.

Founders and Past Presidents Luncheon

12:00 p.m. – 9:00 p.m.

Kennywood Park

AFTERNOON WORKSHOP & TUTORIALS PROGRAM

1:30 p.m. - 5:30 p.m.

TU-PM-1 Special Session Channel Characterization and Modeling for High-Speed Signaling

TU-PM-2 Reverb and TEM

TU-PM-3 Practical Application of Numerical Modeling

TU-PM-4 Radiated Emissions

TU-PM-5 High Power Electromagnetics (Including IEMI and ESD)

1:30 p.m. – 5:30 p.m.

Global EMC University Afternoon Session

2:00 p.m. – 4:00 p.m.

Computer Modeling & Simulation Demonstrations

Cable Analysis using Combined Field and Multi-Conductor Transmission Line Approach for EMC Applications

2:00 p.m. – 4:00 p.m.

Hardware Experiments & Demonstrations

Effect of a Gap in the Signal Return Line

6:30 p.m.

Welcome Reception at the Senator John Heinz History Center

7:05 p.m.

Pittsburgh Pirates Game

WEDNESDAY, AUGUST 8

8:00 a.m. – 12:00 p.m.

Global EMC University Morning Session

8:30 a.m. – 5:00 p.m.

Exhibit Hall Open

MORNING WORKSHOP & TUTORIALS PROGRAM

8:30 a.m. - 10:00 a.m.

WED-AM-1 Smart Grid (SC1)

WED-AM-2 Emissions Prediction and Testing

WED-AM-3 Modeling of EM Pulses

WED-AM-4 Nano Technology

9:00 a.m. – 11:00 a.m.

Computer Modeling & Simulation Demonstrations

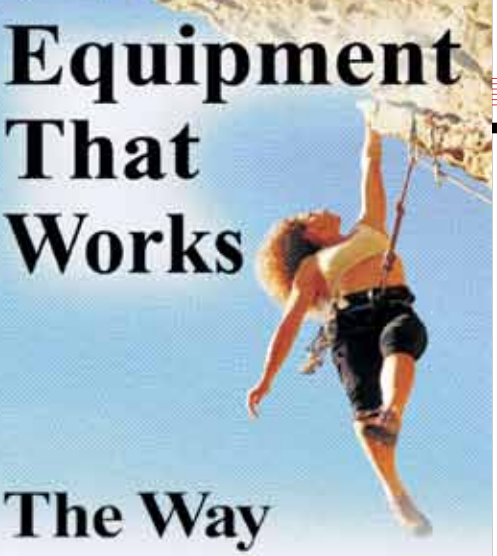
Integrated EM and RF System Simulation for Cosite EMI Analysis

9:00 a.m. – 11:00 a.m.

Hardware Experiments & Demonstrations



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Model Number	Frequency Range(GHz)
T21-200	1-2
T21-250	1-2
T251-200	1-2.5
T251-250	1-2.5
T281-200	1-2.8
T281-250	1-2.8
T31-200	1-3
T42-200	2-4
T42-250	2-4
T82-200	2-8
T82-250	2-8
T84-200	4-8
T84-250	4-8
T128-200	8-12
T128-250	8-12
T1812-200	12-18
T1812-250	12-18
T188-200	7.5-18
T188-250	7.5-18
T188-300	7.5-18
T186-200	6-18
T186-250	6-18
T186-300	6-18
T2118-250	18-21.5

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Embedded Capacitance Effectiveness vs. Board Topology

10:00 a.m. – 11:30 a.m.

Junior Technical Program

11:00 a.m. – 3:30 p.m.

Carnegie Science Center

AFTERNOON WORKSHOP & TUTORIALS PROGRAM

1:30 p.m. - 5:30 p.m.

WED-PM-1 Special Session - Nanotechnology for EMC

WED-PM-2 Emissions Measurements

WED-PM-3 Advances in Modeling Techniques

WED-PM-4 Signal Integrity

1:30 p.m. – 5:30 p.m.

Global EMC University Afternoon Session

2:00 p.m. – 4:00 p.m.

Computer Modeling & Simulation Demonstrations

Multichannel Link Path Analysis

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2:00 p.m. – 4:00 p.m.

Hardware Experiments & Demonstrations

Near Field Probes in EMI/EMC/RF Design and Troubleshooting

6:30 p.m.

Evening Gala Event on the Gateway Clipper Fleet Majestic and Empress Ships

7:05 p.m.

Pittsburgh Pirates Game

THURSDAY, AUGUST 9

8:00 a.m. – 1:00 p.m.

Global EMC University Morning Session

8:15 a.m. – 5:00 p.m.

Fallingwater and Kentuck Knob

8:30 a.m. – 1:00 p.m.

Exhibit Hall Open

MORNING WORKSHOP & TUTORIALS PROGRAM

8:30 a.m. - 12:00 p.m.

TH-AM-1 Special Session - Evolving Trends in Spectrum Management and Engineering

TH-AM-2 Field Transformation

TH-AM-3 Shielding Analysis and Application

TH-AM-4 Shielding

10:00 a.m. – 12:00 a.m.

Junior Technical Program Exhibit Tour

12:30 p.m. – 2:30 p.m.

Awards Luncheon

1:00 p.m. - 6:00 p.m.

Exhibit Hall Move-Out

AFTERNOON WORKSHOP & TUTORIALS PROGRAM

2:30 p.m. - 5:30 p.m.

TH-PM-1 Special Session - TC9 Model Validation with FSV

TH-PM-2 Antennas

TH-PM-3 EM Environment

TH-PM-4 Low Frequency EMC Methods and Applications Including Power Quality

TH-PM-5 Information Leakage

2:30 p.m. – 5:30 p.m.

Global EMC University Afternoon Session

6:00 p.m. – 8:30 p.m.

Gold EMC Party

FRIDAY, AUGUST 10

8:00 a.m. to 12:00 p.m.

Exhibit Hall Move-Out

8:00 a.m. – 5:00 p.m.

iNARTE Certificate Examinations

MORNING WORKSHOP & TUTORIALS PROGRAM

8:30 a.m. - 12:00 p.m.

FR-AM-1 EMC Leadership Training

FR-AM-2 Basic EMC Measurements

FR-AM-3 Recent Developments in EMC Testing of Wireless Devices – The New Technologies Driving the Test Standards

FR-AM-4 EMC Consultant's Toolkit

FR-AM-5 EMCS History – Society Records and Individual Member Records – Retention, Retrieval, and Digitization

10:45 a.m. – 3:45 p.m.

*All events are subject to change. Check www.2012emc.org and the Registration Area daily for updates.

Carnegie Museums of Art and Natural History

AFTERNOON WORKSHOP & TUTORIALS PROGRAM

1:30 p.m. – 5:30 p.m.

FR-PM-1 EMC Leadership Training

FR-PM-2 Does the EMC Society Have a Role or Responsibility to Set Standards in Smart Grid?

FR-PM-3 Fundamentals of Signal and Power Integrity

FR-PM-4 Electromagnetic Compatibility in the Nuclear Age: Plant and Laboratory Perspective

FR-PM-5 Advances in EMI Reduction for Power Electronics Systems

7:05 p.m.

Pittsburgh Pirates Game

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S31-20	1-3
S42-20	2-4
S-41-20	0.8-4.2
S41-25*	0.8-4.2
ST181-20	1-18
S182-20	2-18
T82-20	2-8
T84-20	4-8
T-184-20	4-18
T184-25	4-18
T186-20	6-18
T188-20	8-18
T1812-20	12-18
T128-20	8-12

*25 Watt Output

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Model Number	Freq Range (MHz)	Min Pwr Out (Watts)	Min Sat Gain (dB)
M/TCCX/SCCX Series • *.01-220 MHz*			
SCCX300	.01-220	300	55
SCCX500	.01-220	500	57
M404	.01-220	500	57
M406	.01-220	1000	60
TCCX2000	.01-220	2000	63
TCCX2200	.01-220	2200	63
TCCX2500	.01-220	2500	64
CMX/SMX Series • *.01-1000 MHz*			
SMX301	.01-1000	300/100	55/50
SMX302	.01-1000	300/200	55/53
SMX303	.01-1000	300/300	55/55
SMX501	.01-1000	500/100	57/50
SMX502	.01-1000	500/200	57/53
SMX503	.01-1000	500/300	57/55
CMX10001	.01-1000	1000/100	60/50
CMX100010	.01-1000	1000/1000	60/60



Microwave Solid State and TWT Amplifiers

Model Number	Freq Range (GHz)	Min Pwr Out (Watts)	Min Sat Gain (dB)
T-200 Series • *200-300 Watts CW 1-21.5 GHz*			
T251-250	1-2.5	250	54
T82-250	2-8	250	54
T188-250	7.5-18	250	54
T2118-250	18.0-21.7	250	54
T-500 Series • *500 Watts CW 1-18 GHz*			
T251-500	1-2.5	500	57
T7525-500	2.5-7.5	500	57
T188-500	7.5-18	500	57
MMT Series • *5-150 Watts, 18-40 GHz*			
T2618-40	18-26.5	40	46
T4026-40	26.5-40	40	46
S/T-50 Series • *40-60 Watts CW 1-18 GHz*			
S21-50	1-2	50	47
T82-50	2-8	50	47
T188-50	8-18	50	47



Solid State Amplifiers

Model Number	Freq Range (MHz)	Min Pwr Out (Watts)	Min Sat Gain (dB)
SMCC Series • *200-1000 MHz*			
SMCC350	200-1000	350	55
SMCC600	200-1000	600	58
SMCC1000	200-1000	1000	60
SMCC2000	200-1000	2000	63
SMC Series • *80-1000 MHz*			
SMC250	80-1000	250	54
SMC500	80-1000	500	57
SMC1000	80-1000	1000	60
SMX-CMX Series • *.01-1000 MHz*			
SMX100	.01-1000	100	50
SMX200	.01-1000	200	53
SMX500	.01-1000	500	57
SVC-SMV Series • *100-1000 MHz*			
SVC500	100-500	500	57
SMV500	500-1000	500	57

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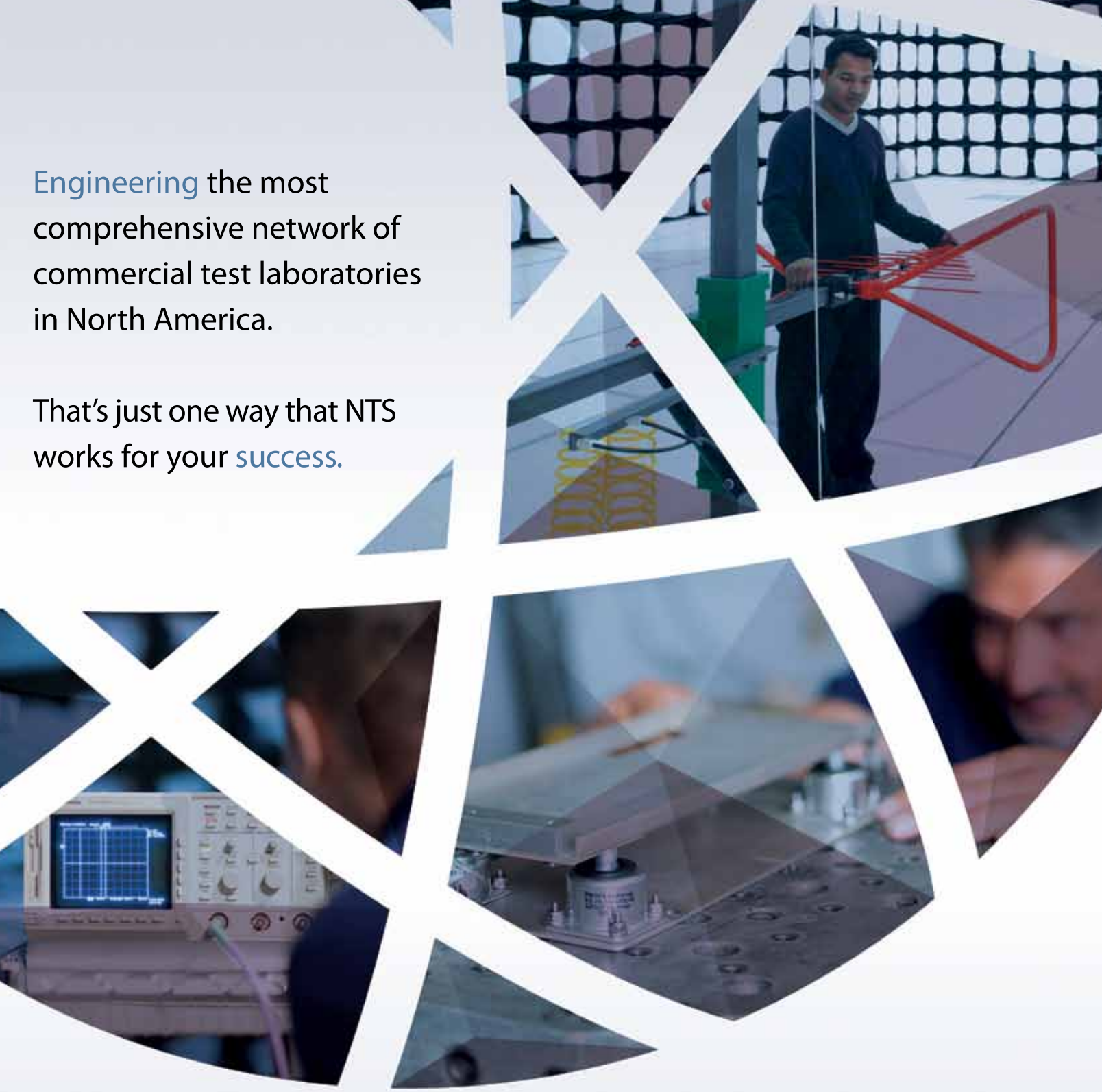
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- Signal Integrity
- EMC Management
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MORNING SESSIONS | 8:30 AM-NOON

MONDAY INCLUDES:*

WORKSHOPS/TUTORIALS

- Fundementals of EMC
- How Certain Are You About Measurement Uncertainty?
- Introduction to EMI Modeling Techniques
- Update on the Standardized Activities for IEMI Protection
- Innovations in Automotive EMC Testing
- The Hype on Hybrid Antennas
- How to Break Down Complex Systems
- Application of Reverberation Chambers
- Advanced Topics in Signal and Power Integrity

OTHER EVENTS

- iNarte Examinations Preparation Tutorial (Page 58)
- Global University Welcome Reception (Page 60)
- Chapter Chairs Training Session and Dinner
- GOLD Special Session
- Phipps Conservatory and Botanical Gardens (Page 86)

EXHIBITOR SET UP

* All events are subject to change. Check www.2012emc.org and the Registration Area daily for updates.

Fundamentals of EMC

Format: Full-day Tutorial – MO-AM-1 Room 301-302

Chair: *Henry W. Ott, Henry Ott Consultants, New Jersey, USA*

Abstract

This tutorial is designed to present the basics of EMC to those who are new to the field, those who are seeking information on an aspect of EMC that they have not previously encountered, or those who desire a refresher on the proposed EMC topics.

Planned Speakers and Topics

- **Introduction** 8:30-8:40AM

  Henry W. Ott, Henry Ott Consultants, New Jersey, USA

- **The Ground Myth** 8:40-10:00AM

  Bruce Archambeault, IBM, North Carolina, USA

  The term "ground" is probably the most misused and misunderstood term in EMC engineering, and in fact, in all of circuit design. Ground is considered to be a zero potential region with zero resistance and zero impedance at all frequencies. This is just not the case in practical high-speed designs. The one thing that should be remembered whenever the term "ground" is used is, "Ground is a place where potatoes and carrots thrive!" By keeping this firmly in mind, many EMC problems can be eliminated.

  The term "ground" is a fine concept at DC voltages, but it just does not exist at the frequencies running on today's typical boards. All metal has some amount of resistance, and even if that resistance was near zero ohms, the current flowing through a conductor in a loop creates inductance. Current through that inductance results in a voltage drop. This means that the metal ground plane/wire/bar/etc. has a voltage drop across it, which contradicts the intention and definition of ground.

  This presentation discusses the origin of the word "ground," what we really mean when we use it, and how to optimize our designs to achieve the overall goals for our reference strategy.

- **Mixed-Signal PCB Design** 10:30AM-12:00PM

  Flavio Canavero, Polytechnic of Turin, Turin, Italy

  The coexistence of analog and digital functions in electronicmodules can generate serious circuit interference and malfunctioning due to unstable potentials and currents in return paths. The fundamental physical principles necessary for the assurance of EMC at the PCB level are provided in this talk. Design rules and precautions are discussed and justified in terms of intuitive circuit and electromagnetic concepts.

- **High-Speed Digital Decoupling** 1:30-3:00PM

  Henry W. Ott, Henry Ott Consultants, New Jersey, USA

  Ineffective decoupling and grounding of high-speed digital logic systems is a major cause of radiated and conducted emissions, as well as increased susceptibility to both internal and external noise sources. Most designers still use the fifty-year-old technique of placing a 0.1 uF capacitor next to an IC to provide decoupling without any analytic understanding, or empirical verification, of the effectiveness of this approach.

  This presentation discusses the effectiveness and limitations of the various approaches to decoupling and grounding. Methods of overcoming these limitations by the use of multiple capacitors, ferrites, distributed capacitance, and isolated power planes are investigated. The interactions between ground plane, power plane, and the decoupling capacitance are discussed. Participants will gain a better understanding of the limitations of traditional decoupling methods and a knowledge of new technology and modern approaches to overcome these limitations.

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FMAC SINE: Sine wave output filter, allows motor cables up to 200m under full load. 4-16A, 500/288 VAC, screw clamp terminals

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MORNING SESSIONS | 8:30 AM-NOON

- **Simple EMC Measurements** 3:30-4:30PM
  Mark Steffka, GM, Michigan, USA

  The best time in a product development cycle to test a product for its likely EMC characteristics is as early as possible. Many times, however, testing is not undertaken until later stages in a project due to the complexities in formal EMC test methods, EMC facility scheduling, and the perceived cost-benefit ratio of the testing. This session will identify several simple EMC tests that can be done very early in product development, for minimal cost (many times with common electronic devices), and without significant time to perform. We will discuss how to translate the results of the simple tests into key indicators of the various aspects of EMC, such as identification of coupling paths, detection of radiation of electric fields, magnetic fields, or a product's response to external sources of energy. Methods to determine the effects of a product's physical dimensions and interconnections with other devices will also be discussed.

- **Printed Circuit Board EMC Design Review** 4:30-5:30PM
  Daryl Gerke, Kimmel-Gerke Associates, Arizona, USA

  As EMC consulting engineers, we are often asked to conduct EMC design reviews. A key area of concern is the printed circuit board – critical circuits, stackup, trace routing, I/O protection, and more. The goal is to catch problems early in the design stage, when it is free or inexpensive to fix them. Knowing what to look for, you can do simple EMC design reviews yourself. You may not catch everything, but if you eliminate 90% of the problems, you are ten times (20 dB) better than before. This session will address twelve of those EMC design concerns.

How Certain Are You About Measurement Uncertainty?

Format: Half-day Tutorial - MO-AM-2 Room 304-305

Chairs: *Vince Rodriguez, ETS-Lindgren, Texas, USA*
Ray Adams, The Boeing Company, California, USA
Janet O'Neil, ETS-Lindgren, Washington, USA

Abstract

In recent years there has been an increased need for accredited calibration test services in the commercial EMC area. This is likely to impact the military and aerospace test communities as well. Part of the accreditation process based on ISO 17025 is the determination of measurement uncertainty – a requirement that is often misunderstood or misinterpreted. This tutorial will provide an overview and discussion of measurement uncertainty to further the knowledge of this subject in the EMC testing community. For example, the impact of cables and connectors on measurement uncertainty will be reviewed. Influences of antenna gains in the near field and the impact of test benches on measurement uncertainty will be addressed. An experienced EMC laboratory assessor will review the nuances of equipment calibration, explain the selection of the proper values for uncertainty calculations, and illustrate the impact of test procedures on uncertainty estimates. Critical items that are looked at during an assessment will be discussed to better prepare test laboratories for future on-site assessments.

This tutorial brings together a number of viewpoints on measurement uncertainty in order to provide a well-rounded discussion of the topic. Speakers include a metrology laboratory manager, an assessor, an antenna designer and manufacturer, an EMC test laboratory manager, an aerospace EMC systems engi-

SPOTLIGHT ON

Fundamentals of EMC



Henry Ott *will be chairing and presenting in this Tutorial Session. Ott is considered by many to be one of the nation's leading EMC educators, and has over forty years experience in the field of EMC. He is the author of* Electromagnetic Compatibility Engineering. Interference Technology *asked Ott for a preview of the session.*

Is there anything different about this year's Fundamentals of EMC session?

Last year's Fundamentals session was very well received, with over two hundred people in attendance. Last year my objective was to focus on bringing the Fundamentals session back to its original intent: as a session for those new to EMC or those looking for a refresher on EMC fundamentals. From the feedback received, I believe that last year's session achieved the desired objective. I therefore tried to duplicate that this year. This year's session, however, will cover all new subjects. Two of the speakers will be new and three will be the same as last year.

How did you choose your fellow speakers for this year's session?

In choosing speakers my criteria was the same as last year; that they knew their material well, were well respected by their peers, and were capable of communicating their knowledge to others. I emphasized that this was a fundamentals session and that the material being presented should be down-to-earth, practical, and understandable by those not already experts in the field. I asked each speaker to pick a subject that they were passionate about and that would be appropriate for the focus of the session.

Which portion of the session are you looking forward to the most?

This is always a difficult question to answer, since I believe that we have a quality session, where all of the presentations will be of interest. If I have to choose which subject I am looking forward to the most, I think that it would be Mark Steffka's "Simple EMC Measurements" because it discusses some very useful EMC measurements that designers can perform early in the development process, in their own labs, with simple, inexpensive test equipment.

Why is it important for EMC engineers to know the myth and origin of the word "ground"?

"Ground" is probably the most misused and misunderstood word in the field of electrical engineering. It can be used to mean a connection to the earth for lightning protection, or to represent a very narrow trace on a PCB used as a signal return path. The technical requirements in both of these cases are entirely different, yet we use the same word to describe them. Bruce's presentation will discuss the origin of the word, what we really mean when we use it, and how to optimize our ground design for the specific application at hand. As Bruce Archambeault likes to say, "Ground is a place where potatoes and carrots thrive."

Why do engineers need to know about limitations of traditional decoupling?

Many designers are still decoupling high-speed digital logic ICs by placing a 0.1 or 0.01 µF capacitor adjacent to the IC. This is the same method that has been used on digital logic ICs for the last forty-plus years, yet over that time IC technology has changed tremendously, and frequency has increased drastically.

No one should be surprised that we are now possibly at the point where a new approach to digital IC decoupling is required.

My presentation will point out the limitations of the traditional approach to decoupling, and will develop a new, modern approach to high-speed digital decoupling. Above 50 MHz, discrete decoupling capacitors become very ineffective. At these frequencies some form of distributed decoupling capacitance is necessary. This can be achieved by using many small capacitors spread out around the IC, or by taking advantage of the distributed interplane capacitance provided by the PCB power and ground planes.



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MORNING SESSIONS | 8:30 AM-NOON

AFTERNOON SESSIONS | 1:30 PM- 5:30 PM

neer, and the chair of an ANSI C63® working group responsible for the standard ANSI C63.23 on measurement uncertainty.

Planned Speakers and Topics

- **An Overview of C63.23 Guide for Electromagnetic Compatibility-Calculations and Application of Measurement Uncertainty** 8:30-9:00AM
  Bob DeLisi, UL, LLC and Chair of ANSI C63® Working Group on Measurement Uncertainty (C63.23), New York, USA
- **EMC Measurement Uncertainty – What Does it All Mean and Why Should I Care?** 9:00-9:30AM
  Ray Adams, The Boeing Company, California, USA
- **Antenna Calibration and Uncertainty: A Numerical Study of the Calibration of a Dual Ridge Horn Antenna** 9:30-10:00AM
  Vince Rodriguez, ETS-Lindgren, Texas, USA
- **The Impact of Cables and Connectors on Measurement Uncertainty** 10:30-11:00AM
  Dennis Lewis, The Boeing Company, Washington, USA
- **Measurement Uncertainty Calculations from an Assessment Perspective** 11:00-11:30AM
  Werner Schaefer, Schaefer Associates, California, USA
- **Panel Discussion with All Speakers** 11:30AM-12:00PM

Introduction to EMI Modeling Techniques *Sponsored by TC9*

Format: Half-day Tutorial - MO-AM-3 Room 310-311

Chair: *Sam Connor, IBM Corporation, North Carolina, USA*

Abstract

This workshop will provide an introduction to all 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, without the need for detailed math. Practicing modelers will also benefit from learning the fundamentals of techniques they are currently not using. Each technique will be presented, along with its strengths and weaknesses, so engineers can decide which are appropriate for their types of problems.

Planned Speakers and Topics

- **Overview of Electromagnetic Modeling Software**
  Todd Hubing, Clemson University, South Carolina, USA
- **The Transmission Line Method**
  David Johns, CST of America, Massachusetts, USA
- **Introduction to the Partial Element Equivalent Circuit Technique**
  Albert Ruehli, Missouri University of Science and Technology, New Hampshire, USA
- **Introduction to the Finite Difference Time-Domain (FDTD) Technique**
  Sam Connor, IBM, North Carolina, USA
- **Introduction to the Finite Element Method**
  Chuck Bunting, Oklahoma State University, Oklahoma, USA
- **Integral Equation Methods (MOM) in Numerical Modeling**
  Ji Chen, Universty of Houston, Texas, USA
- **The Finite Integration Technique**
  Antonio Ciccomancini Scogna, CST of America, Massachusetts, USA

Update on the Standardization Activities for Intentional Electromagnetic Interference (IEMI) Protection

Sponsored by TC5

Format: Half-day Tutorial - MO-AM-4 Room 317-318

Chair: *Dr. William A. Radasky, Metatech Corporation, California, USA*

Co-chair: *Dr. Frank Sabath, Bundeswehr Research Institute for Protective Technologies, Munster, Germany*

Abstract

The objective of this tutorial is to inform members of the IEEE EMC community of the threat of IEMI, the progress that several international standards organizations have made to understand it, and to identify protection and immunity test methods. The content will include a brief discussion of the threat, an update on the standardization activities in the IEC, which has led this effort internationally, and a discussion of the efforts made by other standards organizations including the IEEE EMC Society, ITU-T, and Cigré. Significant work has been recently completed dealing with IEMI simulators that could be used for immunity testing of equipment, and new work is underway to develop specific immunity test methods and levels for commercial equipment.

Planned Speakers and Topics

- **Description of the IEMI Threat** 8:30-9:15AM
  Dr. William A. Radasky, Metatech Corporation, California, USA
- **Activities in the IEC with Emphasis on Test Facilities, 61000-4-35** 9:15-10:00AM
  Dr. Frank Sabath, Bundeswehr Research Institute for Protective Technologies, Munster, Germany
- **Review of Work Underway and Completed in the ITU-T, IEEE, and Cigré** 10:30-11:15AM
  Dr. William A. Radasky, Metatech Corporation, California, USA
- **Review of the New Draft Standard Dealing with IEMI Immunity Test Methods, IEC 61000-4-36** 11:15-12:00PM
  Dr. Frank Sabath, Bundeswehr Research Institute for Protective Technologies, Munster, Germany

Innovations in Automotive EMC Testing

Format: Half-day Workshop – MO-AM-5 Room 320-321

Chair: *Todd Hubing, Clemson University, South Carolina, USA*

Abstract

The rapid rate of innovative developments in automotive electronics has forced the industry to come up with new and creative methods of testing to ensure electromagnetic compatibility. Attendees of this workshop will be introduced to a variety of new EMC test methods designed to keep pace with advances in automotive electronics technology. The workshop will cover methods for ensuring compliance with ISO 26262, compatibility

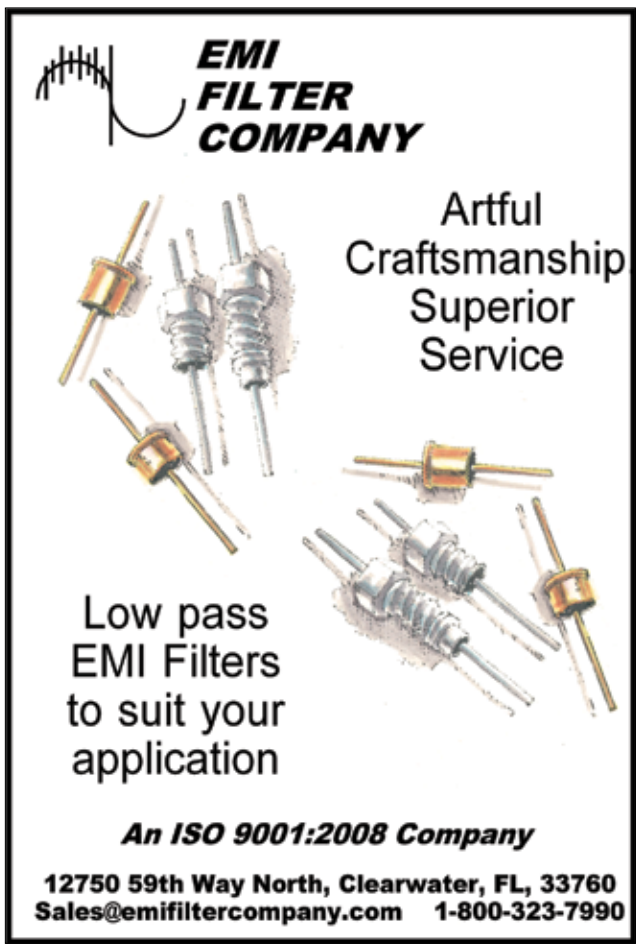

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AFTERNOON SESSIONS | 1:30 PM- 5:30 PM

with spread-spectrum devices and other devices not covered by existing EMC test standards, and new test methods that provide valuable information to EMC engineers and developers of automotive electronic components.

Planned Speakers and Topics

- **Impact on EMC for Electrical Powertrains with Respect to Functional Safety: ISO 26262 8:30-9:15AM**
  Jody Nelson, kVa, Florida, USA
- **Non-standard EMC Tests for Compatibility with New Electronic Technologies 9:15-10:00AM**
  Aaron Lutz, Johnson Controls, Michigan, USA
- **Reverberation Chambers for Automotive EMC Testing 10:30-11:15AM**
  Garth D'Abreu, ETS-Lindgren, Texas, USA
- **Automotive Component Testing to Build Models for Accurate Full-Vehicle Simulations 11:15AM-12:00PM**
  Todd Hubing, Clemson University, South Carolina, USA



Fundamentals of EMC

Format: Full-day Tutorial – MO-PM-1 Room 301-302

Chair: *Henry W. Ott, Henry Ott Consultants, New Jersey, USA*

- **See MO-AM-1 for details. (page 16)**

The Hype on Hybrid Antennas – Dispelling the Controversy for Qualification Testing

Format: Half-day Workshop – MO-PM-2 Room 304-305

Chairs: *Zhong Chen, ETS-Lindgren, Texas, USA*
Dan Hoolihan, Chair of ANSI C63® Committee, Hoolihan EMC Consulting, Minnesota, USA
Janet O'Neil, ETS-Lindgren, Washington, USA

Abstract

The hybrid biconical/log periodic antenna was developed by York University of Great Britain in 1993. EMC labs around the world quickly began to use it for product testing due to the convenience and expedited test time the hybrid antenna's wider frequency range performance offered. Recently, despite technical improvements to the hybrid antenna over the years, the radiated emission test results obtained with a hybrid antenna have become suspect due to their large physical size and their proximity to the equipment under test when testing at a three-meter horizontal antenna distance or in a small test chamber. This tutorial will explore the nuances of utilizing hybrid antennas for formal qualification testing and will discuss whether they can be used in accordance with ANSI C63.4/C63.5, as well as potential changes regarding their use for final compliance testing. Test results from a variety of labs using hybrid antennas will be presented and discussed.

Planned Speakers and Topics

- **Overview of Hybrid Biconical/Log Periodic Antennas for Radiated Emissions in Reference to C63® Standards 1:30-2:15PM**
  Dan Hoolihan, Chair of ANSI C63® Committee, Hoolihan EMC Consulting, Minnesota, USA
- **Comparison of Hybrid Antenna Performance Across Multiple Facilities 2:15-3:00PM**
  Greg Kiemel, Northwest EMC, Oregon, USA
- **Evaluation of Biconical and Log Periodic Antennas in Place of Hybrid Antennas 3:30-3:50PM**
  John Hirvela, Hewlett-Packard, Texas, USA
- **A Comparison of Bilog, Biconical, and Log Periodic Antenna Measurement Results 3:50-4:10PM**
  John Fessler and Keith Hardin, Lexmark, Kentucky, USA
- **Hybrid Antennas, Comparative Measurements with Other Antennas 4:10-4:45PM**
  Andy Griffin, Cisco Systems, California, USA
- **Making Sense of the Comparison Data Using Biconical and Biconical/LPDA Hybrid Antennas 4:45-5:30PM**
  Zhong Chen, Member of ANSI C63 Subcommittee 1, C63.5 Working Group, ETS-Lindgren, Texas, USA

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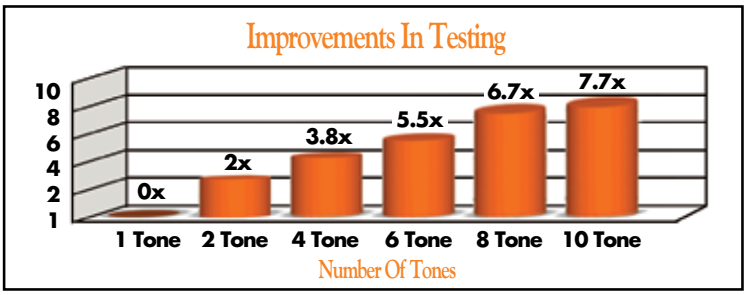


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AFTERNOON SESSIONS | 1:30 PM- 5:30 PM

How to Break Down Complex Systems into Realistic, Solvable, and Accurate Models *Sponsored by TC9*

Format: Half-day Tutorial – MO-PM-3 Room 310-311

Chair: *David Johns, CST of America, Massachusetts, USA*

Abstract

This tutorial will introduce the audience to the techniques used to simplify real-world complex systems into models for full-wave electromagnetic simulation that are able to be solved with today's software tools, while maintaining the required accuracy to correctly predict the EMC problems of interest. The topics will include a wide variety of applications drawn from the automotive, aerospace, computer, and portable device industries. This will give a flavor of many types of complex systems while demonstrating how to break the different types of problems into solvable models.

Planned Speakers and Topics

- **Modeling Techniques for Reducing the Complexity of EMC Simulations**
  David P. Johns, CST of America, Massachusetts, USA
- **Comprehensive Vehicle System EMC/EMI Models with Realistic Structures and Cabling**
  Carl G. Baldwin, Lockheed Martin Missiles and Fire Control, Texas, USA
- **Model Partitioning for Solving Complex EMC Problems**
  Colin Brench, Amphenol High Speed Interconnects, New Hampshire, USA
- **Simplifying Automotive EMC Simulations and Verifying Results with Measurements**
  Scott Piper, Gentex Corporation, Michigan, USA
- **Modeling Complex Systems for EMC and Signal Integrity**
  Bruce Archambeault, IBM, North Carolina, USA

Application of Reverberation Chambers

Format: Half-day Tutorial – MO-PM-4 Room 317-318

Chair: *Chuck Bunting, Oklahoma State University, Oklahoma, USA*

Abstract

This tutorial will provide an introduction to recent applications of reverberation chambers. It is intended to introduce EMC engineers who are interested in applying reverberation chambers to various measurement issues and the extension of reverberation chambers to solve a variety of EMC problems. This half day tutorial provides a brief overview of RC theory followed by recent applications of RCs. The tutorial material will be updated to reflect recent research results and implications.

Planned Speakers and Topics

- **Introduction – Rationale for RC Testing**
  Vignesh Rajamani, Oklahoma State University, Oklahoma, USA
- **Overview of RC Theory**
  Chuck Bunting, Oklahoma State University, Oklahoma, USA
- **Models for Antennas in Reverberation Chambers**
  John Ladbury, National Institute of Standards and Technology (NIST), Colorado, USA
- **Characterization of EM Environments Using RC Techniques**
  Chuck Bunting and Vignesh Rajamani, Oklahoma State University, Oklahoma, USA
- **Evaluation of Material Shielding Effectiveness Using Coupled Reverberant Cavities**
  Greg Tait, Naval Surface Warfare Center, Virginia, USA
- **Evolution of Reverberation Chambers from Metrology to Aerospace Applications**
  Dennis Lewis, Boeing, Washington, USA

Advanced Topics in Signal and Power Integrity

Sponsored by TC-10 Signal Integrity and CPMT TC-12 Electrical Design, Modeling, and Simulation

Format: Half-day Tutorial – MO-PM-5 Room 320-321

Chairs: *Dale Becker, IBM Corporation, New York, USA*
Antonio Ciccomancini Scogna, CST America, Massachusetts, USA

Abstract

The challenges of high-speed channel system design require the electrical engineer to understand signal integrity (SI), power integrity (PI), and EMC, and to make the appropriate decisions so that all imposed electrical constraints are met. This workshop is sponsored by the Components, Packaging, and Manufacturing Technology (CPMT) Society's TC-EDMS – Electrical Design, Modeling, and Simulation, formerly called CPMT TC-12, and by the IEEE EMCS (Signal Integrity) TC-10 to present advanced topics of signal integrity and bridge these topics with EMC. The CPMTS sponsors the Electrical Performance of Electrical Packaging Systems (EPEPS) Conference. The focus of the presentations will be bridging SI/PI/ EMC when developing new technologies such as 3D electronics packaging or optics, or when developing analysis and modeling techniques, such as macro-modeling tools, or designing channels to minimize common-mode emissions and susceptibility issues.

Planned Speakers and Topics

- **Fundamentals Mechanisms for Planar EBG for Power and Signal Integrity**
  F. De Paulis and A. Orlandi, University of L'Aquila, L'Aquila, Italy
- **Parameterized Models for Efficient Design in EMC and SI Applications**
  Francesco Ferranti, Ghent University, Ghent, Belgium,
  Giulio Antonini, University of L'Aquila, L'Aquila, Italy,
  Antonio Ciccomancini Scogna, CST of America, Massachusetts, USA
  Tom Dhaene, Ghent University, Ghent, Belgium
  Luc Knockaert, Ghent University, Ghent, Belgium
- **Statistical Uncertainty Analysis for High-Speed Designs**
  F. Canavero, Polytechnic of Turin, Turin, Italy
- **High-Density Silicon Carrier Transmission Line Design for Chip-to-Chip Interconnects**
  Kevin Gu, IBM Watson Research Center, New York, USA
- **Signal Integrity and Power Integrity Co-Design**
  Madhavan Swaminathan, Georgia Institute of Technology, Georgia, USA

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MORNING SESSIONS | 8:30 AM-NOON

TUESDAY INCLUDES*

WORKSHOPS/TUTORIALS

- EMC Management
- Modeling of Interconnects
- Numerical Investigation of Reverb Chambers
- Transportation Systems
- Channel Characterization and Modeling for High-Speed Signaling
- Reverb and TEM
- Practical Application of Numerical Modeling
- Radiated Emissions
- High Power Electromagnetics

EXPERIMENTS & DEMONSTRATIONS

(Page 56-57)

OTHER EVENTS

- Global University Classes (Page 60-61)
- Youth Technical Program Workshops (Page 87)
- Welcome Reception at the Senator John Heinz History Center (Page 82-83)
- Kennywood Park (Page 86)
- On the Strip and Behind the Scenes (Page 86)

EXHIBIT HALL OPEN

* All events are subject to change. Check www.2012emc.org and the Registration Area daily for updates.

EMC Management *Sponsored by TC-1*

TU-AM-1 – Room 301-302

Chair: *Doug Kramer, ETS-Lindgren*

- **Testing for Immunity to Simultaneous Disturbances and Similar Issues for Risk Managing EMC 9:00-9:30AM**
  Keith Armstrong, Cherry Clough Consultants Ltd, Stafford, United Kingdom
- **Critical EMC Test Issues Needing Early Resolution 9:30-10:00AM**
  Curtis White, Consultant, Rockford, IL

Modeling of Interconnects *Sponsored by TC-10*

TU-AM-2 – Room 304-305

Chair: *Francesco de Paulis, University of L'Aquila*

- **Semi-Automatic Copper Foil Surface Roughness Detection from PCB Microsection Images 8:30-9:00AM**
  Soumya De[1], Aleksandr Gafarov[1], Marina Koledintseva[1], Scott Hinaga[2], R. Joe Stanley[3] and James Drewniak[1], (1)EMC Laboratory, Missouri University of Science and Technology, Rolla, MO, (2)PCB Technology Group, Cisco Systems, San Jose, CA, (3)Department of Electrical and Computer Engineering, Missouri University of Science and Technology, Rolla, MO
- **PCB Conductor Surface Roughness as a Layer with Effective Material Parameters 9:00-9:30AM**
  ***Nominated for Best Symposium Paper Award**
  Marina Koledintseva[1], Alexander Razmadze[1], Scott Hinaga[2], Aleksandr Gafarov[1] and James Drewniak[1], (1)EMC Laboratory, Missouri University of Science and Technology, Rolla, MO, (2)PCB Technology Group, Cisco Systems, San Jose, CA
- **Analysis of Common-Mode Noise on On-Chip Differential Lines through Stochastic Modeling of Parameter Variability 9:30-10:00AM**
  Dries Vande Ginste[1], Daniël De Zutter[1], Dirk Deschrijver[1], Tom Dhaene[1], Paolo Manfredi[2] and Flavio Canavero[2], (1)Dept. of Information Technology, Ghent University, Ghent, Belgium, (2)DET, Politecnico di Torino, Torino, Italy

Numerical Investigation of Reverb Chambers *Sponsored by TC-9*

TU-AM-3 – Room 310-311

Chair: *Vignesh Rajamani, Oklahoma State University*

- **Numerical Study of Currents Induced on a Partially Shielded Wire Within an Ideal Reverberation Test Chamber 9:00-9:30AM**
  Endegena Assefa, Oklahoma State University, Stillwater, OK, James West, PhD, Electrical and Computer Engineering, Oklahoma State University, Stillwater, OK, Vignesh Rajamani, PhD, ECE, Oklahoma State University, Stillwater, OK and Chuck Bunting, PhD, Oklahoma State University, OK
- **Numerical and Experimental Analysis of the Performance of a Reduced Surface Stirrer for Reverberation Chambers 9:30-10:00AM**
  Giacomo Bosco, Cesare Picciani, Valter Mariani Primiani and Franco Moglie, Dept. Information Engineering, Università Politecnica delle Marche, Ancona, Italy

Transportation Systems *Sponsored by SC-3*

TU-AM-4 – Room 317-318

Chairs: *Mark Steffka, University of Michigan and Jeremy Campbell, General Motors*

When Good Enough Is Not Good Enough

It's a tough, competitive world. If you let your guard down for a second, your competition could knock you out of the game. So you've got to keep finding ways to get better, faster, more accurate. That's the way we think at AR, and that's why our customers welcome our new products and new technologies. We can help you gain a competitive edge with innovations like the following:



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Traveling Wave Tube Amplifiers

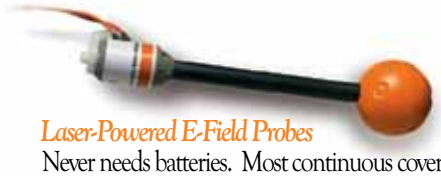
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AFTERNOON SESSIONS | 1:30 PM-5:30 PM

- **Automotive AM-Band Radiated Emission Mitigation Techniques, a Practical Approach 9:00-9:30AM**
  Cyrous Rostamzadeh, Bosch, Plymouth, MI, Flavio Canavero, DET, Politecnico di Torino, Torino, Italy, Feraydune Kashefi, Azad University, Shabestar, Iran and Mehdi Darbandi, Tehran University, Tehran, Iran
- **Evaluation of the Current in the Rail by 2D and 3D Methods: Influence of the Railway Platform 9:30-10:00AM**
  Maria Alejandra Mora[1], Noël Haddad[1] and Michel Ney[2], (1)Telecommunications Department, SNCF, La Plaine Saint Denis, France, (2)Lab-STICC, TELECOM Bretagne Institute, Brest, France

Special Session Channel Characterization and Modeling for High-Speed Signaling

Sponsored by TC-10
TU-PM-1 – Room 301-302

Chairs: *Jianmin Zhang, Cisco Systems, Inc and Ye Chunfei, Intel*

- **System Level Jitter Characterization of High Speed I/O Systems 1:30-2:00PM**
  Kyung Suk (Dan) Oh, Signal and Power Integrity, Rambus Inc., Sunnyvale, CA
- **SI and PI Analyses of Complex IC Packagings Using Non-Conformal Domain Decomposition Methods 2:00-2:30PM**
  Yang Shao, Zhen Peng and Jin-Fa Lee, Department of Electrical and Computer Engineering, The Ohio State University, Columbus, OH
- **A Measurement Based Methodology to Evaluate Die-to-Die Link Performance for High-speed IOs 2:30-3:00PM**
  Chunfei Ye, IAG, Intel Co., DuPont, WA and Kai Xiao, Intel Corp, DuPont, WA
- **A Fast and Accurate O(1) Solution to the Low-Frequency Breakdown Problem of Fullwave Solvers 3:00-3:30PM**
  Jianfang Zhu, Purdue University, West Lafayettte, IN and Dan Jiao, School of Electrical and Computer Engineering , Purdue University, West Lafayette, IN
- **Break 3:30-4:00PM**
- **Differential Far-End Crosstalk Cancellation – Implementations and Challenges 4:00-4:30PM**
  Xiaoning Ye, Intel Corporation, Hillsboro, OR
- **ASIC Package Design Optimization for 10 Gbps and Above Backplane SerDes Links 4:30-5:30PM**
  Jane Lim, Cisco Systems, Inc, San Jose, CA

Reverb and TEM *Sponsored by TC-2*

TU-PM-2 – Room 304-305

Chairs: *Diane Kempf, US Navy and Galen Koepke, NIST*

TIPS FROM THE LOCALS



Mark Ravenstahl
Director, Product Marketing, Electronic Business Unit, ANSYS, INC.
Pittsburgh, Penn.

TOWN IN WHICH YOU LIVE: Pittsburgh, PA

YEARS SPENT LIVING IN WESTERN PENNSYLVANIA: 47

ATTRACTION YOU WOULD RECOMMEND TO A FIRST-TIME VISITOR: The Oakland area where the universities and museums are located. You can see remnants of the old Forbes Field there as well. It is a short distance to Shady Side where there are restaurants and shops.

FAVORITE FAMILY-FRIENDLY ACTIVITY: Baseball game at PNC Park

FAVORITE OUTDOOR RECREATION: golf

BEST LOCATION FOR RECREATION: Riverfront has nice walking and jogging areas if you are staying in town. North Park and South Park are great for hiking, golf, and picnics.

BEST ENTERTAINMENT VENUES: Theater district offers many concerts and plays.

FAVORITE PLACE TO EAT: Cafe Brugge in Point Breeze - get the mussels.

MUST-HAVE SOUVENIR: Terrible towel

PITTSBURGH'S BEST-KEPT SECRET: Architecture of the houses and the many ethnic neighborhoods.

BEST VIEW: Mount Washington

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AFTERNOON SESSIONS | 1:30 PM-5:30 PM

- **Validation of a One-Antenna Reverberation-Chamber Technique for Determining the Total and Radiation Efficiency of an Antenna** 1:30-2:00PM
  Christopher Holloway, NIST, Boulder, CO
- **Characterizing Reverberation Chambers with Measurements of the Enhanced Backscatter Coefficient** 2:00-2:30PM
  ***Nominated for Best Symposium Paper Award**
  Christopher Holloway, NIST, Boulder, CO
- **An Alternative Method for Combining Stirring Techniques in a Reverberation Chamber** 2:30-3:00PM
  Jason Coder[1], John Ladbury[1] and Mark Golkowski[2], (1)RF Fields, National Institute of Standards and Technology, Boulder, CO, (2) Electrical Engineering, University of Colorado Denver, Denver, CO
- **Correlation of TEM Waveguide Measurements with Respect to Effective Aperture Calculation for Waveguides** 3:00-3:30PM
  David Hamann, May-Britt Konerding and Heyno Garbe, Institute of Electrical Engineering and Measurement Technologies, Leibniz Universität Hannover, Hannover, Germany
- **Break** 3:30-4:00PM
- **Experimental and Numerical Analysis of a Carousel Stirrer for Reverberation Chambers** 4:00-4:30PM
  Dario Fedeli, Matteo Iuale, Franco Moglie and Valter Mariani Primiani, Dept. Information Engineering, Università Politecnica delle Marche, Ancona, Italy
- **Considerations for Performing Immunity Testing with Frequency Stirring** 4:30-5:00PM
  Vignesh Rajamani, PhD, ECE, Oklahoma State University, Stillwater, OK, Gustav Freyer, Consultant, Monument, CO and Chuck Bunting, PhD, Oklahoma State University, OK
- **New Concept of Hybrid TEM-Cell and Reverberation Chamber** 5:00-5:30PM
  Andrew Podgorski, PhD in EE, ASR Technologies Inc., Ottawa, ON, Canada

Practical Application of Numerical Modeling *Sponsored by TC-9*

TU-PM-3 – Room 310-311

Chair: *Todd Hubing, Clemson University*

- **Antenna Design of a UHF RFID Tag for Human Tracking Avoiding Spurious Emission** 1:30-2:00PM
  Francesca Maradei, Sapienza University, ROME, Italy and Mauro Feliziani, University of L'Aquila, L'Aquila, Italy
- **EMC Modeling Approach to the Design of Micro Magnetic Radiators** 2:00-2:30PM
  Daniele Trinchero and Riccardo Stefanelli, Electronics, iXem Labs Politecnico di Torino, Torino, Italy
- **Computational Study of External Fixation Devices Surface Heating in MRI RF Environment** 2:30-3:00PM
  Yan Liu, yliu32, Electrical and Computer Engineering, University of Houston, Houston, TX
- **A Simplified Model of a Common Mode Choke Coil for 3D Field Simulators** 3:00-3:30PM
  Fujiyuki Nakamoto, Mitsubishi Electric Corporation, Kamakura-City Kanagawa-Pref, Japan
- **Break** 3:30-4:00PM

TIPS FROM THE LOCALS



Jacqueline Gentile
Marketing Specialist, ITEM Media
Plymouth Meeting, Penn.

TOWN IN WHICH YOU LIVE: Downingtown, PA

YEARS SPENT LIVING IN WESTERN PENNSYLVANIA: 4 years… Let's go PITT!

ATTRACTION YOU WOULD RECOMMEND TO A FIRST-TIME VISITOR: Cathedral of Learning (Nationality Rooms), Phipps Conservatory, Mount Washington Incline, Carnegie Museum of Art

FAVORITE FAMILY-FRIENDLY ACTIVITY: The Pittsburgh Zoo or the Carnegie Museum of Natural History

FAVORITE OUTDOOR RECREATION: Reading and hanging out with friends at Schenley Plaza (Oakland) or hiking/running in Schenley Park

FAVORITE PLACE TO EAT: When I lived in Pittsburgh, I was still in college and, therefore, lacked the funds to eat in some of the more well-known restaurants in the area so my picks are little more low budget. I highly recommend a sandwich from Primanti Brothers and the French fries from The "O" or The Original. If you are looking for something sweet, you must stop by Dave & Andy's. They have some of the BEST ice cream I have ever had. I also got to eat at Lydia's Pittsburgh, thanks to a visit from my parents. It was a fantastic!

PITTSBURGH'S BEST-KEPT SECRET: The Pumpkin Pie Ice Cream at Dave & Andy's in Oakland (U of Pitt Campus)

BEST VIEW: The Cathedral of Learning and the Mount Washington Incline

- **Applicability of the Thin Sheet Approximation to the Analysis of EM Emission from Coated PCBs** 4:00-4:30PM
  Alexander Vogt[1], Heinz Bruens[1], Samuel Connor[2], Bruce Archambeault[2] and Christian Schuster[1], (1)Institut für Theoretische Elektrotechnik, Technische Universität Hamburg Harburg, Hamburg, Germany, (2)Systems & Technology Group, IBM Corporation, RTP, NC
- **Investigation of the Imbalance Difference Model and its Application to Various Circuit Board and Cable Geometries** 4:30-5:00PM
  Hocheol Kwak, Inkjet Consumer Solutions, Hewlett-Packard Company, San Diego, CA and Todd Hubing, Electrical and Comp. Eng., Clemson University, Clemson, SC
- **Evaluation of Dielectric Permittivity for Homogeneous Materials from Transmittance Requirements** 5:00-5:30PM
  Francesco de Paulis, Hilmi Nisanci and Antonio Orlandi, Electrical Engineering, University of L'Aquila, L'Aquila, Italy

Radiated Emissions *Sponsored by TC-4*

TU-PM-4 – Room 317-318

Chairs: *Philip Keebler, Electric Power Research Institute and Michael Evans, Student*

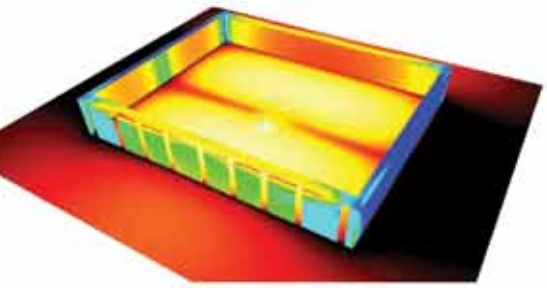
- **Troubleshooting Setup with Simple Coaxial Antenna for TDMA-GSM EMI/EMC in Audio Systems** 1:30-2:00PM
  Arturo Mediano, Prof., Electronics Engineering, University of Zaragoza, Zaragoza, Spain and Douglas C. Smith, D. C. Smith Consultants, Los Gatos, CA



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CHANGING THE STANDARDS

AFTERNOON SESSIONS | 1:30PM-5:30 PM

- **Efficient Analysis of Radiated Immunity of Complex Printed Circuit Boards Using SPICE** 2:00-2:30PM

  *Nominated for Best Symposium Paper Award

  Huapeng Zhao, Department of Electronics and Photonics, Institute of High Performance Computing, Singapore, Singapore

- **On Different Methods to Combine Cable Information into Near-field Data for Far-Field Estimation** 2:30-3:00PM

  *Nominated for Best Symposium Paper Award

  Keong Kam, Andriy Radchenko and David Pommerenke, EMC Laboratory, Missouri S&T, Rolla, MO

- **Carbon Nanostructure Enhanced Reinforcements in Electromagnetic Compatibility Applications** 3:00-3:30PM

  David Hartman, Owens Corning, Granville, OH

- **Break** 3:30-4:00PM

- **A Metamaterial-Inspired Handset Antenna with the SAR Reduction** 4:00-4:30PM

  Sungtek Kahng[1], Kyungseok Kahng[2], Dajeong Eom[1], Boram Lee[1], Se-gyoon Mok[1], Seongryong Yoo[1], Jong-Guk Kim[3], Jeong-Hoon Cho[3] and Kyungsuk Kim[3], (1)Information and telecommunication engineering, University of Incheon, Incheon, South Korea, (2) Information and Telecommunication Eng., University of Incheon, Incheon, South Korea, (3)LG Innotek Co. Ltd., Ansan, South Korea

- **Identifying EM Radiation from Asymmetrical Differential-Paired Lines with Equidistance Routing** 4:30-5:30PM

  Yoshiki Kayano, Yasunori Tsuda and Hiroshi Inoue, Department of Electrical & Electronic Engineering, Akita University, Akita, Japan

High Power Electromagnetics (Including IEMI and ESD) *Sponsored by TC-5*

TU-PM-5 – Room 320-321

Chairs: *Bill Radasky, Metatech Corporation and Michael McInerney, US Army Corp of Engineers*

- **Overview of the Threat of IEMI (Intentional Electromagnetic Interference)** 1:30-2:00PM

  Edward Savage, Metatech Corporation, Goleta, CA

- **A Technique for Calculating the Currents Induced by Geomagnetic Storms on Large High Voltage Power Grids** 2:00-2:30PM

  James Gilbert, Bill Radasky and Edward Savage, Metatech Corporation, Goleta, CA

- **Electrothermal Breakdown of an Intentional Electromagnetic Pulse (IEMP) Injected into Ku-Band GaAs MESFET-Based Low Noise Amplifier(LNA)** 2:30-3:00PM

  Liang Lin, Department of Electronic Eng. , Shanghai Jiao Tong University , Shanghai, China and Wen-Yan Yin, Key Lab of Ministry of Education of Design and EMC of High-Speed Electronic Systems, Shanghai Jiao Tong University, Shanghai, China

- **Parameters of Lightning Stroke Currents Defining Their Thermal and Mechanical Effects** 3:00-3:30PM

  Vesna Javor, Department of Theoretical Electrical Engineering, University of Nis, Faculty of Electronic Engineering, Nis, Serbia

SPOTLIGHT ON

Practical Application of Numerical Modeling



Bruce Archambeault
IBM Corporation,
North Carolina, USA

How did you choose your fellow speakers for the Simulation and Measurement Validation session?
All the speakers are very experienced in modeling/simulation and know the importance of validation and also quantifying the validation.

Who would most benefit from this presentation?
Anyone who currently does modeling or plans to start doing modeling in the future. In fact, it is probably most important for people just starting out using simulation tools. The commercial s/w tools will give a very accurate answer to whatever question the user poses. However, making sure the *user* asked the intended question is where validation comes in. I am very experienced with simulation tools, but I still make sure to validate my work.

Which portion of the session are you looking forward to the most?
The whole session seems very good to me.

Why is it important that engineers learn about this topic?
Modeling is more common than ever before, and more engineers are starting to use the tools without really understanding how they work. So validation is more important than ever before!

Is there anything else about this session that you'd like to mention?
Just that this is an on-going work, and using the FSV technique to quantify validation is part of the IEEE Standard 1594.

- **Break** 3:30-4:00PM

- **Unified Circuit Modeling Technique for the Simulation of Electrostatic Discharge (ESD) Injected by an ESD Generator** 4:00-4:30PM

  *Nominated for Best Symposium Paper Award

  Tadatoshi Sekine, Information Science and Technology, Graduate School of Science and Technology, Shizuoka University, Hamamatsu-shi, Japan, Hideki Asai, Systems Engineering, Shizuoka University, Hamamatsu-shi, Japan and John Lee, Samsung Electronics, Gyeonggi-do, South Korea

- **Application of Utilizing System-Efficient-ESD-Design Concept to Analyze an LED Protection Circuit of a Cell Phone** 4:30-5:00PM

  Tianqi Li, Electrical Engineering, EMC laboratory, Missouri University of Science and Technology, Rolla, MO

- **Electrostatic Field Distribution Measurement Using Silicon Micro-mirror Array** 5:00-5:30PM

  Toshihide Kuriyama, Kinki University, Kinokawa, Japan

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WEDNESDAY INCLUDES:*

WORKSHOPS/TUTORIALS

- SC1 Smart Grid
- Emissions Prediction and Testing
- Modeling of EM Pulses
- Nano Technology
- Nanotechnology for EMC
- Emissions Measurements
- Advances in Modeling Techniques
- Signal Integrity

EXPERIMENTS & DEMONSTRATIONS

(Page 56-57)

OTHER EVENTS

- Global University classes (Page 60-61)
- Youth Technical Program Workshops (Page 87)
- Evening Gala Event on the Gateway Clipper Fleet Majestic and Empress Ships (Page 82-83)
- Founders and Past Presidents Luncheon (Page 82-83)
- Carnegie Science Center (page 85)

EXHIBIT HALL OPEN

* All events are subject to change. Check www.2012emc.org and the Registration Area daily for updates.

Smart Grid *Sponsored by SC-1*

WED-AM-1 – Room 301-302

Chair: *Don Heirman, Don HEIRMAN Consultants*

- **Corona Noise Considerations for Smart Grid Wireless Communication and Control Network Planning 9:30-10:00AM**

  ***Nominated for Best Symposium Paper Award**

  Dheena Moongilan, Bell Laboratories, Alcatel-Lucent, Murray Hill, NJ

Emissions Prediction and Testing *Sponsored by TC-4*

WED-AM-2 – Room 304-305

Chairs: *Michael Evans, Student and Philip Keebler, Electric Power Research Institute*

- **Mode Conversion Due to Asymmetric GND Via Configuration 8:30-9:00AM**

  Alma Jaze[1], Bruce Archambeault[2] and Samuel Connor[2], (1)IBM, Poughkeepsie, NY, (2)Systems & Technology Group, IBM Corporation, RTP, NC

- **Optimal Placement for Partially Populated System EMI Testing 9:00-9:30AM**

  Michael Cracraft[1], Samuel Connor[2] and Bruce Archambeault[2], (1)Systems & Technology Group, IBM Corporation, Poughkeepsie, NY, (2)Systems & Technology Group, IBM Corporation, RTP, NC

- **Prediction of Radiation-Induced Frequency Locking and Shifting in a Microwave Oscillator 9:30-10:00AM**

  HAN-Chang Hsieh, PHD, BSMI, Taipei, Taiwan

Modeling of EM Pulses *Sponsored by TC-9*

WED-AM-3 – Room 310-311

Chair: *Wen-Yan Yin, Shanghai Jiao Tong University*

- **Characterization of Mutual Coupling Effects Among Multi-Antennas Mounted on a PEC Tower Platform in the Presence of Intentional Electromagnetic Pulses (IEMPs) 8:30-9:00AM**

  ***Nominated for Best Symposium Paper Award**

  Wei Luo[1], Wen-Yan Yin[1,2], Ming-Da Zhu[1], Jun-Fa Mao[3] and Jian-Yao Zhao[2], (1) Key Lab of Ministry of Education of Design and EMC of High-Speed Electronic Systems, Shanghai Jiao Tong University, Shanghai, China, (2)Centre for Optical and EM Research (COER), State Key Lab of MOI, Zhejiang University, Hangzhou, China, (3)Key Lab of Ministry of Education of Design and EMC of High-Speed Electronic Systems, Shanghai Jiao Tong University, Shanghai, China

- **An Improved Leapfrog ADI-FDTD Method for Computing Surface Current Distributions of Complex Structures in the Presence of an Intentional Electromagnetic Pulse (IEMP) 9:00-9:30AM**

  Xiang-Hua Wang, Center for Optical and Electromagnetic Research (COER), Zhejiang University, Zhejiang, China; Tianjin Institute of Technology and Education, Tianjin, China, Wen-Yan Yin, Centre for Optical and EM Research (COER), State Key Lab of MOI, Zhejiang University, Hangzhou, China; Key Lab of Ministry of Education of Design and EMC of High-Speed Electronic Systems, Shanghai Jiao Tong University, Shanghai, China and Jian Wang, Center for Microwave and RF Technologies, Key Lab of the Ministry of Education of EMC and High-Speed Electronic Information Systems, School of Electronic Information and Electrical Engineering, Shanghai Jiao Tong University, Shanghai, China

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MORNING SESSIONS | 8:30 AM-NOON

- **Accurate and Stable Solution of TD-MFIE Using Adaptive MOD Method for Transient Scattering of 3-D Objects Illuminated by an EMP** 9:30-10:00AM

  Ming-Da Zhu[1], Xi-Lang Zhou[2] and Wen-Yan Yin[1,3], (1)Key Lab of Ministry of Education of Design and EMC of High-Speed Electronic Systems, Shanghai Jiao Tong University, Shanghai, China, (2)Center for Microwave and RF Technologies(CMRFT), Shanghai Jiao Tong University, Shanghai, China, (3)Centre for Optical and EM Research (COER), State Key Lab of MOI, Zhejiang University, Hangzhou, China

Nano Technology *Sponsored by TC-11*

WED-AM-4 – Room 317-318

Chair: *Marina Koledintseva, Missouri University of Science and Technology*

- **Formulation Based on Percolation Theory to Model the Effective Conductivity of Carbon Nanotube Networks** 8:30-9:00AM

  Emmanuel Decrossas[1], Mahmoud A. EL Sabbagh[2], Victor Fouad Hanna[3] and Samir M. El-Ghazaly[1], (1)Electrical Engineering, University of Arkansas, Fayetteville, AR, (2)Electrical Engineering and Computer Science, Syracuse University, Syracuse, NY, (3) Université Pierre et Marie Curie - Paris 6, Paris, France

- **EBG Structures on High Permittivity Substrate to Reduce Noise in Power Distribution Networks** 9:00-9:30AM

  Olga Tereshchenko[1], Frits Buesink, F. J. K.[2] and Frank Leferink, F. B. J.[2,3], (1)CTIT Research Institute Faculty of EEMCS, University of Twente, Telecommunication Engineering group , Enschede, Netherlands, (2)Electrical Engineering, University of Twente, Enschede, Netherlands, (3)Environmental Competence Centre, Thales Nederland B.V., Hengelo, Netherlands

- **Simulation Geometry Rasterization for Applications Toward Graphene Interconnect Characterization** 9:30-10:00AM

  Brian Rautio, Syracuse University, Syracuse, NY

Special Session Nanotechnology for EMC

Sponsored by TC-11

WED-PM-1 – Room 317-318

Chairs: *Marina Koledintseva, Missouri University of Science and Technology and Alessio Tamburrano, Sapienza University of Rome*

- **Electromagnetic Properties of Metal Granular Composite Materials for EMC Applications** 1:30-2:00PM

  Takanori Tsutaoka[1], Aiko Tsurunaga[1], Teruhiro Kasagi[2], Kenichi Hatakeyama[3] and Marina Koledintseva[4], (1)Graduate School of Education, Hiroshima University, Higashi-Hiroshima, Japan, (2) Tokuyama College of Technology, Shunan, Japan, (3)University of Hyogo, Himeji, Japan, (4)EMC Laboratory, Missouri University of Science and Technology, Rolla, MO

- **Design Method of EM Absorber and Shielding Screen Using Wire Array Sheet** 2:00-2:30PM

  Shinichiro Yamamoto, Graduate School of Engineering, University of Hyogo, Himeji, Japan

- **Analytical Representations for Frequency Dependences of Microwave Permeability** 2:30-3:00PM

  Konstantin Rozanov, Lab. for Microwave Composites, ITAE RAS, Moscow, Russia and Marina Koledintseva, EMC Laboratory, Missouri University of Science and Technology, Rolla, MO

SPOTLIGHT ON

Nanotechnology for EMC



Marina Y. Koledintseva
EMC Laboratory, Missouri University of Science and Technology
Rolla, MO

How did you choose your fellow speakers for the Nanotechnology for EMC session?

When thinking about organizing the Special Session on Nanotechnology for EMC, we decided to invite the speakers who are the well-known specialists in the area of nanotechnology and advanced materials. Some of them made outstanding talks at the previous analogous sessions at the IEEE EMC Symposia, and the others attended alternative symposia and conferences or published papers related to the topic of interest but have never attended the IEEE EMC Symposium. We thought these speakers would be a great asset to the IEEE EMC Symposium.

Who would most benefit from these presentations?

Nanotechnology is a very new area of research and engineering. The IEEE EMC Society should definitely pay much attention to the new breakthroughs and trends in modern materials science, engineering, and practical applications of new types of materials. Scientists and engineers working in the areas of developing new filtering/shielding structures for solving various problems of electromagnetic compatibility and electromagnetic ecology would definitely benefit from this session.

I noticed that there are two females organizing this session. How rare is that to see in your profession?

Yes, it happened that Prof. Sabrina Sarto from Sapienza University of Rome and myself (I am from the EMC Lab Missouri University of Science & Technology - former UMR) are currently the co-Chairs of the Technical Committee TC-11 "Nanotechnology and Advanced Materials" and organizers of the Special Session "Nanotechnology in EMC". This is a coincidence to some extent that two females are organizing this session, but there is some logic in this coincidence because there is much in common in our education (European style – Prof. Sarto got her education in Rome Italy, I got my education in Moscow, Russia), research interests (Electromagnetics of Materials), and professional affiliations (we are both university professors). It is even more uncommon to find females working on complex problems related to electromagnetics of new materials. Though our backgrounds seem quite similar, we came to the nanotechnology in EMC from solving quite different problems. Prof. Sabrina Sarto for a number of years has been dealing with advanced composite materials, transparent conductors, and interconnects, and these problems led her to nanotechnology. She is the Director of the Research Center on Nanotechnology applied to Engineering of Sapienza University and of the new Sapienza Nanoscience and Nanotechnology Lab (SNN-Lab) and currently is organizing the Nanotechnology Session at the EMC EUROPE 2012. As for me, I have come to nanoscience from the research in the area of electromagnetic absorbing materials, both wideband or frequency-selective. I have been very interested in the physics of how electromagnetic energy is absorbed by material media, including gyromagnetic media, magneto-dielectric composites, and metamaterials.

SPOTLIGHT ON

Nanotechnology for EMC

I would also like to mention that we have a male scientist, Prof. Alessio Tamburrano from the University of Rome "La Sapienza," the current Secretary of TC-11, who is also involved in organizing both the Special Session and the regular session on Nanotechnology and Advanced Materials.

Which portion of the session are you looking forward to the most?

Our session will logically contain two parts: the first will focus on nanotechnology of interconnects, and the second on nano-science in engineering and characterization of new advanced materials for wide range of electromagnetic compatibility/signal integrity/power integrity problems. Personally, I am looking forward to both of parts of the session. I am looking forward to learning something new about nanosize interconnects and functional devices during the first part of the session. Since my colleagues and co-authors from Russia and Japan will make presentations at the second part, I am looking forward to listening to those talks and hope they will be well-received.

Why is nanotechnology becoming so prominent in EMC applications?

Nanotechnology is the understanding and controlling of matter at the atomic and molecular scale. Nanotechnology has already found its way into various EMC applications. New materials such as single- and multi-phase composites filled with nanoparticles, nanotube, or nanofibres have been designed and tested for gaskets and absorbing screens with outstanding performance and capabilities. Innovative nano-structured shields have shown multifunctional properties and higher efficiency than commonly used materials. Nanowires for high speed interconnects and high density integrated systems could replace copper in the near future, but they require adequate modelling and simulation approaches for signal integrity and also to avoid electromagnetic interference problems.

Is there anything else about this session that you'd like to mention?

I would like to mention that interest in nanotechnology and, specifically, its applications in EMC, is increasing world-wide and the invited talks in our session will be represented by scientists from many countries. Also, I believe that many young researchers, engineers, and students will attend our session, since this is an area which is developing fast and will definitely have a future. In addition, I would like to mention that during the IEEE EMC Symposium we will also run the regular technical session sponsored by TC-11 on Nanotechnology and Advanced Materials.

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5088	0.01-200MHz	600W	8U
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5227	80-1000MHz	500W	5U
5228	80-1000MHz	1000W	11U
5135	800-2000MHz	300W	5U
5136	800-2000MHz	500W	5U
5163	800-4200MHz	50W	3U
5164	800-4200MHz	80W	5U
5165	800-4200MHz	250W	8U
5193	2000-6000MHz	50W	3U
5194	2000-6000MHz	100W	5U

RF Amplifier Modules

Model	Frequency	Power	Size (H x W x L)
5304024	100-1000MHz	200 W	1.5" x 3.0" x 12.0"
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5304043	2500-6000MHz	50 W	1.1" x 5.0" x 7.0"

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AFTERNOON SESSIONS | 1:30 PM-5:30 PM

- **Carbon Nanotubes for Electromagnetic Compatibility Applications 3:00-3:30PM**
  Emmanuel Decrossas[1], Mahmoud A. EL Sabbagh[2], Victor Hanna[3] and Samir M. El-Ghazaly[1], (1)Electrical Engineering, University of Arkansas, Fayetteville, AR, (2)Electrical Engineering and Computer Science, Syracuse University, Syracuse, NY, (3)Université Pierre et Marie Curie - Paris 6, Paris, France
- **Break 3:30-4:00PM**
- **Bundles of Multiwall Carbon Nanotube Interconnects: RF Crosstalk Analysis by Equivalent Circuits 4:00-4:30PM**
  Alessio Tamburrano, Alessandro Giuseppe D'Aloia and Maria Sabrina Sarto, Sapienza University of Rome, Rome, Italy
- **Analytical Models for the Frequency Response of Multi-Layer Graphene Nanoribbon Interconnects 4:30-5:30PM**
  Vachan Kumar, Georgia Institute of Technology, Atlanta, GA and Azad Naeemi, Electrical and Computer Engineering, Georgia Institute of Technology, Atlanta, GA

Emissions Measurements *Sponsored by TC-2*

WED-PM-2 – Room 301-302

Chairs: *Don Heirman, Don HEIRMAN Consultants and H. Robert Hofmann, Hofmann EMC Engineering*

- **Enhance the Test Reproducibility of Radiated Emission by Defined Cable Termination 1:30-2:00PM**
  Bor-Lin Lee, EMC Laboratory, Delta Electronics (Jiang Su) LTD., Wujiang, China
- **CISPR 32 vs. ANSI C63.4: Color Bars, Scrolling H Patterns, and the Quasi-Peak Detector 2:00-2:30PM**
  Dave Arnett, Hewlett Packard, Vancouver, WA
- **Opportunities for Improved 80%80% Statistical Methods with C.I.S.P.R. 32 2:30-3:00PM**
  Lowell Kolb, Hewlett-Packard Company, Fort Collins, CO
- **A Novel Vector Near-field Scanning System for Emission Measurements in Time-Domain 3:00-3:30PM**
  ***Nominated for Best Symposium Paper Award**
  Johannes Russer, Electrical Engineering, Technische Universitat Muenchen, Munich, Germany and Stephan Braun, GAUSS INSTRUMENTS GmbH, Munich, Germany
- **Break 3:30-4:00PM**
- **A Broadband, Low-Noise Time-Domain System for EMI Measurements through Ka-Band up to 40 GHz 4:00-4:30PM**
  Christian Hoffmann[1], Ayoub Sidhom[2], Stephan Braun[1] and Peter Russer[2], (1)GAUSS INSTRUMENTS GmbH, Munich, Germany, (2)Institute for Nanoelectronics, Technische Universitat Muenchen, Munich, Germany
- **Experimental Assessment of Wireless Coexistence for 802.15.4 in the Presence of 802.11g/n 4:30-5:00PM**
  Nickolas LaSorte, Samer Rajab, and Hazem Refai, ECE, University of Oklahoma, Tulsa, OK
- **Emission Source for Compatibility Testing of Wireless Networks in the Below-Deck Environment on Ships 5:00-5:30PM**
  Gregory Tait, NSWC Dahlgren, Dahlgren, VA

Advances in Modeling Techniques

Sponsored by TC-9

WED-PM-3 – Room 310-311

Chairs: *Albert Ruehli, Missouri University of Science and Technology and Lijun Jiang, University of Hong Kong*

- **Generation of Physical Equivalent Circuits using 3D Simulations 1:30-2:00PM**
  Felix Traub[1],[2], Jan Hansen[1], Wolfgang Ackermann[2] and Thomas Weiland[2], (1)Robert Bosch GmbH, Gerlingen-Schillerhoehe, Germany, (2)TU Darmstadt, Institut Theorie elektromagnetischer Felder, Darmstadt, Germany
- **Experimental Model Validation of Mode-Conversion Sources Introduced to Modal Equivalent Circuit 2:00-2:30PM**
  Sejima Kota, Okayama University, Okayama, Japan
- **Total-Field Scattered-Field Plane Wave Sources for FDTD Analysis of Stratified Lossy Dispersive Media 2:30-3:00PM**
  Qingsheng Zeng, Government of Canada, Ottawa, ON, Canada
- **Wavefront Topology System & Finite Element Method Applied to Orthogonal Mesh Structures 3:00-3:30PM**
  Clayton Thomas Jr. and Gregory M. Wilkins, Electrical and Computer Engineering, Morgan State University, Baltimore, MD
- **Break 3:30-4:00PM**
- **Speed-Up of PEEC EM/Ckt Solver Using Rank-Reduced Waveform Relaxation 4:00-4:30PM**
  ***Nominated for Best Symposium Paper Award**
  Giulio Antonini, Ingegneria Elettrica e dell'Informazione, Università degli Studi dell'Aquila, L'Aquila, Italy and Albert Ruehli, EMC Laboratory, Missouri University of Science and Technology, Windham, NH
- **Alternative AEFIE-EFIE Method for Broadband CEM Modelling 4:30-5:00PM**
  Lijun Jiang, EEE, University of Hong Kong, Hong Kong, Hong Kong and Jia Liu, electronic and information engineering, BeiJing University of Aeronautics and Astronautics, Bei Jing, China
- **Time Domain E-PMCHW Integral Equation Solved by Adaptive Marching-On-In-Order Procedure for Predicting Transient Responses of Some Composite Structures 5:00-5:30PM**
  Jian-Yao Zhao[1], Wen-Yan Yin[1],[2], Ming-Da Zhu[2] and Wei Luo[2], (1) Centre for Optical and EM Research (COER), State Key Lab of MOI, Zhejiang University, Hangzhou, China, (2)Key Lab of Ministry of Education of Design and EMC of High-Speed Electronic Systems, Shanghai Jiao Tong University, Shanghai, China

Signal Integrity *Sponsored by TC-10*

WED-PM-4 – Room 304-305

Chairs: *Francesco Ferranti, University of Ghent and Antonio Ciccomancini, CST of America*

- **Optimum Geometrical Parameters for the EBG-Based Common Mode Filter Design 1:30-2:00PM**
  Hilmi Nisanci[1], Francesco de Paulis[1], Antonio Orlandi[1], Bruce Archambeault[2] and Samuel Connor[2], (1)Electrical Engineering, University of L'Aquila, L'Aquila, Italy, (2)Systems & Technology Group, IBM Corporation, RTP, NC

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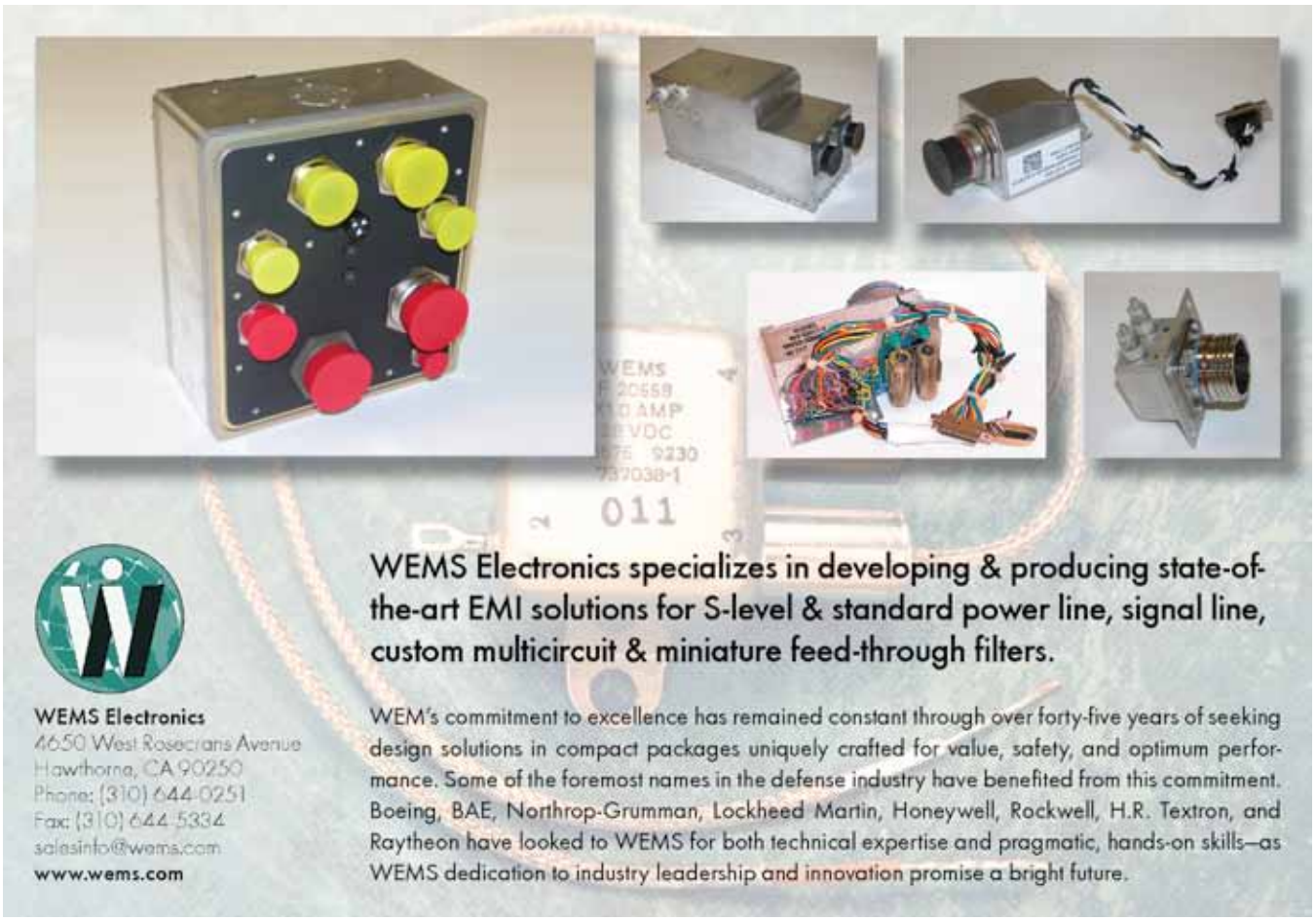
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AFTERNOON SESSIONS | 1:30 PM-5:30 PM

- **Unintended Passive Resonant Structures in Interconnect Design for Multi-Gigabit Signaling 2:00-2:30PM**
  ***Nominated for Best Symposium Paper Award**
  Kai Xiao, Intel Corp, DuPont, WA
- **Effects of Critically Damped Total PDN Impedance in Chip-Package-Board Co-Design 2:30-3:00PM**
  Toshio Sudo, Dept of Electronic Engineering, Shibaura Institute of Technology, Tokyo, Japan, Tatsuya Mido, Dept. of Electronic Engineering, Shibaura Institute of Technology, Tokyo, Japan and Genki Kubo, Dept. of Electronic Engineering, Shibaura Institute of Technology, Tokyo, Japan
- **Protection of a Delay-Locked Loop from Simultaneous Switching Noise Coupling Using an On-Chip Electromagnetic Bandgap Structure 3:00-3:30PM**
  ***Nominated for Best Symposium Paper Award**
  Chulsoon Hwang, KAIST, Deajeon, South Korea
- **Break 3:30-4:00PM**
- **On-Chip Design Technque for Reducing Power Supply Noise Coupling on ADC with Chip-PCB Hierarchical Structure 4:00-4:30PM**
  Bumhee Bae[1], Jonghyun Cho[2] and Joungho Kim[2], (1)Electrical Engineering, KAIST, Daejeon, South Korea, (2)EE, KAIST, Daejeon, South Korea
- **A Hybrid Stack-Up of Printed Circuit Board for High-Speed Networking Systems 4:30-5:00PM**
  Jianmin Zhang, Cisco Systems, Inc, San Jose, CA, Antonio Ciccomancini Scogna, CST of America, Framingham, MA, Jun Fan, MST, Rolla, MO, Bruce Archambeault, Systems & Technology Group, IBM Corporation, RTP, NC, James Drewniak, Department of Electrical and Computer Engineering, EMC Laboratory, Rolla, MO and Antonio Orlandi, Electrical Engineering, University of L'Aquila, L'Aquila, Italy
- **Switching-Current Measurement for Multiple ICs Sharing a Common Power Island Structure 5:00-5:30PM**
  Liang Li[1], Chulsoon Hwang[2], Tao Wang[1], Yuzo Takita[3], Hayato Takeuchi[3], Kenji Araki[3] and Jun Fan[1], (1)Missouri University of Science and Technology, Rolla, MO, (2)KAIST, Deajeon, South Korea, (3)Sony Corporation, Tokyo, Japan

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ITEM MEDIA

MORNING SESSIONS | 8:30 AM-NOON

THURSDAY INCLUDES:*

WORKSHOPS/TUTORIALS

- Evolving Trends in Spectrum Management and Engineering
- Field Transformation
- Shielding Analysis and Application
- Shielding
- Model Validation with FSV
- Antennas
- EM Environment
- Low Frequency EMC Methods and Applications
- Information Leakage

EXPERIMENTS & DEMONSTRATIONS

(Page 56-57)

OTHER EVENTS

- Global University classes (Page 60-61)
- Youth Technical Program Exhibit Tour (Page 87)
- Awards Luncheon (Page 82-83)
- GOLD EMC Party (Page 83)
- Fallingwater and Kentuck Knob (Page 86)

EXHIBIT HALL OPEN

* All events are subject to change. Check www.2012emc.org and the Registration Area daily for updates.

Special Session Evolving Trends in Spectrum Management and Engineering *Sponsored by TC-6*

TH-AM-1 – Room 301-302

Chairs: *Larry Cohen, Naval Research Laboratory and Bob Johnk, Institute for Telecommunication Sciences (NTIA/ITS)*

- **Specialized Algorithms for Spectrum Surveys 8:30-9:00AM**
  Heather Ottke, Electronics Engineer and Chriss Hammerschmidt, Propagation and Measurements Division, NTIA/ITS, Boulder, CO
- **Spectrum Attributes of Frequency-Steerable Phased Array Antennas 9:00-9:30AM**
  Brian Cordill[1], Sarah Seguin[2], Larry Cohen[3], John de Graaf[3] and Louis Parent[1], (1)The University of Kansas, Lawrence, KS, (2)Electrical Engineering and Computer Science (EECS), University of Kansas, Lawrence, KS, (3)Naval Research Laboratory, Washington, DC
- **A 3-Axis Antenna Array For Polarimetric Spectrum Surveys 9:30-10:00AM**
  Wayde Allen, ITS.M, Institute for Telecommunication Sciences, Boulder, CO
- **Break 10:00-10:30AM**
- **Characterizing and S-band Marine Radar Receiver in the Presence of Interference 10:30-11:00AM**
  Mark McFarland, PE, Institute for Telecommunication Sciences, Boulder, CO and Bob Johnk, Dr., Institute for Telecommunication Sciences (NTIA/ITS), Boulder, CO
- **A Fast-Fading Mobile Channel Measurement System 11:00AM-12:00PM**
  Bob Johnk, Dr., Institute for Telecommunication Sciences (NTIA/ITS), Boulder, CO

Field Transformation *Sponsored by TC-9*

TH-AM-2 – Room 304-305

Chair: *Alan Roden, Aerospace Corporation*

- **Far-Field Prediction from Amplitude-Only Near-Field Measurements Using Equivalent Electric Currents 8:30-9:00AM**
  Wei-Jiang Zhao, Institute of High Performance Computing, Singapore, Singapore
- **Perturbation of Near-Field Scan from Connected Cables 9:00-9:30AM**
  Morten Sørensen[1], Ondrej Franek[1], Gert F. Pedersen[1], Knud A. Baltsen[2] and Hans Ebert[1], (1)Antennas, Propagation and Radio Networking, Department of Electronic Systems, Faculty of Engineering and Science, Aalborg University, Aalborg, Denmark, (2)Bang & Olufsen a/s, Struer, Denmark
- **Influence of Nearby Obstacles on the Feasibility of a Huygens Box as a Field Source 9:30-10:00AM**
  Ondrej Franek, Morten Sorensen, Hans Ebert and Gert F. Pedersen, Antennas, Propagation and Radio Networking, Department of Electronic Systems, Faculty of Engineering and Science, Aalborg University, Aalborg, Denmark
- **Break 10:00-10:30AM**
- **Numerical Evaluation of Near-Field to Far-Field Transformation Robustness for EMC 10:30-11:00AM**
  ***Nominated for Best Symposium Paper Award**
  Andriy Radchenko, Ji Zhang, Keong Kam and David Pommerenke, EMC Laboratory, Missouri S&T, Rolla, MO

MORNING SESSIONS | 8:30 AM-NOON

- **Near-Field Coupling Method for a Complex Navy Ship Environment** 11:00AM-12:00PM

  Patrick Deschênes, M. A. Sc., Eng.[1], Martin Coulombe, M. A. Sc.[1], Robert Paknys, Ph. D., Eng.[2] and Amy Pinchuk, Ph. D., Eng.[1], (1) InField Scientific Inc., Pointe-Claire, QC, Canada, (2)Concordia University, Montreal, QC, Canada

- **E3 Computational Analysis of a Navy Frigate** 11:30AM-12:00PM

  Martin Coulombe, M. A. Sc.[1], Patrick Deschênes, M. A. Sc., Eng.[1], Amy Pinchuk, Ph. D., Eng.[1] and Robert Paknys, Ph. D., Eng.[2], (1) InField Scientific Inc., Pointe-Claire, QC, Canada, (2)Concordia University, Montreal, QC, Canada

Shielding Analysis and Application

Sponsored by TC-4

TH-AM-3 – Room 310-311

Chairs: *John Kraemer, Rockwell Collins and Phil Berger, John Deere Tractor Co.*

- **Planar and Bulk Resonant Periodic Screens Against Plane-Wave and Electric-Dipole Excitations** 8:30-9:00AM

  Giampiero Lovat, Rodolfo Araneo and Salvatore Celozzi, Department of Astronautical, Electrical, and Energetic Engineering, Electrical Division, "Sapienza" University of Rome, Roma, Italy

- **An Approximate Theory of RF Shielded Enclosures** 9:00-9:30AM

  David Stallings, National Security Agency, Jessup, MD

- **Novel Common-Mode Current Detector using Metamaterial CRLH Transmission-Line Structure** 9:30-10:00AM

  ***Nominated for Best Symposium Paper Award**

  Dajeong Eom, Sungtek Kahng, Boram Lee, Se-gyoon Mok and Seongryong Yoo, Information and telecommunication engineering, University of Incheon, Incheon, South Korea

- **Break** 10:00-10:30AM

- **Suppression of Leakage Magnetic Field from a Wireless Power Transfer System using Ferrimagnetic Material and Metallic Shielding** 10:30-11:00AM

  Hongseok Kim[1], Jonghyun Cho[2], Seungyoung Ahn[2], Jonghoon Kim[2] and Joungho Kim[2], (1)Division of Future Vehicle, KAIST, Daejeon, South Korea, (2)EE, KAIST, Daejeon, South Korea

- **EMI Reduction Evaluation with Flexible Absorbing Materials and Ferrite Cores Applied on Cables** 11:00AM-12:00PM

  Jing Li[1], Yao-Jiang Zhang[1], Aleksandr Gafarov[1], Soumya De[1], Marina Koledintseva[1], Joel Marchand[2], David Hess[2], Todd Durant[2], James Drewniak[1] and Jun Fan[1], (1)Missouri University of Science and Technology, Rolla, MO, (2)ARC Technologies, Amesbury, MA



MORNING SESSIONS | 8:30 AM-NOON

Shielding *Sponsored by TC-2*
TH-AM-4 – Room 317-318

Chair: *Bill Radasky, Metatech Corporation*

- **Shielding Effectiveness Estimation of Physically Small Electrically Large Enclosures through Dimensional Scaling** 8:30-9:00AM
  Andrew Marvin[1], Rob Armstrong[2], and John Dawson[1], (1)Electronics, University of York, York, United Kingdom, (2)York EMC Services, York, United Kingdom
- **Swept CW Testing of Shielded Systems** 9:00-9:30AM
  William D Prather, Senior Member, High Power Microwave Division, Air Force Research Laboratory, Kirtland AFB, NM
- **Three Methods for Measuring the Shielding Effectiveness Of Shielding Materials: A Comparison** 9:30-10:00AM
  Mario Pocai, EMC Consultant, Pisa, Italy, Ivan Dotto, CISAM, S.Piero a Grado, Italy and Domenico Festa, IBD, CHIARI, Italy
- **Expanding the Stripline Measuring Setup for the Characterisation of Conductive Gaskets Up to 40 GHz** 10:00-10:30AM
  Johan Catrysse, electronics/FMEC, KHBO/KULeuven, Oostende, Belgium

Special Session Model Validation with FSV *Sponsored by TC-9*
TH-PM-1 – Room 301-302

Chairs: *Jianmin Zhang, Cisco Systems, Inc and Bruce Archambeault, IBM Corporation*

- **FSV TOOLS AND STANDARDS** 2:30-3:00PM
  Bruce Archambeault, Systems & Technology Group, IBM Corporation, RTP, NC, Andy Drozd, R&D, ANDRO Computational Solutions, LLC, Rome, NY, Irina Kasperovich, ANDRO Computational Solutions, LLC, Rome, NY and Alistair Duffy, De Montfort University, Leicester, United Kingdom
- **FSV versus Human Subjective Data Evaluation: Informal Survey** 3:00-3:30PM
  Michael Johnson, USAF, Eglin AFB, FL
- **Break** 3:30pm
- **The Use of Probability Density Functions to Improve the Interpretation of FSV Results** 4:00-4:30PM
  Gang Zhang[1], Alistair Duffy[2], Hugh Sasse[2] and Lixin Wang[1], (1) Harbin Institute of Technology, Harbin, China, (2)De Montfort University, Leicester, United Kingdom
- **Using FSV in High-Speed Channel Characterization and Correlation** 4:30-5:00PM
  Ji Zhang[1], Jianmin Zhang[2], Jane Lim[2], Kelvin Qiu[2], Rick Brooks[2] and Bill Chen[3], (1)EMC Laboratory, Missouri S&T, Rolla, MO, (2) Cisco Systems, Inc, San Jose, CA, (3)Yangtze Delta Region Institute of Tsinghua University, Beijing, China
- **Using FSV for Far-Field Patterns** 5:00-5:30PM
  Michael Johnson, USAF, Eglin AFB, FL

TIPS FROM THE LOCALS



Tony Masone
President, Keystone Compliance
New Castle, Penn.

TOWN IN WHICH YOU LIVE: New Castle, PA

YEARS SPENT LIVING IN WESTERN PENNSYLVANIA: 23

ATTRACTION YOU WOULD RECOMMEND TO A FIRST-TIME VISITOR: Drive through the Fort Pitt tunnel into the city at night, The Duquesne Incline for an amazing panoramic view of the city

FAVORITE FAMILY-FRIENDLY ACTIVITY: Pittsburgh Zoo + PPG Aquarium, Carnegie Science Center, Pittsburgh Children's Museum, Three Rivers Regatta + Fourth of July Celebration

FAVORITE OUTDOOR RECREATION: Boating, fishing, or going to a ballgame

BEST LOCATION FOR RECREATION: McConnells Mill State Park

BEST ENTERTAINMENT VENUES: PNC Park, CONSOL Energy Center, Heinz Field, Kennywood Park, Station Square River Boat Cruises

FAVORITE PLACE TO EAT: Primanti Brothers, Hyde Park Steakhouse, Monterey Bay Fish Grotto (Beautiful panoramic view of Downtown Pittsburgh)

MUST-HAVE SOUVENIR: Terrible Towel

PITTSBURGH'S BEST-KEPT SECRET: The Wineries (it's the fourth-largest wine-growing state in the country), John Heinz History Center

BEST VIEW: Mount Washington overlooking the city

Antennas *Sponsored by TC-2*
TH-PM-2 – Room 304-305

Chairs: *Dave Arnett, Hewlett Packard and H. Robert Hofmann, Hofmann EMC Engineering*

- **Uncertainty Analysis for Three Antenna Method and Standard Antenna Method** 2:30-3:00PM
  Katsumi Fujii[1], Martin Alexander[2] and Akira Sugiura[1], (1)National Inst. of Info. Commun. Technology, Tokyo, Japan, (2)National Physical Laboratory, Middlesex, United Kingdom
- **Equivalent Capacitance Substitution Method for Monopole Antenna Calibration** 3:00-3:30PM
  Akira Sugiura[1], Martin Alexander[2], David Knight[2] and Katsumi Fujii[1], (1)National Inst. of Info. Commun. Technology, Tokyo, Japan, (2)National Physical Laboratory, Middlesex, United Kingdom
- **Break** 3:30-4:00PM
- **Measurement-Based Modeling of Dual Loop Magnetic Near-Field Probe** 4:00-4:30PM

***Nominated for Best Symposium Paper Award**

  Hiroki Funato[1], Takashi Suga[1] and Michihiko Suhara[2], (1)Yokohama Research Lab, Hitachi, Ltd., Yokohama, Japan, (2) Department of Electrical and Electronic Engineering, Graduate School of Science and Engineering, Tokyo Metropolitan University, Hachioji, Japan
- **An Inductive Probe for the Measurement of Common Mode Currents on Differential Traces** 4:30-5:00PM
  Victor Khilkevich, Electrical and Computer Engineering , Missouri University of Science and Technology, ROLLA, MO

AFTERNOON SESSIONS | 1:30 PM - 5:30 PM

- **An Updated EMC Standard for NASA's Goddard Space Flight Center 5:00-5:30PM**
  John McCloskey, NASA/GSFC, Greenbelt, MD

EM Environment *Sponsored by TC-3*
TH-PM-3 – Room 310-311

Chair: *Fred Heather, US Navy*

- **Detecting Man-Made Noise by Using its Wideband Characteristic 2:30-3:00PM**
  Pablo Torio and Manuel G. Sanchez, Universidad de Vigo, Vigo, Spain
- **Characterization of Baseband Demodulated Man-Made Noise 3:00-3:30PM**
  Pablo Torio and Manuel G. Sanchez, Universidad de Vigo, Vigo, Spain
- **Break 3:30-4:00PM**
- **Study On the Radiation From Smartmeters 4:00-4:30PM**
  Jin BAI, Mission San Jose High School, Fremont, CA; SIEMIC Labs, San Jose, CA
- **Eliminating Man-Made Noise from PLC Systems by Taking Advantage of the Masked Tones 4:30-5:00PM**
  Pablo Torio and Manuel G. Sanchez, Universidad de Vigo, Vigo, Spain
- **Human Exposure in Arc-Welding Processes: Current versus Previous ICNIRP Basic Restrictions 5:00-5:30PM**
  Flavia Grassi, Sergio A. Pignari and Giordano Spadacini, Dept. of Electrical Engineering, Politecnico di Milano, Milan, Italy

Low Frequency EMC Methods and Applications Including Power Quality
Sponsored by TC-7
TH-PM-4 – Room 317-318

Chairs: *Magnus Olofsson, Elforsk - Swedish Electrical Utilities' R & D Company and Dave Thomas, University of Nottingham*

- **Voltage Quality in Urban and Rural Areas 2:30-3:00PM**
  Roelof Bernardus Timens, R. B.[1], Frits Buesink, F. J. K.[1] and Frank Leferink, F. B. J.[1,2], (1)Electrical Engineering, University of Twente, Enschede, Netherlands, (2)Environmental Competence Centre, Thales Nederland B.V., Hengelo, Netherlands
- **Are DC Currents in an AC Power Distribution the Root Cause for Some Abnormalities in AU? 3:00-3:00PM**
  Lars Gertmar, LTH/IEA, Lund University, Västerås, Sweden, Ragnar Eide, Eureka VI, E6, Melbourne / Montrose, Australia and Max Baxter, Eureka VI, E6, Melbourne / Doncaster East, Australia
- **Break 3:30pm**
- **Improved Wavelet-Based Techniques for Power Quality Evaluation in Three-Phase Systems 4:00-4:30PM**
  Ileana-Diana Nicolae[1], Petre-Marian Nicolae[2] and Marian-Stefan Nicolae[2], (1) Computer and Information Technology Dept., University of Craiova, Craiova / Dolj County, Romania, (2)Electrical Engineering, Energetics, and Aeronautics, University of Craiova, Craiova / Dolj County, Romania
- **Design of Coupled Resonators for Wireless Power Transfer to Mobile Devices Using Magnetic Field Shaping 4:30-5:00PM**
  Woojin Ahn[1], Sungkwan Jung[2], Wonkyum Lee[2], Sangsik Kim[2], Junseok Park[2], Jaegue Shin[3], Hongseok Kim[4] and Kyoungchoul Koo[4], (1)System LSI Samsung Electronics Co. Ltd., Yongin, South Korea, (2)Institute for IT Convergence, KAIST, Daejeon, South Korea, (3)On-line Electric Vehicle Project, KAIST, Daejeon, South Korea, (4)Terahertz Interconnection and Package Laboratory, KAIST, Daejeon, South Korea



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AFTERNOON SESSIONS | 1:30 PM-5:30 PM

- **Effective Length Study of Grounding Electrodes Reached by Lightning Based on Transmission Line Modelling Method** 5:00-5:30PM

  Daniel da Silva Gazzana[1], Arturo Suman Bretas[1], Guilherme Alfredo D. Dias[1], Marcos Telló[2], Dave Thomas[3] and Christos Christopoulos[3], (1)Department of Electrical Engineering, Federal University of Rio Grande do Sul - UFRGS, Porto Alegre, Brazil, (2) State Company of Electrical Energy – CEEE D, Porto Alegre, Brazil, (3)University of Nottingham, Nottingham, United Kingdom

Information Leakage *Sponsored by TC-5*

TH-PM-5 – Room 320-321

Chairs: *Yuichi Hayashi, Tohoku University and William Price, Boeing*

- **Feasibility of Fault Analysis Based on Intentional Electromagnetic Interference** 2:30-3:00PM

  Junko Takahashi[1], Yu-ichi Hayashi[2], Naofumi Homma[2], Hitoshi Fuji[1] and Takafumi Aoki[2], (1)NTT Information Sharing Platform Laboratories, Nippon Telegraph and Telephone Corporation, Tokyo, Japan, (2)Tohoku University, Sendai, Japan

- **A Fault Model for Conducted Intentional ElectroMagnetic Interferences** 3:00-3:30PM

  Laurent Sauvage, Dr[1], Sylvain Guilley, Dr[1], Olivier Meynard, Dr[1], Jean-Luc Danger, Pr[1], Naofumi Homma[2] and Yu-ichi Hayashi[2], (1) COMELEC, Institut Télécom, Paris, France, (2)Tohoku University, Sendai, Japan

- **Break** 3:30-4:00PM

- **Efficient Mapping of EM Radiation Associated with Information Leakage for Cryptographic Devices** 4:00-4:30PM

  ***Nominated for Symposium Paper Award**

  Haruki Shimada[1], Yu-ichi Hayashi[1], Naofumi Homma[1], Takaaki Mizuki1, Takafumi Aoki[1], Hideaki Sone[1], Laurent Sauvage, Dr[2] and Jean-Luc Danger, Pr[2], (1)Tohoku University, Sendai, Japan, (2)COMELEC, Institut Télécom, Paris, France

- **A Method for Estimating the Possibility of Information Extraction from Electromagnetic Radiation** 4:30-5:00PM

  Yu-ichi Hayashi[1], Naofumi Homma[1], Taishi Ikematsu[1], Takaaki Mizuki[1], Hideaki Sone[1], Takafumi Aoki[1] and Jean-Luc Danger, Pr2, (1)Tohoku University, Sendai, Japan, (2)COMELEC, Institut Télécom, Paris, France

- **Equivalent Current Source of Side-Channel Signal for Countermeasure Design with Analog Circuit Simulator** 5:00-5:30PM

  Amano Tetsuo, Okayama University, Okayama, Japan

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ITEM MEDIA

MORNING SESSIONS | 8:30 AM-NOON

FRIDAY INCLUDES:*

WORKSHOPS/TUTORIALS

- EMC Leadership Training
- Basic EMC Measurements
- Recent Developments in EMC Testing of Wireless Devices
- EMC Consultant's Toolkit
- EMCS History - Society Records and Individual Member Records
- Does the EMC Society Have a Role or Responsibility to Set Standards in Smart Grid?
- Fundamentals of Signal and Power Integrity
- Electromagnetic Compatibility in the Nuclear Age
- Advances in EMI Reduction for Power Electronics Systems

EXPERIMENTS & DEMONSTRATIONS

(Page 56-57)

OTHER EVENTS

- Global University classes (Page 60-61)
- iNARTE Certification Examinations (Page 58)
- Carnegie Museums of Art and Natural History (Page 87)

* All events are subject to change. Check www.2012emc.org and the Registration Area daily for updates.

EMC Leadership Training *Sponsored by TC1*

Format: Full-day Tutorial – FR-AM-1 Room 301-302

Chair: *Kimball Williams, Denso Americas International, Michigan, USA*

Abstract

Sufficient training in the "soft skills" is often lacking in the curricula of engineers. The industry approach of "sink or swim" can be harsh. This session will provide opportunities to learn or brush-up on critical communication and business skills necessary for career success as an engineer in today's market.

Planned Speakers and Topics

- **Introduction to Leadership 8:30-9:30AM**
  Elya Joffe, Israel
- **Effective Meetings 9:30-10:00AM**
  John LaSalle, Northrop Grumman, New York, USA
- **Effective Presentations 10:30-11:30AM**
  Bruce Archambeault, IBM Corporation, North Carolina, USA
- **Navigating Organizational Politics 11:30AM-12:00PM**
  Bob Hofmann, Hofmann EMC Engineering, Illinois, USA
- **Code of Ethics 1:30-2:30PM**
  Elya Joffe, Israel
- **Networking Skills 2:30-3:00PM**
  Dan Hoolihan, Hoolihan EMC Consulting, Minnesota, USA
- **Effective Memos and Reports 3:30-4:30PM**
  Bob Scully, NASA, Texas, USA
- **Designing a Career Path 4:30-5:00PM**
  Kimball Williams, IEEE Southeastern Michigan Section Chair, Michigan, USA

Basic EMC Measurements *Sponsored by TC2*

Format: Half-day Tutorial – FR-AM-2 Room 304-305

Chair: *Don Heirman, Don HEIRMAN Consultants, New Jersey, USA*

Abstract

This tutorial will be an introduction to product compliance testing to comply with basic EMC emission measurements methods for both tabletop and floor-standing equipment. Included will be a description of the latest test-site validation requirements and construction review. The latest activity in national and international standards related to EMC emission measurements and application will also be presented as time allows. Where appropriate, attendees will be asked questions as to what they learned and have an opportunity for extended questioning of the speakers' subjects at the end of the session.

Planned Speakers and Topics

- **Emission Measurement Requirements and Experiences/Pitfalls in Performing Compliance Measurements for Tabletop Equipment 8:30-9:45AM**
  Steve Koster, Washington Laboratories, Maryland, USA
- **Emission Measurement Requirements and Experiences/Pitfalls in Performing Compliance Measurements for Floor-Standing Equipment 9:45-10:00AM and 10:30-11:00AM**
  H. R. (Bob) Hofmann, Hofmann EMC Engineering, Illinois, USA
- **Radiated and Conducted Measurement Test Facilities, Test Site Validation and Construction, and Associated Standards Changes Planned 11:00AM-12:00PM**
  Don Heirman, Don HEIRMAN Consultants, New Jersey, USA

MORNING SESSIONS | 8:30 AM-NOON

Recent Developments in EMC Testing of Wireless Devices – The New Technologies Driving the Test Standards

Format: Half-day Tutorial – FR-AM-3 Room 310-311

Chair: *Doug Kramer, ETS-Lindgren, Texas, USA*
Co-chair: Janet O'Neil, ETS-Lindgren, Washington, USA

Abstract

With the proliferation of wireless devices and increasingly complex multiple-input and multiple-output (MIMO) applications, a new type of EMC issue has arisen, which is considerably different than those addressed by traditional EMC testing. Termed coexistence, this refers to the issues related to having one device with multiple wireless technologies that are expected to be active at one time, such as GPS and streaming video – to name two technologies. More loosely, it can also refer to the use of different wireless technologies at the same location. In traditional EMC testing, unintentional radiation, including spurious emissions (out-of-bound harmonics) of intentional radiators, is required to be below a regulatory limit to pass the device. Coexistence testing focuses on degradation of performance of one wireless link due to the interference from the other types of wireless radios.

This tutorial will present the convergence of wireless test requirements and review changes in test methods for wireless devices. The current shift in focus to the fully anechoic site for an increasing number of measurements, as well as the latest research in using reverberation chambers for wireless testing, will be reviewed and discussed. The new technologies driving the wireless standards, such as those from ETSI, CTIA, FCC, and ANSI C63®, plus ITU-R regulations, will be addressed. Tutorial attendees will learn how current developments in the wireless testing area are affecting EMC product design and test practices.

Planned Speakers and Topics

- **New Regulatory Challenges: A Look at the International Telecommunications Union Radio Sector and Frequency Allocations** 8:30-9:15AM
  Dave Case, Cisco Systems, Ohio, USA
- **Radiated Spurious Emission Measurements: A Variety of Techniques** 9:15-10:00AM
  Doug Kramer, ETS-Lindgren, Texas, USA
- **Reverberation Chamber Testing of State-of-the-Art Wireless Devices** 10:30-11:15AM
  Kate Remley, NIST Electromagnetics Division, Colorado, USA
- **Panel Discussion** 11:15AM-12:00PM

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MORNING SESSIONS | 8:30 AM-NOON

EMC Consultant's Toolkit

Format: Half-day Workshop – FR-AM-4 Room 317-318

Chair: *Jerry Meyerhoff, JDM Labs LLC, Illinois, USA*

Abstract

As more engineering and design firms outsource and reduce staff, more qualified EMC engineers are finding themselves "homeless." As well, there are hundreds of companies that do not have the resources to hire a full-time EMC engineer. The purpose of this workshop is to provide an introduction to the technical, business, and marketing skills to interested EMC engineers so that they can successfully locate, market, and provide effective services to these companies at a fair profit and with job satisfaction.

Topics to be addressed include practical tools and skills in the following areas: EMC troubleshooting and applying fixes, pre-compliance testing at the designer's bench or on-site, new and low-cost troubleshooting tools and equipment, how to use social media marketing (such as LinkedIn), networking practices, advertising, setting up your office, pricing your services, tracking your time, best business practices, how to present yourself professionally, tax and legal obligations, and how to review contracts and non-disclosure agreements.

Planned Speakers and Topics

- **Marketing Yourself** 8:30-9:00AM
  Jerry Meyerhoff, JDM Labs LLC, Illinois, USA
- **Low-Cost EMC Troubleshooting Kit, Plus Networking, Branding, and Providing Client Value** 9:00-9:30AM
  Kenneth Wyatt, Wyatt Technical Services, LLC, Colorado, USA
- **A Funny Thing Happened on the Way to Work** 9:30-10:00AM
  Lee Hill, Silent Solutions LLC, New Hampshire, USA
- **Presenting Yourself Professionally** 10:30-11:00AM
  Patrick André, André Consulting Inc., Washington, USA
- **Key Steps in Starting and Running a Consultancy** 11:00-11:30AM
  Bill Kimmel, Kimmel Gerke Associates, Minnesota, USA
- **Panel Discussion** 11:30AM-12:00PM

EMCS History – Society Records and Individual Member Records – Retention, Retrieval, and Digitization

Format: Half-day Tutorial – FR-AM-5 Room 320-321

Chair: *Dan Hoolihan, Hoolihan EMC Consulting, Minnesota, USA*

Abstract

The objective of this tutorial will be to describe the techniques available to EMC professionals for preserving, retaining, and digitizing important historical records of the EMC Society. The records could be of the EMC Society (including the Board of Directors), technical committees, local EMC Chapters, and individual EMC Society members. Techniques for digitizing the important records will be discussed and elaborated on from a practical and technical perspective, respectively.

Topics to be addressed include IEEE historical sources of information and assistance, the EMCS History Committee resources, and use of digitizing techniques and utilization of the IEEE Global History Network. Individual members of the Society will describe their personal experiences in preserving historical information on EMC Engineering activities.

Planned Speakers and Topics

- **Overview of the IEEE History Center Including the Global History Network**
  Michael Geselowitz, IEEE History Center, New Jersey, USA
- **Background on the EMC Society's History Committee with Planned Activities for the Future of the History Committee**
  Dan Hoolihan, EMCS History Committee, Minnesota, USA
- **An Archivist's Guidelines on Preserving Society and Individual Information on EMC Engineering**
  Sheldon Hochheiser, IEEE History Center, New Jersey, USA
- **One Engineer's Perspective on Archiving His Professional Records on EMC and EMC Standardization Activities**
  Donald Heirman, EMCS History Committee, New Jersey, USA
- **An Engineer's Perspective on Archiving Another EMC Engineer's Records and Publications on EMC**
  Donald Sweeney, EMCS History Committee, Illinois, USA
- **Another Engineer's Perspective on Archiving the Records of a Founder of the EMC Society and His Personal Papers Relative to EMC and Radio Frequency Interference**
  Dan Hoolihan, EMCS History Committee, Minnesota, USA

EMC Leadership Training *Sponsored by TC1*

Format: Full-day Tutorial – FR-PM-1 Room 301-302

Chair: *Kimball Williams, Denso Americas International, Michigan, USA*

- **See FR-AM-1 for details. (page 48)**

TIPS FROM THE LOCALS



Michael Oliver

V.P. Electrical/EMC Engineering, MAJR Products Corporations
Saegertown, Penn.

TOWN IN WHICH YOU LIVE: Pittsburgh

YEARS SPENT LIVING IN WESTERN PENNSYLVANIA: Childhood, then returned 10 years ago.

ATTRACTION YOU WOULD RECOMMEND TO A FIRST-TIME VISITOR: The Duquesne Incline.

FAVORITE FAMILY-FRIENDLY ACTIVITY: Riding bicycles on the Montour trail near Pittsburgh.

FAVORITE OUTDOOR RECREATION: Dirt bike riding, baseball and football games.

BEST LOCATION FOR RECREATION: Slippery Rock Dunes north of Pittsburgh.

BEST ENTERTAINMENT VENUES: Gateway Clipper, The John Heinz History Museum, and Phipps Conservatory.

FAVORITE PLACE TO EAT: Fatheads Restaurant and Saloon.

MUST-HAVE SOUVENIR: A Terrible Towel

PITTSBURGH'S BEST-KEPT SECRET: The strip district, shopping, and ethnic foods.

BEST VIEW: Monterey Bay Fish Grotto Restaurant

AFTERNOON SESSIONS | 1:30 PM - 5:30 PM

Does the EMC Society Have a Role or Responsibility to Set Standards in Smart Grid? *Sponsored by SETCom and SC1*

Format: Half-day Workshop – FR-PM-2 Room 304-305

Chairs: *Alistair Duffy, De Montfort University, Leicester, United Kingdom*
Qiubo Ye, Communications Research Centre Canada, Ontario, Canada
Don Heirman, Don HEIRMAN Consultants, New Jersey, USA
William Radasky, Metatech Corporation, California, USA

Abstract

The purpose of this workshop is to explore possible uses of EMCS standards for Smart Grid application and to identify where additional needs are. Doing this will help the attendees understand the standards-related work performed by the Society, see how it might be applied to Smart Grid, and also to interest the attendees in the broader scope of EMCS standards work.

Planned Speakers and Topics

- **Introduction to Smart Grid and Overview of Current Developments in this Area 1:30-2:15PM**
  Don Heirman, Don HEIRMAN Consultants, New Jersey, USA
- **Introduction to EMC Standards – Review of Some Standards and the Process of Standard Development 2:15-3:00PM**
  Andy Drozd, ANDRO Computational Solutions, New York, USA
- **The Case for EMCS Involvement in Smart Grid 3:30-4:15PM**
  William Radasky, Metatech Corporation, California, USA
- **The Concern for EMCS Not Being Involved or Maintaining a Passive 'Watching' Brief 4:15-5:00PM**
  Alistair Duffy, De Montfort University, Leicester, United Kingdom
- **Panel Discussion 5:00-5:30PM**
  Don Heirman; Andy Drozd; William Radasky; Alistair Duffy; and Galen Koepke, Chair of SGIP EMIIWG, NIST, Colorado, USA

Attendee participation: Propose the scope of a new EMC standard that fills any gaps in either immunity test needs or test levels.

Summary

Fundamentals of Signal and Power Integrity

Sponsored by TC10

Format: Half-day Tutorial – FR-PM-3
Room 310-311

Chair: *A. Ege Engin, San Diego State University, California, USA*
Co-chair: *Bill Chen, Tsinghua University, Beijing, China*



AFTERNOON SESSIONS | 1:30 PM-5:30 PM

Abstract

As the clock frequencies for off-chip signals approach 20 GHz and beyond, maintaining signal and power integrity are becoming major issues to designing a computer system that can actually support such speed. This tutorial will cover fundamentals of modeling, simulation, and characterization techniques to ensure signal and power integrity. The list of topics covered in this tutorial can be summarized as:

Equivalent-circuit modeling of power distribution system, power plane resonances, target impedance, and noise coupling through return currents.

EM simulation set-up issues such as ports, reference (GND) planes, boundaries, PCB/package co-design, and model truncation effect.

Challenges in model correlation, general practices to assure high quality of electrical models.

Modeling and simulation methodologies through chip/package/PCB co-design, and co-optimization to enable 25+Gbps serial-link channels.

Planned Speakers and Topics

- **Power Integrity Analysis and Design**
  A. Ege Engin, San Diego State University, California, USA
- **Modeling Issues and Possible Solutions for EM Simulation of High Speed PCBs/ Packages**
  Antonio Ciccomancini, CST of America, Massachusetts, USA
- **Simulation and Measurement Correlation for High Speed Interconnect**
  Xiaoning Ye, Intel, California, USA
- **Chip/Package/PCB Co-Design for 25+Gbps Serial-Link Channels**
  Bill Chen, Tsinghua University, Beijing, China

Electromagnetic Compatibility in the Nuclear Age: Plant and Laboratory Perspective

Format: Half-day Workshop – FR-PM-4
Room 317-318

Chair: *Michael A. Hoffman, Exelon Nuclear/ Peach Bottom APS, Pennsylvania, USA*

Abstract

Nuclear plants, originally commissioned for 40 years, are being maintained on-line beyond that time by upgrading equipment, expanding and improving safety systems, and making improvements in plant operations. At the core of the upgrade and modernization efforts is the critical emphasis on assuring Electromagnetic Compatibility (EMC) in these installations. Safety-critical systems must be sufficiently robust to withstand potential threats from radiated and conducted interference. Additionally, other upgrades must also be shown to have no impact on the safety-related equipment already installed, nor have issues that would cause a loss of generation. As

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- T-PEDS
- RF Site Surveys
- Shielding Effectiveness
- Transmissivity Testing
- Safety
- Training Courses

Lab Highlights

- NARTE Certified Technicians, E3 Technologists & Electrical/Mechanical Engineers
- 5 Anechoic Chambers
- HIRF Test Facilities
- High Voltage Lab
- Mechanical Engineering & Design
  - Engineering and analysis of materials and components
- Custom Fabrication
- Machining, MIG, TIG Welding

Compliance Testing

Aeronautical	DO-160, Airbus, Boeing
Automotive	SAE, CISPR, ISO E-Mark
Commercial	CISPR, CE Mark, ANSI
Military	MIL-STD, DEF-STAN
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AFTERNOON SESSIONS | 1:30 PM - 5:30 PM

plants become more dependent on wireless communications, a new set of issues dealing with radiated interference as well as channel capacity and bandwidth become of greater concern.

This workshop will address the issue of Nuclear EMC from the plant operations point-of-view as well as from the laboratory. The format will be presentation style for the individual speakers, followed by a panel session in which all presenters will field questions, moderated by the session chair.

Planned Speakers and Topics

- **Introduction** 1:30-1:35PM
  Michael A. Hoffman, Exelon Nuclear, Delta, Pennsylvania, USA
- **Lightning Strike Avoidance and Critical Circuit Protection** 1:35-2:05PM
  Richard L. Brehm, Tennessee Valley Authority, Tennessee, USA
- **Plant Perspectives on Controlling the EM Environment** 2:05-2:30PM
  Gopi Mehrotra and Michael A. Hoffman, Exelon Nuclear/ Peach Bottom APS, Pennsylvania, USA
- **A Vendor Perspective for Holistic System Implementation** 2:30-3:00PM
  Chad Kiger, Analysis & Measurement Services Corp., Tennessee, USA
- **EMC Test Laboratory Perspectives** 3:30-4:00PM
  Steve Ferguson, Washington Laboratories, Maryland, USA
- **Overview and Updates on Related Standards Activities** 4:00-4:30PM
  Philip Keebler, Electric Power Research Institute, Tennessee, USA
- **Digital Upgrade Implementation Experiences – Panel Discussion** 4:30-5:30PM
  The panel will consist of the above presenters with the intent to cover any questions or comments for the entire workshop. Chaired by Michael A. Hoffman, Exelon Nuclear, Pennsylvania, USA

Advances in EMI Reduction for Power Electronics Systems

Format: Half-day Tutorial – FR-PM-5 Room 320-321

Chair: *Shuo Wang, University of Texas at San Antonio, Texas, USA*

Abstract

Power electronics is very important to many emerging energy applications such as renewable energy power conversion, electric vehicle charging, and PV power conversion and inversion. EMI is a very important research topic in the power electronics area. This tutorial will introduce the advances in EMI characterization, EMI



AFTERNOON SESSIONS | 1:30 PM-5:30 PM

suppression, EMI filter design, and EMI measurement in power electronics systems. The tutorial material will greatly benefit the EMI/EMC engineers and researchers in both academia and industry.

Planned Speakers and Topics

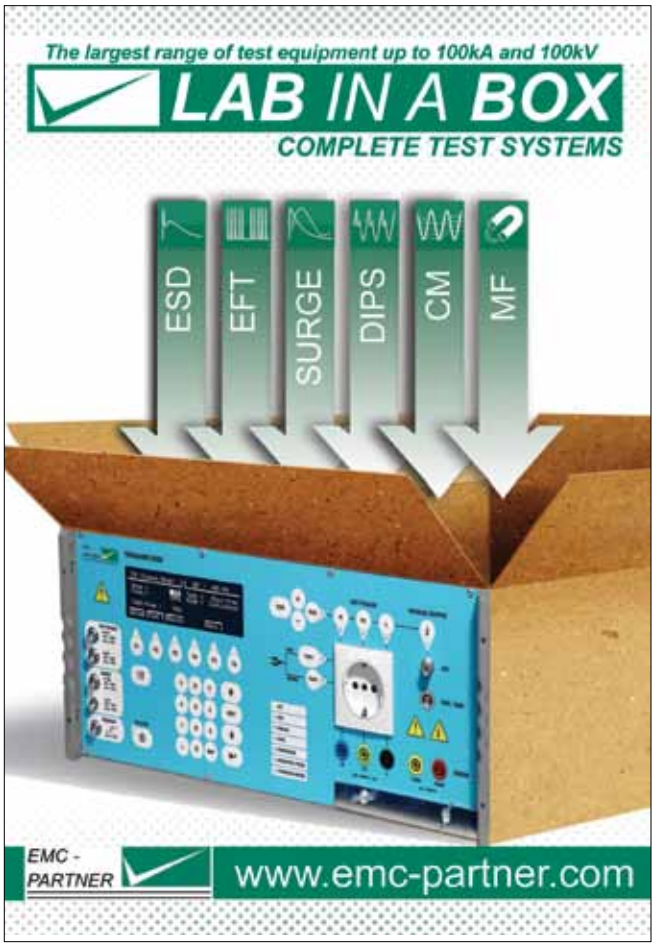
- **High Performance EMI Filter Design with Parasitic Cancellation for Power Electronics Systems**
  Shuo Wang, University of Texas at San Antonio, Texas, USA
- **EMI Reduction for Power Conversion Modules with Impedance Balance Concept**
  Pengju Kong, Intersil Corp., California, USA
- **EMI Prediction for Power Converters Based on the Principle of Spectrum Analyzers**
  Zijian Wang, Monolithic Power Systems Inc., California, USA
- **Advanced EMI Reduction and Measurement Techniques for Power Electronics Systems**
  Shuo Wang, University of Texas at San Antonio, Texas, USA

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TC MEETINGS PLAY AN IMPORTANT ROLE IN THE OVERALL success of the EMC Society by promoting activities in their fields and providing expert knowledge and assistance to generate and review technical papers, organize and operate sessions at symposia, generate and develop standards, and evaluate the state of the art in EMC science. All meetings are open to everyone; join them for breakfast, a break, lunch, or dinner. Listen to the discussions and learn what they are working on. Join your peers who volunteer to make EMC better. Just by attending, you can be part of the solution and the future of EMC!

TECHNICAL COMMITTEE 1: EMC MANAGEMENT

This committee is concerned with the development and dissemination of Best Practices and Methodologies for the successful leadership, supervision, and guidance of EMC-related activities. These Best Practices and Methodologies shall be structured so as to provide assistance to all managers and engineers. Appropriate and convenient tools shall serve as a foundation to these Best Practices and Methodologies.

TECHNICAL COMMITTEE 2:EMC MEASUREMENTS

This committee is concerned with the measurement and instrumentation requirements in EMC standards and procedures and how they are interpreted. It is also concerned with the adequacy of measurement procedures and measurement instrumentation specifications for radiated and conducted emission, susceptibility tests, and the rationale for performance limits for these tests.

TECHNICAL COMMITTEE 3: ELECTROMAGNETIC ENVIRONMENT

This Technical Committee is to encourage research in the following areas:

- **electromagnetic environment (EME)**
- **development of standards for EME measurement and characterization**
- **natural and man-made sources of electromagnetic environment that comprise this environment**
- **effects of noise (unwanted portions of EME) on systems performance**
- **effects of international civil and military standards intended to control manmade intentional and unintentional emissions of electromagnetic energy**

TECHNICAL COMMITTEE 4: EMI CONTROL

This committee is concerned with design, analysis, and modeling techniques useful in suppressing interference or eliminating it at its source. Bonding, grounding, shielding, and filtering are within the jurisdiction of this committee. These activities span efforts at the system, subsystem, and unit levels.

TECHNICAL COMMITTEE 5: HIGH POWER ELECTROMAGNETICS

This committee is concerned with the effects and protection methods for electronic equipment and systems for all types of high-power electromagnetic environments. These environments include electromagnetic pulse (EMP), intentional EMI environments (e.g. high power microwaves and ultrawideband), lightning electromagnetic currents and fields, and electrostatic discharge. Interactions with aircraft and other mobile systems are included.

TECHNICAL COMMITTEE 6: SPECTRUM MANAGEMENT

This committee is concerned with frequency coordination management procedures for efficient spectrum use, band occupancy and congestion, federal regulations and their adequacy, and associated electromagnetic compatibility concerns.
Note: For the 2012 Symposium, TC-6 will be joining up with TechAmerica's G46 EMC Subcommittee to provide a full Tuesday afternoon "Spectrum Update" event.

TECHNICAL COMMITTEE 7: LOW FREQUENCY EMC

This committee is concerned with low-frequency EMC including Power Quality in electric power systems. The committee is focusing on application of fundamental EMC concepts and also on low frequency conducted disturbances. EMC in power systems is expected to be increasingly important. This is due to increased use of electronics in renewables, electric vehicles, energy efficient technologies, and Smart Grid applications.

TECHNICAL COMMITTEE 9: COMPUTATIONAL ELECTROMAGNETICS

This committee is concerned with broad aspects of Applied Computational Electromagnetic techniques, which can be used to model electromagnetic interaction phenomena in circuits, devices, and systems. The primary focus is with the identification of the modeling methods that can be applied to interference (EMC) phenomena, their validation, and delineating the practical limits of their applicability. Included are low- and high-frequency spectral-domain techniques and time-domain methods.

TECHNICAL COMMITTEE 10: SIGNAL INTEGRITY

This committee is concerned with the design, analysis, simulation, modeling, and measurement techniques useful in maintaining the quality of electrical signals. These activities encompass all aspects of signal integrity from the integrated circuit level to the system level.

TECHNICAL COMMITTEE 11: NANOTECHNOLOGY

This newest technical area for the EMC Society has topics that include carbon nanotubes, composite materials, and other measurement, design, and analysis applications.

SPECIAL COMMITTEE 1: SMART GRID

This special committee is concerned with coordinating the EMC Society activity on providing EMC principles for organizations,and with the associated documentation and specifications that address the efficient use of the AC power grid including the control of power entering and in some cases exiting a house or building.

SPECIAL COMMITTEE 3: TRANSPORTATION SYSTEM EMC

This committee is concerned with the component and system design, testing, and modeling/simulation of transportation systems. This includes both passenger carrying and non-passenger vehicles such as automobiles, trucks, trains/trams, and aircraft. Special emphasis is placed on the latest developments in high-power and high-voltage systems used for propulsion or control.

Have you discovered the EMC ZONE blog on the new Interference Technology website? www.interferencetechnology.com

COMPUTER MODELING & SIMULATION DEMONSTRATIONS

TUESDAY, AUGUST 7 – 9:00 – 11:00AM

TOPIC: Using Simulated Instruments to Conveniently Develop, Edit, and Validate EMC Test Routines

PRESENTER: Joe Tannehill, ETS-Lindgren, Austin, TX, USA

ABSTRACT: Automating the test process has the benefit of improving measurement accuracy and repeatability while also increasing test throughput. For those who wish to create their own software, many code development tools are available. However, there are also a number of commercially available software packages in which the software routines have already been developed and tested. Regardless of whether user developed software or a commercially available package is used, trial runs of the test often need to be made to assure correct event sequencing and equipment parameters are being used. Sometimes this can be complicated by the unavailability of an instrument for the trial run. A recent development has been the introduction of simulated or virtual instruments that allow the test engineer to run a trial test without encumbering test equipment or lab space. This demonstration will show how instrument simulation can be used to model test results in an efficient and cost effective manner.

TUESDAY, AUGUST 7 – 2:00 – 4:00PM

TOPIC: Cable Analysis using Combined Field and Multi-Conductor Transmission Line Approach for EMC Applications

PRESENTER: Marlize Schoeman, EM Software & Systems – S.A. (Pty) Ltd., Stellenbosch, South Africa and C.J. Reddy, EM Software & Systems Inc., Hampton, VA, USA

ABSTRACT: Many EMC and interference compliance problems involve cables, which have a major impact on the susceptibility and emissions performance of a system. Topics will include the RLCG network description of general cross sections, bi-directional coupling considerations, interconnection of cable paths into harnesses and a unique approach for solving shielded cables along an arbitrary path.

WEDNESDAY, AUGUST 8 – 9:00 – 11:00AM

TOPIC: Integrated EM and RF System Simulation for Cosite EMI Analysis

PRESENTER: Fred German, Delcross Technologies, Champaign, IL, USA and David Johns, CST of America, Framingham, MA, USA

ABSTRACT: Prediction of cosite interference in complex environments requires a combination of computational electromagnetic (CEM) and RF system-level simulation in order to accurately simulate all possible interference mechanisms. In this demonstration, we will show how these different simulation technologies can be integrated into a streamlined process for predicting cosite interference.

WEDNESDAY, AUGUST 8 – 2:00 – 4:00PM

TOPIC: Multichannel Link Path Analysis

PRESENTERS: Alexander Razmadze, Missouri University of Science & Technology, Rolla, MO, USA

ABSTRACT: Algorithms employed in multichannel link path analysis will be discussed in this demonstration. The topics covered will include S-parameter matrix cascading, calculation of transfer functions accounting for reflection, vector fitting for macromodeling, channel delay extraction, recursive convolution, and causality/passivity checking and enforcement. Also, the relationship between the quality of frequency domain data and the results of time domain simulations will be highlighted.

HARDWARE EXPERIMENTS & DEMONSTRATIONS

TUESDAY, AUGUST 7 – 9:00 – 11:00AM

TOPIC: Electromagnetic Field Containment Using the Principle of "Self-Shielding"

PRESENTER: Thomas Van Doren, EMC Laboratory, Missouri University of Science & Technology, Rolla, MO, USA

ABSTRACT: The "self-shielding" principle involves routing a current so that the geometric centroids of the outgoing and the return paths are coincident. This is a new way to visualize an old idea. The self-shielding concept will be explained and then demonstrated using a variety of cables; such as an untwisted pair, a twisted pair, and a coaxial cable.

TUESDAY, AUGUST 7 – 2:00 – 4:00PM

TOPIC: Effect of a Gap in the Signal Return Line

PRESENTERS: Kenneth Wyatt, Wyatt Technical Services LLC, Woodland Park, CO, USA

ABSTRACT: This demonstration illustrates one of the top causes of EMC failure in products today. A gap in the return path will generate large common-mode currents, which can then cause board resonance and cable emissions, as well as external susceptibilities. This demonstration can be easily reproduced at the attendee's workplace as a form of valuable instruction.

CONTENT:

1. **Description & demo test PC board, with and without gap in return.**
2. **Demo increased radiated emissions (with current and h-field probes).**
3. **Demo increased radiated susceptibility with FRS transmitter.**
4. **Demo increased ESD susceptibility with simulator.**

WEDNESDAY, AUGUST 8 – 9:00 – 11:00AM

TOPIC: Embedded Capacitance Effectiveness vs. Board Topology

PRESENTERS: Bogdan Adamczyk, Grand Valley State University, Grand Rapids, MI, USA and Scott Piper, Gentex Corp, Zeeland, MI, USA and Jim Teune, Gentex Corp, Zeeland, MI, USA

ABSTRACT: Understanding the PCB embedded capacitance (parasitic inter-plane capacitance) effect on PCB power distribution network is a challenging problem. While the embedded capacitance is generally a desirable factor, one must understand some fundamental principles governing its impact in order to effectively use it.

This hardware demo will show impedance measurements of multiple PCBs with varying values of embedded capacitance. S parameter measurements will be performed on several printed circuit boards with following configurations:

-PCBs of various dielectric thicknesses and the same dimensions

-PCBs of various dimensions and the same dielectric thickness

-PCBs of various dimensions with discrete capacitors including high ESR capacitors

Hardware demonstration will be supported by theoretical explanations and simulations. Attendees of this demonstration will leave with a good understanding of embedded capacitance, its limitations, and ways to use it for their specific application.

Topic: Magnetic Field Shielding Using High Conductivity or High Permeability Metals

Presenter: Thomas Van Doren, EMC Laboratory, Missouri University of Science & Technology, Rolla, MO, USA

Abstract: Undesirable time-changing magnetic-fields can sometimes be reduced or controlled by using a high conductivity metal to create an eddy current generated field that opposes the time-rate-of-change of the original field or by using a metal with a high magnetic permeability to reroute the magnetic flux. This demonstration will show which metals are effective at frequencies from 100-100,000 Hz.

WEDNESDAY, AUGUST 8 – 2:00 – 4:00PM

Topic: Near Field Probes in EMI/EMC/RF Design and Troubleshooting

Presenter: Arturo Mediano, University of Zaragoza, Zaragoza, Spain

Abstract: People in the electronics field are usually very interested in EMI fundamentals because they experience their effects on the lab (EMI and "RF black magic") or production work (EMC). A lot of them usually need to solve the problems in a short time, under pressure and by trial and error. In that process, electric and magnetic near-field probes are very useful tools. Near-field probes are useful too for RF engineers, as they can be used to tune circuits in a non-invasive way. This session will cover the following topics related to the use of near-field probes:

i) Commercial vs. homebrew near-field probes

ii) Near-field probes and instrumentation: scope (time domain), spectrum analyzer, tracking generator, and VSWR bridge (frequency domain), etc.

iii) Near-field probe techniques with circuits, cables, rack, and box design

iv) Near-field probes in RF design.

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NEW iNARTE CERTIFICATIONS FOR 2012



Brian F. Lawrence
Business Adviser, iNARTE
at RABQSA International
1-800-89-NARTE
lawrence@inarte.us

iNARTE IS NOW MERGED INTO THE RABQSA International organization, a subsidiary of the American Society for Quality, ASQ. At IEEE EMCS 2012 iNARTE will still offer examinations in our traditional EMC discipline and others. However, this year we have something new to offer: **EMC Design Engineer Certification.**

Although not entirely new this year, the EMC Design Engineer credential is now fully developed and already we have almost 140 certificate holders. Examinations will be available at EMCS 2012 in the following two levels:

EMC DESIGN ENGINEER: Intended for the recent graduate and young engineer with limited work experience, who has the knowledge and skill to apply EMC principles to electronics design. A typical candidate will have included several EMC elective courses in an EE degree curriculum and will be seeking a position in industry or will have been employed in industry for less than three years. Applicants who do not have a bachelor's degree will be accepted if they have four or more years of related work experience. Undergraduates may also apply and will be awarded an Associate level certification pending graduation. Applicants will need to pass the examination, write two new original examination questions, and provide a reference and proof of education.

SENIOR EMC DESIGN ENGINEER: This level can be attained by an individual who has held EMC Design Engineer certification for three years and passes an upgrade examination. Applications will also be accepted from individuals with an appropriate bachelor's degree and who have four or more years of related work experience. Applicants will need to pass the Senior level examination, write five new original examination questions, and provide three references and proof of education.

Application forms for all these levels are available from the iNARTE website. These forms contain greater detail on the certification requirements and the nature of the examination. All examinations are CLOSED BOOK. Certifications in this discipline will be awarded for life with no annual renewal requirement or fee.

MIL-STD EMC SPECIALIST CERTIFICATION:

iNARTE has developed a new certification specifically for engineers and technicians involved with testing and designing for compliance to MIL-STDs. The requirements are similar to the structure of our traditional EMC certification program but are not as demanding:

The four-hour examination will consist of forty-eight questions, but only forty are to be answered. Half of the forty-eight questions will be taken from the MIL-STDs. The remainder will be from other EMC fundamentals, such as antennas, amplifiers, filters, shielding, and bonding.

WIRELESS DEVICE CERTIFICATION PROFESSIONAL:

This credential is intended to validate the knowledge and experience of engineers and technicians working in test laboratories that have the responsibilityof evaluating wireless devices for compliance with international regulatory standards. In recent years there has been an explosion in the number and complexity of these devices. Understanding the requirements for their certification has become a technology unto itself worthy of recognition.

Applicants should have an appropriate education background and at least six years of related work experience. Supervisory and peer references are required. Applicants must pass an iNARTE examination consisting of two four-hour test sessions. Part 1 addresses EMC fundamentals and Part 2 concentrates on wireless certification requirements for FCC and IC with options to add RTTE endorsements.

All above application files can be downloaded from the iNARTE website www.narte.org.

Monday, August 6

The iNARTE Examinations Preparation Workshop is a recommended Workshop for all who register to take any of the iNARTE Certification Examinations on Friday, August 10, 2012. This year we will offer several different EMC Certification examinations – our traditional eight-hour examination for EMC Engineers or Technicians, a new six-hour examination leading to a Certification for Senior EMC Design Engineers, and a six- hour examination leading to a Certification for entry level EMC Design Engineers. The traditional EMC Certification examinations feature general EMC knowledge with an emphasis on Testing, Metrology, and Standards. The new EMC Design Engineer examinations concentrate more heavily on the ability to apply EMC principles to electronic design for compliance. These new certification programs have been developed with the cooperation of leading electronics and automotive corporations in the U. S. and Japan. At the workshop we will discuss the format of both program examinations and the best approach to ensure success. The last two hours of the workshop will be devoted to a trial examination paper, where we will present twenty or so typical questions. All attendees are invited to bring notebooks, reference materials, calculators, and laptop computers if they are planning to take the trial examinations. To determine which of these certifications is better suited to your career goals, visit www.narte.org for all program details.

Tuesday, August 7 to Thursday, August 9

iNARTE will be at our exhibition booth each day. We invite all our members and anyone interested in learning more about iNARTE and our Certification programs to visit us there. You can register for any of the Friday examinations at our booth. We will also have on display, and for purchase, books and CDs that may be used as Study Guides for the examinations.

Friday, August 10

The iNARTE Certification Examinations will be held at the Symposium from 8:00am to 5:00pm. We hope that many who attend The Global EMC University lectures during the week will validate their knowledge and experience by becoming an iNARTE Certified Engineer or Technician. This is the ideal time and place to take the examination element of our certification process. The traditional exams for EMC Engineer and EMC Technician will run concurrently. Each is a two-part paper, and each part is scheduled to run for four hours with an optional one-hour break at lunchtime. The new senior and entry-level EMC Design Engineer examinations are also two-part papers, each three hours long with an optional one-hour break. Examinees for the traditional program may bring any reference materials and a PC to the examination room. We do not guarantee access to either electric power or wireless Internet access, but if it is available, it may be used. Examinees for the EMC Design Engineer certification may bring only their own notebooks and a scientific calculator; no reference books or laptops will be allowed.

NEW FOR 2012! Full Day on Interlab Comparisons and Data Reduction

This workshop is presented now in four parts over a three-day period including: (1) Introduction to interlab emission measurement comparisons (ILC) and requisite data reduction, (2) Review of the 2009 edition of ANSI C63 4 (accepted by the FCC), (3) Review of the 2006 edition of C63 5, and (4) Application of time domain (TD) for test-site validation and antenna calibration. The changes proposed for the expected 2012 edition of C63 4 and C63 5 will also be highlighted.

The workshops are designed to increase your understanding of these standards, the TD approach, and the importance of interlab comparisons (ILC) as they apply to emission measurements and how to analyze results to improve lab test accuracy. The C63 4 workshop will include an analysis of the test-site validation, including using the CISPR S-VSWR method and the appropriate antenna. The C63 5 workshop will highlight which technique should be used based on the type of antenna being calibrated. This is essential to ensure that the right antenna factor is obtained, especially when validating semi-anechoic chambers. The application of the TD method to validating test sites and antenna calibrations will also be presented. Group problem solving will be a highlight of all four workshops. **Visit www.c63.org for more information.**

In the ILC workshop, you will learn:
- Elements of ISO 17025, Clause 59
- Collecting/analyzing data
- Setting control limits/uncertainty
- Computing/presenting results
- Lab experience with comparisons

In the C63.4 workshop, you will learn:
- Emission measurement procedures
- Regulatory implications
- Test facility and instrumentation requirements
- Test arrangements and configurations
- Changes proposed for 2012 edition

In the C63.5 workshop, you will learn:
- General test conditions
- Application of standard site method
- Rationale for geometry specific correction factors for biconicals
- Measurement uncertainty guidelines
- Changes proposed for 201X edition

In the TD workshop, you will learn:
- Application for site validation
- Application for antenna calibration
- Tips on using TD instrumentation in a ten meter semi-anechoic chamber

Support Material
- A complete lecture notebook
- FCC handouts and references

Who Should Attend
- Product managers and developers
- EMC engineers and test technicians
- Regulatory compliance managers
- Test instrumentation developers
- Calibration labs/technicians
- Accreditation bodies and lab quality assessors
- Test instrumentation and chamber manufacturers
- Data reduction analysts

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Fee Includes
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Agenda

Interlab Comparison
August 2: Registration 8:30 am
Class: 9:00 am to 5:00 pm

ANSI C63.4:
August 3: Registration: 8:30 am
Class: 9:00 am to 5:00 pm

ANSI C63.5 and Time Domain:
August 4: Registration: 8:30 am
Class: 9:00 am to 5:00 pm

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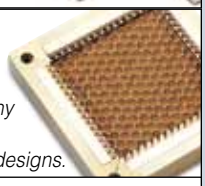
BeCu Fingerstock Gaskets *are offered to close gaps as narrow as .010". Tech-Etch manufactures over 120 standard profiles for immediate delivery.*



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New Low-Profile 2-Piece Standard Designs *offers heights as low as .060". Interactive PDF sales drawings on website.*



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Global EMC University with NEW SI Track Added for 2012 EMC Conference

2012 SCHEDULE

- **TUESDAY, AUGUST 7**

8 AM-Noon, Morning Session / 1:30-5:30 PM, Afternoon Session

- **WEDNESDAY, AUGUST 8**

8 AM-Noon, Morning Session / 1:30-5:30 PM, Afternoon Session

- **THURSDAY, AUGUST 9**

8 AM-Noon, Morning Session / 1:30-5:30 PM, Afternoon Session

THE GLOBAL EMC UNIVERSITY HAS BEEN OFFERED AT the annual IEEE EMC Symposium since 2007. It is an opportunity for practicing EMC engineers to jump-start their careers by attending lectures offered by industry experts on selective EMC topics. This program has always received high praise from attendees and will be offered again at the 2012 Symposium in Pittsburgh, PA.

New for 2012, the topics will expand to include signal integrity. To build the SI curriculum, Dr. Eric Bogatin has been added to the organizing team, which includes Mark Steffka and Chuck Bunting. These experienced industry veterans have put together an exciting program of lectures sure to interest practicing engineers facing the higher bandwidth problems of today's leading applications.

Over a three-day span, more than 16 industry experts will present 90-minute workshops on EMC and Signal Integrity topics such as conducted emissions, antennas, EM shielding, transmission lines, differential pairs, PDN noise control, eye diagrams, and S-parameters.

Lectures are taught by an international team of industry experts and educators, each selected for their reputation for engineering excellence and demonstrated ability to effectively communicate essential concepts. Nowhere else will you find such a collection of global experts in one forum.

Among the featured lecturers are Prof. Todd Hubing, Larry Smith, Lee Hill, Jeff Loyer, Bruce Archambeault, Collin Brench, and Colin Warwick.

Each of the organizers will also be presenting workshops at the Global University. Mark Steffka will present a workshop entitled "Conducted Emissions and Power Supply Filters". He will review the conducted emission regulatory requirements, the LISN, common-mode and differential-mode currents, and an analysis of typical power supply filters.

Chuck Bunting will present a workshop entitled "Selecting the Right Numerical Simulation Tool". This will be a brief overview of numerical methods for solving problems in electromagnetics including FDTD, BEM, FEM techniques, and the software that employs them, with emphasis on practical problems to solve.

Eric Bogatin will present a hands-on lab introducing QUCS (Quite Universal Circuit Simulator), a popular circuit simulator that also does S-parameter simulation. He will demonstrate how this simple, easy to use, and free simulation tool can be used to analyze important problems related to reflection noise, ground bounce, capacitor selection for the PDN, and single-ended and differential S-parameter viewing and simulation.

The grand finale of the three-day Global University workshop will be an ask-the-experts panel. Our collection of world-class expert instructors will be available in the main lecture hall to answer questions from the audience on any topic related to EMC or SI engineering. Where else can you find such a concentration of talent, experience, and knowledge to answer those perplexing questions?

This is truly a unique opportunity to get a jump-start on your EMC or SI Engineering career. Don't miss this exciting event. To register for the Global EMC and SI University, visit the 2012 IEEE EMC Symposium website at **www.2012emc.org**.

PCB LAYOUT FOR EMC COMPLIANCE

Bruce Archambeault, IBM (EMC and SI tracks)

Demonstrate printed circuit board layout techniques that reduce radiated emissions and improve a product's immunity to external threats.

TRANSMISSION LINES

Tzong-Lin Wu, Department of Electrical Engineering, National Taiwan University (EMC and SI tracks)

Transmission line propagation characteristics: impedance, delay, loss, and signal impact will be described. The transient behavior of the discontinuities or mismatch, such as vias or split power/ground planes, will be demonstrated, and their impact on signal integrity and EMC issues will be discussed.

CONDUCTED EMISSIONS AND POWER SUPPLY FILTERS

Mark Steffka, University of Michigan-Dearborn (EMC track)

A brief review of the conducted emission regulatory requirements, the LISN, common-mode and differential-mode currents, and analysis of typical power-supply filters.

ANTENNAS

Andy Marvin, University of York (EMC track)

This talk will describe the basic properties of antennas with specific reference to EMC applications. The use of antennas for both transmission (radiated immunity) and reception (radiated emissions) will be highlighted. The criteria for near-field to far-field operation will be described. Exercises will rely on students obtaining and using antenna data from exhibitors.

HOW TO UNDERSTAND, IDENTIFY, AND REDUCE RADIATED EMISSIONS FROM ELECTRONIC PRODUCTS DURING DESIGN

Lee Hill, Silent Solutions, LLC (EMC track)

This talk will discuss how radiated electromagnetic fields are produced in an electronic product and which design methods reduce those emissions. Fundamental sources and antenna structures that cause strong radiated emissions will be discussed using a combination of conceptual and mathematical definitions based on published IEEE EMCS research and illustrated using hardware demonstrations that combine observations and measurements of high frequency noise.

EM SHIELDING THEORY AND PRACTICE

Colin Brench, Amphenol High Speed Interconnects (EMC track)

This session will present the basic physics of RF shielding and examine the practical details that must be addressed to achieve good shielding performance in real products. Shielding examples, using both computational and real product data, are used to illustrate the subtle factors that must be addressed. It is anticipated that a software demo will be arranged to demonstrate further details of system EMI shielding.

OVERVIEW OF NUMERICAL METHODS

Chuck Bunting, Oklahoma State University (EMC track)

A brief overview of numerical methods for solving problems in electromagnetics including FDTD, BEM, and FEM techniques and the software that employs them emphasizing practical problems to solve.

HORROR STORIES FROM THE FIELD, BUT WITH HAPPY ENDINGS

Richard Hartley, L-3 Communications (EMC and SI tracks)

This presentation will review some of the more instructive signal integrity and EMC failures encountered in the field and the take-away lessons that can be learned from these experiences. Many of the problems encountered are caused by not following some of the important design guidelines that all SI and EMC engineers should know.

CIRCUIT SIMULATION FOR EVERYONE

Eric Bogatin, Bogatin Enterprises (EMC and SI tracks)

In this short presentation, a simple, easy to use circuit simulator will be introduced and four important problems will be solved using it. We will simulate a TDR, a 2-port network analyzer, the reflection noise in a branched network, and the impedance profile of a collection of capacitors used in the PDN. Best of all, this tool is free.

DDR DESIGN CASE STUDY

John Medina, High Speed Design Services, LLC (SI track)

In this presentation, a DDR3 memory design will be used to illustrate the design cycle when signal integrity plays an important role. We start with identifying the required performance specs, then identify which nets might be troublesome. We then identify how to establish design rules to get it right the first time. We will show a few examples of what can go wrong and how to avoid common problems in DDR designs.

ISSUES IN STACK-UP, LAYOUT, AND RETURN PATH DISCONTINUITIES IN PRINTED CIRCUIT BOARD DESIGN

Jim Herrmann, AppliedLogix (SI track)

This technical session will identify common PCB design pitfalls and present a set of best PCB stack-up and trace routing practices for achieving optimal SI and EMC. The key electrical and electromagnetic principles that are at the core of both the common problems and the best practices will be highlighted.

PDN CURRENT PROFILES

Larry Smith, Qualcomm Corp (SI track)

It is the transient current from the die passing through the impedance of the PDN which causes power rail noise. We introduce a simple model to describe the transient current through a die and how this helps explain the voltage noise profile on-die and on-board.

PRINTED CIRCUIT BOARD POWER BUS DECOUPLING

Todd Hubing, Clemson University (SI track)

Power bus decoupling at the circuit board level plays a critical role in the signal integrity and electromagnetic compatibility of electronic systems. Yet there is a lot of confusion about the best design practices. Should decoupling capacitors be located near each active device or spread around the board? Should they have the same value or should different values be used? How much capacitance is required? Is it better to put power planes next to ground planes, or is it better to sandwich high-speed traces between the planes? Should capacitors be connected to the planes or directly to the device being decoupled? How effective is embedded capacitance? The answers to these questions will depend on your application. A decoupling strategy that works very well on one circuit board can be disastrous when applied to another board. This presentation reviews proper strategies for printed circuit board decoupling in various situations and discusses recent advances in this field.

DIFFERENTIAL PAIRS: WHAT I WISH MOM HAD TOLD ME ABOUT THEM

Jeff Loyer, Intel Corp. (EMC and SI tracks)

Differential pairs are used universally for all high speed products. If routed properly, they can support significantly higher bandwidth than single-ended signals while providing relaxation of some constraints (compared to single-ended signals). In this presentation, some of the design principles and guidelines for optimized differential pairs will be reviewed.

THE POWER OF S-PARAMETERS FOR HIGH SPEED DIGITAL DESIGN

Colin Warwick, Agilent Corp. (EMC and SI tracks)

Multigigabit/s connections between chips that are linear and time-invariant can be completely characterized by measured parameters – called network parameters – at their terminals, irrespective of their internal configuration. Moreover, the measured parameters of any such individual component, such as connectors and PCB traces, can be used to determine the network parameters of any configuration containing these components.

S-parameters are being used more and more in high-speed digital design because, as microwave engineers have known for decades, they are easier to measure and work with than other kinds of parametric models. Although s-parameters are a frequency-domain representation, they can be combined easily with time-domain techniques such as SPICE and IBIS IC models and eye pattern diagrams by use of convolution (IFFT) methods

This talk will explain the motivation behind the generation and use of s-parameter models and offer some tricks and tips to avoid pitfalls that can sometimes occur.

WHY EYES COLLAPSE AND WHAT TO DO ABOUT IT

Patrick Carrier, Mentor Graphics (SI track)

An eye is created from a pseudo-random bit sequence (PRBS) signal. It is the most important final metric for the performance of a high-speed serial link. Too much vertical or horizontal collapse may result in too high a bit error rate. In this presentation we will review where an eye comes from and how the features in the physical design of the channel influence it. In addition, we will show how an eye can be improved by using equalization techniques at the transmitter and at the receiver.

SYSTEM LEVEL ESD FAILURE ANALYSIS AND DESIGN

David Pommerenke, Missouri University of Science and Technology (EMC track)

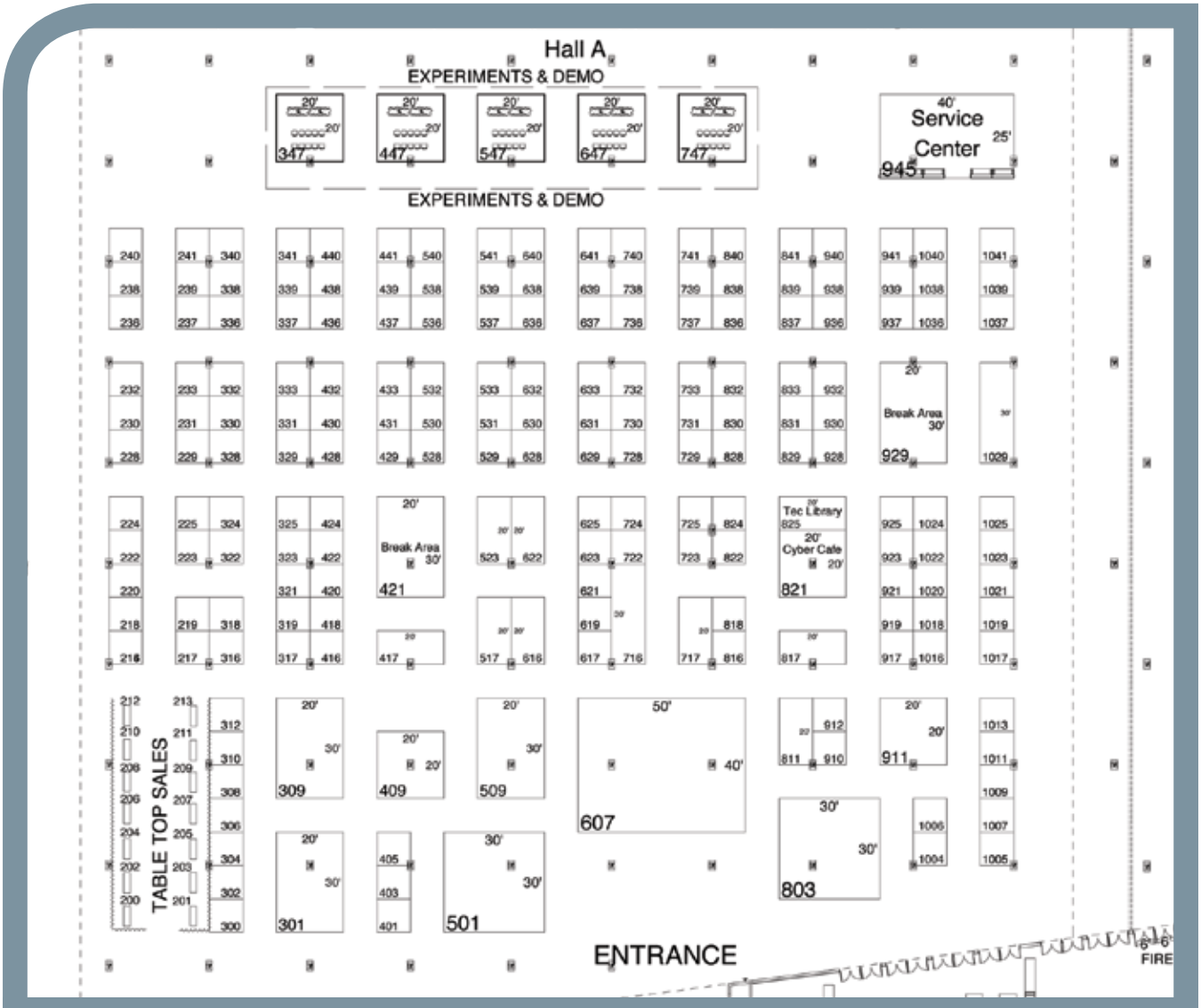
In this presentation, a design guideline will be given for ESD robust system level design. Each aspect of the design guideline will be derived from the analysis of products or from theoretical or simulation-based considerations. The objective is to enable the audience to apply rules based on understanding their bases and limitations.



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EMC Partner AG
Fischer Custom Communications, Inc.

LIGHTNING SIMULATORS
Advanced Test Equipment Rentals
EM TEST USA
Fischer Custom Communications, Inc.

LIGHTNING STRIKE TESTING
National Technical Systems
Retlif Testing Laboratories
TÜV SÜD America Inc.

LINE IMPEDANCE STABILIZATION NETWORKS (LISNS/PLISNS)
TESEQ, Inc.

LOG PERIODIC ANTENNAS
A.H. Systems, Inc.
Advanced Test Equipment Rentals
AR RF / Microwave Instrumentation
Instruments for Industry (IFI)
Rohde & Schwarz, Inc.

MAGNETIC FIELD PROBES/METERS
AR RF / Microwave Instrumentation
ETS-Lindgren
Fischer Custom Communications, Inc.
Rohde & Schwarz, Inc.

MAGNETIC SHIELDING GASKETS
GORE
Spectrum Advanced Specialty Products
Spira Manufacturing Corp.

MICROWAVE ABSORBERS
Dutch Microwave Absorber Solutions
Leader Tech, Inc.

MICROWAVE FILTERS
EMI Filter Company
Instruments for Industry (IFI)
Spectrum Advanced Specialty Products
V Technical Textiles, Inc./Shieldex U.S.

MICROWAVE POWER AMPLIFIERS
Advanced Test Equipment Rentals
AR RF / Microwave Instrumentation
Instruments for Industry (IFI)
Ophir RF

MIL-STD 188/125 TESTING
Clark Testing
MET Laboratories, Inc.
National Technical Systems

MIL-STD 461/462 TESTING
National Technical Systems
TÜV SÜD America, Inc.

MOBILE SHIELDED ROOMS
Advanced Test Equipment Rentals

MONOPOLE ANTENNAS
Instruments for Industry (IFI)
Rohde & Schwarz, Inc.

MRI SHIELDING
ETS-Lindgren
Leader Tech, Inc.
Mushield Company
V Technical Textiles, Inc./Shieldex U.S.

NAVLAP / A2LA APPROVED TESTING
Keystone Compliance
National Technical Systems
TÜV SÜD America, Inc.

NETWORK ANALYZERS
Agilent Technologies, Inc.

PARALLEL PLATE LINE TEST SET
ETS-Lindgren
Fischer Custom Communications, Inc.
Rohde & Schwarz, Inc.

PORTABLE TEST EQUIPMENT
A.H. Systems, Inc.
Advanced Test Equipment Rentals
Instruments for Industry (IFI)

POWER LINE FILTERS
Curtis Industries/ Filter Networks
Schurter, Inc.
V Technical Textiles, Inc./Shieldex U.S.

PRINTED CIRCUIT BOARD FILTERS
Curtis Industries/ Filter Networks
Schurter, Inc.
Spectrum Advanced Specialty Products
Tri-Mag, Inc.

PRODUCT SAFETY TESTING
National Technical Systems
Retlif Testing Laboratories
TÜV SÜD America, Inc.

RADIATION HAZARD METERS/PROBES
Advanced Test Equipment Rentals
ETS-Lindgren
Instruments for Industry (IFI)

RETROFIT FILTERS & CONNECTORS
Amphenol Canada
Curtis Industries/ Filter Networks
Quell Corp.
Schurter, Inc.
V Technical Textiles, Inc./Shieldex U.S.

RF POWER AMPLIFIERS
Advanced Test Equipment Rentals
AR RF / Microwave Instrumentation
Instruments for Industry (IFI)
Ophir RF
TESEQ, Inc.

RF POWER METERS
AR RF / Microwave Instrumentation
ETS-Lindgren
Rohde & Schwarz, Inc.

RF SHIELDING GASKETS
MAJR Products
Spectrum Advanced Specialty Products
Spira Manufacturing Corp.
Tech-Etch, Inc.

RF SHIELDING MATERIAL
Spectrum Advanced Specialty Products
Spira Manufacturing Corp.
Tech-Etch, Inc.
V Technical Textiles, Inc./Shieldex U.S.

RS03<200 V/METER TESTING
National Technical Systems
TÜV SÜD America, Inc.

RTCA DO-160 TESTING
National Technical Systems
Retlif Testing Laboratories
TÜV SÜD America, Inc.

SCIF DESIGN, CONSTRUCTION, & MAINTENANCE
ETS-Lindgren

SHIELDED AIR FILTERS
ETS-Lindgren
Leader Tech, Inc.
Spira Manufacturing Corp.
Tech-Etch, Inc.

SHIELDED BUILDINGS
Advanced Test Equipment Rentals
ETS-Lindgren
MET Laboratories, Inc.
V Technical Textiles, Inc./Shieldex U.S.

SHIELDED COMPONENTS
Schurter, Inc.
Spira Manufacturing Corp.
Tech-Etch, Inc.

SHIELDED DOORS
ETS-Lindgren
V Technical Textiles, Inc./Shieldex U.S.

SHIELDED FANS
ETS-Lindgren
Leader Tech, Inc.
Spira Manufacturing Corp.
Tech-Etch, Inc.

SHIELDED ROOM FILTERS
ETS-Lindgren
V Technical Textiles, Inc./Shieldex U.S.

SHIELDED ROOMS
Advanced Test Equipment Rentals
Applied Electromagnetic Technology
Braden Shielding Systems
ETS-Lindgren
Panashield

SHIELDED ROOMS/ACCESSORIES
Leader Tech, Inc.
National Technical Systems
V Technical Textiles, Inc./Shieldex U.S

SHIELDED ROOMS / LEAK DETECTORS
ETS-Lindgren

SHIELDED TUBING
Mushield Company

SHIELDING
Intermark (USA) Inc.
Kreiger Specialty Products
Metal Textiles Corp.
Mushield Company
Quell Corp.
Vermillion Inc.

SHIELDING EFFECTIVENESS TESTING
ETS-Lindgren
Leader Tech, Inc.
National Technical Systems
Retlif Testing Laboratories
TÜV SÜD America Inc.

SHIELDING, MAGNETIC FIELD
Silk Metallic Corporation
Spira Manufacturing Corp.

SIGNAL GENERATORS
Advanced Test Equipment Rentals
Agilent Technologies, Inc
AR RF / Microwave Instrumentation
Rohde & Schwarz, Inc.

SIGNAL LINE FILTERS
Curtis Industries/ Filter Networks
EMI Filter Company
ETS-Lindgren
Spectrum Advanced Specialty Products
V Technical Textiles, Inc./Shieldex U.S

SITE ATTENUATION TESTING
ETS-Lindgren
MET Laboratories Inc.
National Technical Systems

SITE SURVEY SERVICES
ETS-Lindgren
National Technical Systems

SOFTWARE, EMI/EMC RELATED
2comu
ANSYS, Inc. (Ansoft Products)
Delcross Technologies, LLC
Detectus (Interfax)
Electro-Magnetic Applications, Inc.
EM Software & Systems (USA) - FEKO
EMSCAN
Moss Bay EDA
NEXIO
Techcelerant

SOLID-STATE AMPLIFIERS
AR RF / Microwave Instrumentation
Instruments for Industry (IFI)

SPECTRUM ANALYZERS
Agilent Technologies, Inc.
Rohde & Schwarz, Inc.

STANDARDS TRANSLATIONS
ANDRO Computational Solutions, LLC
TÜV SÜD America, Inc.

STATIC CONTROL MATERIALS & EQUIPMENT
Advanced Test Equipment Rentals

SUPPRESSORS
Fair-Rite Products Corp.
Fischer Custom Communications, Inc.

TELCORDIA TESTING
MET Laboratories, Inc.
National Technical Systems
TÜV SÜD America, Inc.

TELECOMMUNICATIONS TEST NETWORKS
Advanced Test Equipment Rentals
Agilent Technologies, Inc.
Ophir RF

TEM CELLS
Advanced Test Equipment Rentals
ETS-Lindgren
Fischer Custom Communications, Inc.
Instruments for Industry (IFI)
Rohde & Schwarz, Inc.
TESEQ, Inc.

TEMPEST FILTERS
Curtis Industries/ Filter Networks
Dynamic Sciences International
Spectrum Advanced Specialty Products

TEMPEST TESTING/ TEST EQUIPMENT
A.H. Systems, Inc.
Advanced Test Equipment Rentals
Dynamic Sciences International
Fischer Custom Communications, Inc.
Kreiger Specialty Products
National Technical Systems
Rohde & Schwarz, Inc.
Shinyei Corporation of America (Noiseken)

TEST ACCESSORIES
A.H. Systems, Inc.
Advanced Test Equipment Rentals
AR RF / Microwave Instrumentation
EM TEST USA
ETS-Lindgren
Fischer Custom Communications, Inc
Instruments for Industry (IFI)
Ophir RF
Rohde & Schwarz, Inc.
TESEQ, Inc.

TEST EQUIPMENT, LEASING & RENTAL
A.H. Systems, Inc.
Advanced Test Equipment Rentals
AR RF / Microwave Instrumentation
Instruments for Industry (IFI)
TESEQ, Inc.

TEST EQUIPMENT, REPAIR & CALIBRATION
Advanced Test Equipment Rentals
Agilent Technologies, Inc.
ETS-Lindgren
Fischer Custom Communications, Inc.
Instruments for Industry (IFI), Inc.
Tektronix, Inc.
TESEQ, Inc.
TestEquipment.com

TEST INSTRUMENTATION
A.H. Systems, Inc.
Aeroflex
Amber Precision Instruments, Inc.
EMI Instrumentation
Haefely EMC
HV Technologies, Inc.

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Thermo Fisher Scientific

TESTING

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Boeing
Clark Testing
DNB Engineering, Inc
Dynamic Sciences International
Electronics Test Centre (ETC) - Kanata
Empower RF Sytems, Inc.
Keystone Compliance
NAVAIR
Nemko USA, Inc.
NEXIO
Northwest EMC, Inc.
Qualtest
Retlif Testing Laboratories
RF Exposure Lab LLC
Techcelerant
Timco Engineering, Inc.
TUV Rheinland of North America, Inc.
TUV SUD America, Inc.
Washington Laboratories, Ltd

TESTING LABORATORIES

Aberdeen Test Center
D.L.S. Electronics Systems, Inc.
Elite Electronic Engineering, Inc.
Keystone Compliance
Liberty Labs Inc.-World Cal, Inc.
National Technical Systems
Qualtest
Retlif Testing Laboratories
TÜV SÜD America, Inc.

TRAINING, SEMINARS & WORKSHOPS

A2LA, American Association for Laboratory Accreditation
China Electrotechnical Society (CES)
CST of America, Inc.
Kimmel Gerke Associates, Ltd.
Leader Tech, Inc.
TESEQ, Inc.
TÜV SÜD America, Inc.

TRANSIENT DETECTION & MEASURING EQUIPMENT

Advanced Test Equipment Rentals

AR RF / Microwave Instrumentation

TRANSIENT GENERATORS

Advanced Test Equipment Rentals
AR RF / Microwave Instrumentation
EM TEST USA
EMC Partner AG
Fischer Custom Communications, Inc.
TESEQ, Inc.
Transient Specialists, Inc.

TRAVELING WAVE TUBE AMPLIFIERS

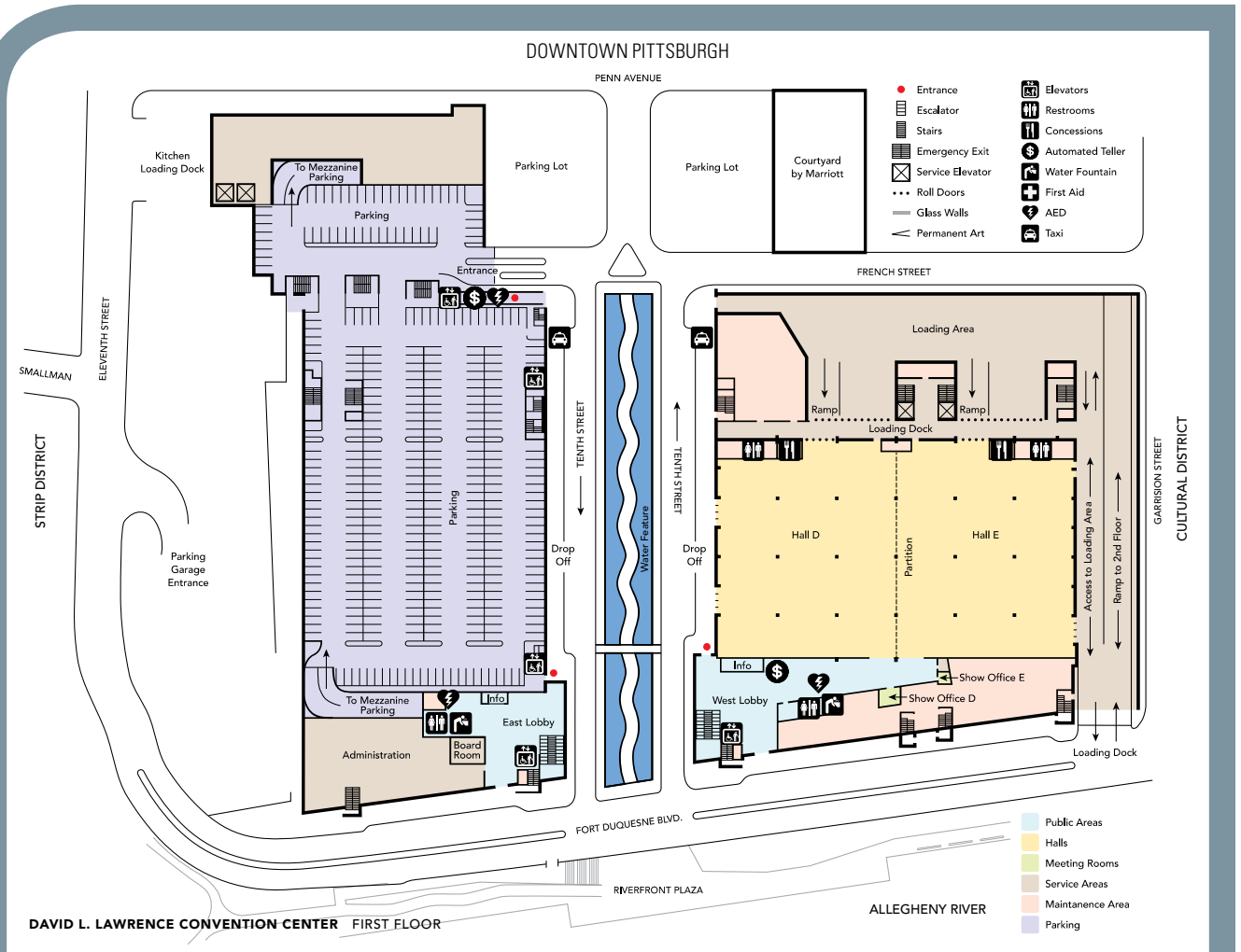
AR RF / Microwave Instrumentation
Instruments for Industry (IFI)

VOLTAGE PROBES

Advanced Test Equipment Rentals
Fischer Custom Communications, Inc.
Rohde & Schwarz, Inc.

WIRE & CABLE FILTERS

Spectrum Advanced Specialty Products



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EVERYTHING YOU NEED TO KNOW ABOUT PITTSBURGH

WELCOME TO PITTSBURGH! Check out all the sights of one of America's favorite cities as you explore on foot, by car, or by riverboat. Take in the vibrant and diverse shopping of the Strip or relax in the peaceful Phipps Conservatory. Grab a classic American dog at The Original, or impress your date with the world-class cuisine of Lidia's. After dinner you'll find a vibrant night-life with dozens of bars and clubs to suit any style. Of course, no visit would be complete without a trip to PNC Park to catch a Pirates game.

If you're looking to escape the bustle for an afternoon, there's no better way to see the city than a trip up Mount Washington on the historic incline, or a cruise on the Majestic and Empress riverboats as they explore the Allegheny, Monongahela, and Ohio rivers.

Pittsburgh has no shortage of museums and galleries for those looking to soak in Western Pennsylvania's history and culture. Explore the hands-on exhibits of the Carnegie Science Center, relive the life of an art legend at the Andy Warhol Museum, or wander with the dinosaurs at the expansive Carnegie Natural History Museum.

Whatever your taste, Pittsburgh has something for everyone. Let us show you why we're America's Most Livable City. You might just want to stay -- We sure do! ■

RESTAURANTS

SYMPOSIUM TRIPS ARE EXPENSIVE, ISN'T THERE ANYTHING CHEAP TO EAT?

ESSIE'S ORIGINAL HOT DOG SHOP – THE "O" A
3901 Forbes, Pittsburgh, PA
412-621-7388
American
Signature dish: Fresh cut fries, fried twice
http://www.hollyeats.com/OriginalHotDog.htm
$10-15 per entrée

PRIMANTI BROS.
3803 Forbes Ave., Pittsburgh, PA 15213
(more than 5 Pittsburgh locations)
412-621-4444
Sandwich shop
Signature dishes: All sandwiches are topped with french fries, cole slaw & tomatoes
http://www.primantibros.com/index.html
Menu: http://www.primantibros.com/assets/pdf/menu_city_oakland.pdf
$5-10 per entrée

ANDY'S WINE BAR
510 Market Street, Pittsburgh, PA, 15222
412-773-8884
Pizza and sandwiches
http://andyswinebar.com/
Menu: http://andyswinebar.com/generate.php?page=menu
$5-10 per entrée, wine $9-15 per glass

DOUBLE WIDE GRILL
2339 E. Carson St., Pittsburgh, PA 15203
412-390-1111
American
Signature dish: Jailhouse Beef Chili
http://doublewidegrill.com/
Dinner menu: http://doublewidegrill.com/PDFs/Menu_Dinner.pdf
$8-10 per entrée

THAT STUFF LOOKS GREAT, BUT I'M TRYING TO IMPRESS MY CLIENT!

LIDIA'S PITTSBURGH
1400 Smallman St., Pittsburgh, PA 15222
412-552-0150
Italian
Signature dish: Lidia's Pasta Trio
http://www.lidias-pittsburgh.com/
Dinner menu: http://www.lidias-pittsburgh.com/wp-content/uploads/2011/04/Dinner-2011-mayweb.pdf
$15-25 per entrée

AUGUST HENRY'S CITY SALOON
946 Penn Avenue, Pittsburgh, PA 15222
412-765-3270
Steaks and seafood
Signature dish: Crab Cakes
http://www.augusthenrys.com/
Menus: http://www.augusthenrys.com/pdf/AugustHenry_Dinner.pdf
$15-25 per entrée

KIKU JAPANESE RESTAURANT
Commerce Court, 225 West Station Square Drive, Pittsburgh, PA 15219
412-765-3200
Japanese
Signature dishes: Kaki Frieds, Beef Maki
http://kikupittsburgh.net/index.htm
Menu: http://kikupittsburgh.net/dinner.htm
$10-30 per entrée

NOLA ON THE SQUARE B
24 Market Square, Pittsburgh, PA 15222
412-471-9100
New Orleans cuisine
Signature dishes: Scallop Mac Daddy
http://www.nolaonthesquare.com/
Menu: http://www.nolaonthesquare.com/menu.html
$10-30 per entrée





VALLOZZI'S
220 5th Ave., Pittsburgh, PA 15222
412-394-3400
Italian
Signature dishes: Filet and Crab
http://vallozzispittsburgh.com/
Dinner menu: http://vallozzispittsburgh.com/dinner/
$15-30 per entrée

CHURCH BREW WORKS
3525 Liberty Ave., Pittsburgh, PA 15201
412-688-8200
American
Signature dishes: Seven-Onion Soup, Brewmisu
http://www.churchbrew.com/
Dinner menu: http://www.churchbrew.com/menus/DinnerMenu.pdf
$15-35 per entrée

HOFBRÄUHAUS
2705 South Water St., Pittsburgh, PA 15203
412-224-2328
German
Signature dish: Hofbräuhaus Pretzels and Bier Cheese
http://www.hofbrauhauspittsburgh.com/
Menu: http://www.hofbrauhauspittsburgh.com/pdf/hbpmenu.pdf
$10-20 per entrée

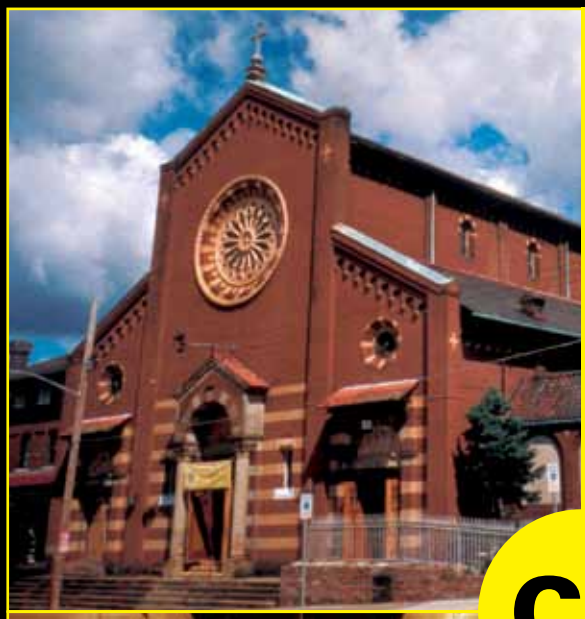
I MEAN I REALLY WANT TO IMPRESS MY CLIENT.

MONTEREY BAY FISH GROTTO
1411 Grandview Avenue, Pittsburgh, PA 15211
412-481-4414
Seafood
Signature dishes: Crab Cakes
http://www.montereybayfishgrotto.com/pittsburgh/default.aspx
Dinner menu: http://www.montereybayfishgrotto.com/pittsburgh/menu.aspx
$25-$40 per entrée

ELEVEN
1150 Smallman St, Pittsburgh, PA 15222
412-201-5856
Steak and Seafood
Signature dishes: Shrimp and grits
http://www.bigburrito.com/eleven/eleven.shtml
Dinner menu: http://www.bigburrito.com/eleven/menu/pdf/eleven_dinner.pdf
$20-50 per entrée

NAKAMA JAPANESE STEAKHOUSE AND SUSHI BAR
1611 East Carson St., Pittsburgh, PA 15203
412-381-6000
Steak and Sushi
Signature dish: Hibachi Chateaubriand
http://eatatnakama.com/pittsburgh/
Menu: http://eatatnakama.com/pittsburgh/menus.php
$15-70 per entrée

TERRACE ROOM
530 William Penn Place, Pittsburgh, Pennsylvania 15219
412-281-710
American
Signature dish: Wild Boar
http://www.omnihotels.com/findahotel/pittsburghwilliampenn/dining.aspx
Dinner Menu: http://www.omnihotels.com/findahotel/pittsburghwilliampenn/~/media/14F9BD071A4943BF87C4F8341B539727.ashx
$20-40 per entrée


C




D



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ITEM MEDIA

SOCIAL EVENTS

CHAPTER CHAIR TRAINING SESSION AND DINNER

Monday, August 6 2:00 PM – 9:00 PM

The Chapter Chair Training Session (2:00 PM – 5:00 PM) provides a forum for focused training to the Chapter Chairs, provides them with the opportunity to discuss their chapter issues and get group feedback, gives them the opportunity to meet Chapter Chairs from around the world, and allows for the Chapter Coordinator to disseminate important information from IEEE headquarters and the EMC Society Board of Directors.

A Social Session (6:00 PM – 6:30 PM) will precede the dinner, giving the Chapter Chairs the opportunity to socialize with the other Chapter Chairs and their Angels. The dinner will be served at the end of the Social Session (6:30 PM – 8:30 PM). Besides enjoying a great meal, each Chapter Chair or their representative will have the opportunity to share what their chapter has been doing for the past year.

After the dinner, an interactive brainstorming session (8:30 PM – 9:00 PM) will conclude the meeting. This session is intended to provide an opportunity to exchange information and new ideas for effective chapter management, as well as to discuss best practices and suggestions for future development and growth of the EMC chapters.

This is a free event open to Chapter Chairs or their representatives. Please check with your Chapter Chair, as you might be that representative for your chapter if your Chapter Chair cannot attend this event.

WELCOME RECEPTION

Tuesday, August 7 6:30 PM

Senator John Heinz History Center

From the pre-revolutionary drama of the French and Indian War to the legendary match-ups of the Super Steelers, discover 250 years of Pittsburgh history at the Senator John Heinz History Center.

An affiliate of the Smithsonian Institution, the History Center is the largest history museum in Pennsylvania. The 275,000 sq. ft. museum features six floors of long-term and changing exhibition space, including the Western Pennsylvania Sports Museum, a dynamic museum-within-a-museum, and the Library & Archives, an extensive scholarly resource documenting 250 years of life in Western Pennsylvania. The History Center presents the most compelling stories from American history with a Western Pennsylvania connection, all in an interactive environment that is perfect for visitors of all ages!

A Full Technical Registration (member, non-member, life member, retired, unemployed, or student) or a Companion Club Registration includes one ticket to the reception and two drink coupons. All others may purchase a ticket to the reception (which includes two drink coupons) as an add-on cost to your registration:

- Adult Reception Ticket is $55 before July 9, 2012 and $65 afterwards.
- Junior (Age 8 – 18) Reception Ticket is $30 before July 9, 2012 and $35 afterwards.
- Children under age 8 are free, but must have a free Exhibit Hall registration badge.



FOUNDERS AND PAST PRESIDENTS LUNCHEON

Wednesday, August 8 11:30 AM – 1:30 PM

The Founders and Past Presidents Luncheon will be held at the convention center. The luncheon is open to the Founders of the EMC Society, Past Presidents of the EMC Society, current members of the Board of Directors, and students. The luncheon is a chance for the old and the new to mix, exchange stories of the past and challenges of the future, and learn about the EMC profession.

A sit-down lunch is provided. Please indicate that you plan to attend so there will be seating and food for you.

EVENING GALA EVENT

Wednesday, August 8 6:30 PM

Gateway Clipper Fleet Majestic and Empress Ships

There is no better way to see America's Most Livable City than from the decks of the Majestic and Empress riverboats. Come aboard and explore the Allegheny, Monongahela, and Ohio rivers and experience an uncompromised view of beautiful landscapes that rise from the banks of the three rivers. The clean, blue waters are framed by lush foliage and award-winning architecture that make Pittsburgh one of the most scenic cities in the United States.

A Full Technical Registration (member, non-member, life member, retired, unemployed, or student) includes one ticket to the Gala and two drink coupons. All others may purchase a ticket to the Gala (which includes two drink coupons) as an add-on cost to your registration:

- Adult Gala Ticket is $80 before July 9, 2012 and $85 afterwards.
- Junior (Age 8 – 18) Gala Ticket is $30 before July 9, 2012 and $35 afterwards.
- Children under ago eight are free but must have a free Exhibit Hall registration badge.





AWARDS LUNCHEON

Thursday, August 9 12:30 PM – 2:30 PM

The Awards Luncheon will be the last formal opportunity to gather and network with family of EMC professionals from academia, industry, government, military, and retired. The event will begin with a sit-down meal. Afterwards, the EMC Society will take time to recognize members and non-members for their contribution to the society and professional excellence.

A Full Technical Registration (member, non-member, life member, retired, unemployed, or student) or a Companion Registration includes one ticket to the Luncheon. All others may purchase a ticket to the Awards Luncheon separately:

- Children under age 8 are free, but must have a free Exhibit Hall registration badge.
- An Adult Luncheon Ticket is $40 before July 9, 2012 and $45 afterwards.
- A Junior (Age 8 – 18) Awards Luncheon Ticket is $20 before July 9, 2012 and $25 afterwards.

GOLD EMC PARTY

Thursday, August 9 6:00 PM – 8:30 PM

All those who are GOLD EMC-eligible, come and join us for a fun night of bowling and pizza. Mingle with the young professional crowd and see how many "turkeys" or "spares" we get.

A $10 fee will be collected on-site. Limited to 50 attendees, so sign up early! Transportation will be provided to and from the bowling alley. Additional information will be provided in the Final Program.

Sign up during GOLD Session and Welcome Reception Check-in. Let us know if you are coming on www facebook/ieeegoldemc for a head count. Raffle tickets will be distributed during the GOLD Session to **ONLY** GOLD EMC members and those eligible for GOLD membership.

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ITEM MEDIA

ATTRACTIONS

PNC PARK

A

115 Federal Street
Pittsburgh, PA 15212

1-800-BUY-BUCS

PNC Park's prime location along the shore of the Allegheny River and adjacent to Federal Street takes advantage of scenic vistas of the downtown skyline and riverfront, creating an exciting and dramatic urban sports venue. It also provides easy access for riverboats and for pedestrians crossing the Roberto Clemente bridge from downtown, as well as those arriving from the riverwalk. On game days the bridge is closed off to vehicular traffic and spectators are met by a dynamic interactive retail, restaurant, and sports pavilion beyond right field with attractions for all ages.

ANDY WARHOL MUSEUM

117 Sandusky Street
Pittsburgh, PA 15212-5890

http://www.warhol.org/

The Andy Warhol Museum is one of the four Carnegie Museums of Pittsburgh and a collaborative project between the Carnegie Institute, the Dia Art Foundation, and the Andy Warhol Foundation for the Visual Arts. The collection covers the entire range of Warhol's work from all periods, including student work from the 1940s, 1950s drawings, commercial illustrations and sketchbooks, 1960s Pop paintings of consumer products, celebrities, portrait paintings, skull paintings from the 1970s, works from the 1980s, and source materials such as photographs, newspapers, and magazines. Enjoy a can of Campbell's soup to get you in the mood for this one!

PHIPPS CONSERVATORY

One Schenley Park
Pittsburgh, PA 15213

http://phipps.conservatory.org/

Phipps Conservatory and Botanical Gardens has been inviting visitors to explore the beauty and mysteries of plants since 1893 in their great steel and glass greenhouse. Phipps Conservatory is set amidst one of Pittsburgh's largest green spaces, Schenley Park.
In recent decades, Phipps has evolved into one of the region's most vibrant and thriving cultural attractions, bringing fresh perspectives and artists into its historic glasshouse environment. Your allergies might not thank you, but your eyes and nose certainly will.

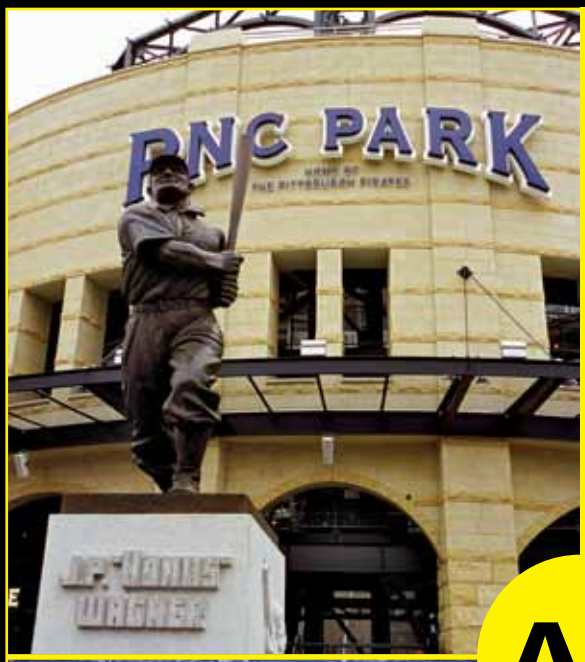
THE MOUNT WASHINGTON INCLINES DUQUESNE INCLINE

B

1197 West Carson Street
Pittsburgh, PA 15219
Monongahela Incline
East Carson Street
Pittsburgh, PA 15211

http://www.stationsquare.com/info/inclines

If you want to see Pittsburgh, the best way to do it is from the cable-cars on Mount Washington. Choose from either the Duquesne Incline, located just west of the Fort Pitt Bridge and facing the Ohio River, or the Monongahela Incline, located near the Smithfield Street Bridge. directly across the Monongahela River from downtown Pittsburgh. For only $2.25, if you can only do one thing while you're in Pittsburgh, this is definitely it!



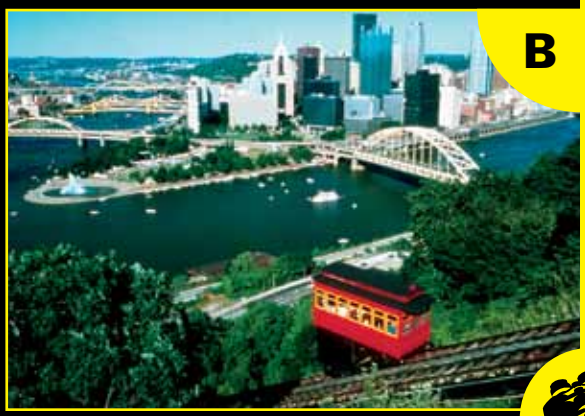
A



GAMES:

PITTSBURGH PIRATES V. ARIZONA DIAMONDBACKS
Monday, Aug. 6 @ 7:05 PM
Tuesday, Aug. 7 @ 7:05 PM
Wednesday, Aug. 8 @ 7:05 PM
Thursday, Aug. 9 @ 4:05 PM

PITTSBURGH PIRATES V. SAN DIEGO PADRES
Friday, Aug. 10 @ 7:05 PM
Saturday, Aug. 11 @ 7:05 PM
Sunday, Aug 12 @ 1:35 PM



B

STATION SQUARE

125 West Station Square Drive
Pittsburgh, PA 15219

http://www.stationsquare.com/

Whether you want to check out the Hard Rock Café or watch the Waltzing Waters Liquid Fireworks Show at the fountain at Bessemer Court, Station Square is the place for you. Housing over 20 unique retailers, shoppers will find everything from Pittsburgh souvenirs to novelties from around the world including toys, fashions, jewelry, and cigars. But don't forget, there's no swimming in this fountain.

SENATOR JOHN HEINZ HISTORY CENTER

1212 Smallman Street
Pittsburgh, PA 15222

http://www.heinzhistorycenter.org/index.aspx

From the pre-revolutionary drama of the French & Indian War to the legendary match-ups of the Super Steelers, discover 250 years of Pittsburgh history at the Senator John Heinz History Center. An affiliate of the Smithsonian Institution, the History Center is the largest history museum in Pennsylvania. The 275,000 sq. ft. museum features six floors of long-term and changing exhibition space. Be careful not to get lost!

CARNEGIE MUSEUM OF NATURAL HISTORY

C

4400 Forbes Avenue
Pittsburgh, PA 15213

http://www.carnegiemnh.org/

At Carnegie Museum of Natural History, dinosaurs are just the beginning. Discover prehistoric sea creatures, gem and mineral collections, Ancient Egyptian history, and the Hall of North American Wildlife. Take part in hands-on activities that make scientific discovery come alive.



CARNEGIE MUSEUM OF ART

4400 Forbes Avenue
Pittsburgh, PA 15213-4080

http://web.cmoa.org/

The Carnegie Museum of Art offers a distinguished collection of contemporary art that includes film and video works, American art from the late 19th century, French Impressionist and Post-Impressionist paintings, and European and American decorative arts from the late 17th century to the present. The Heinz Architectural Center, opened as part of the museum in 1993, is dedicated to the collection, study, and exhibition of architectural drawings and models. The Hall of Architecture contains the largest collection of plaster casts of architectural masterpieces in America and one of the three largest in the world. The marble Hall of Sculpture replicates the interior of the Parthenon. But don't get confused, you're not in Athens.

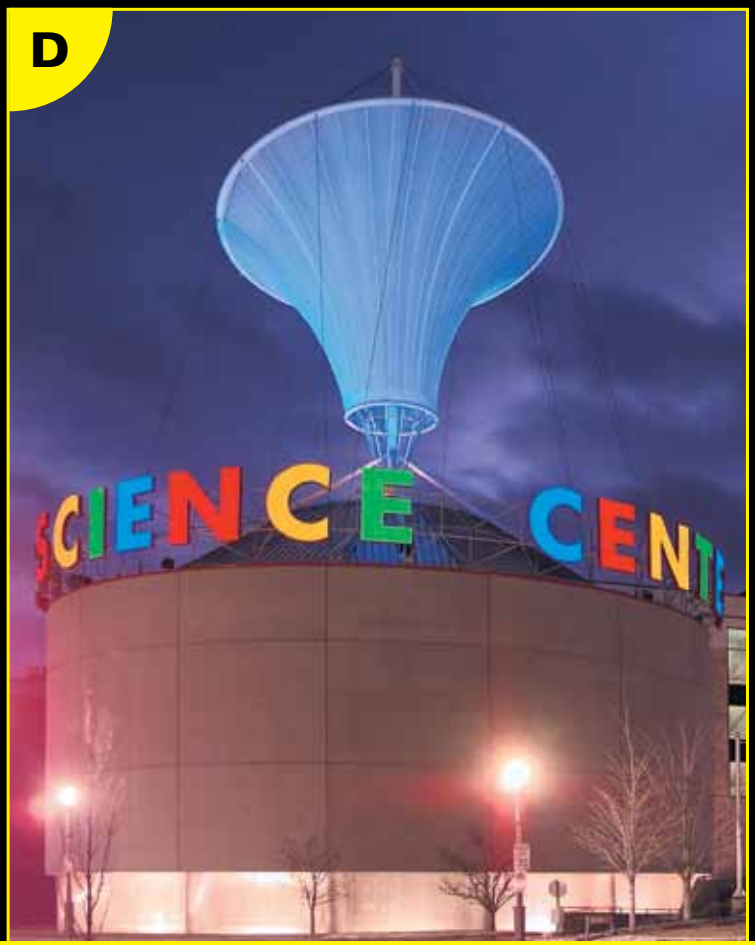
CARNEGIE SCIENCE CENTER

D

One Allegheny Avenue
Pittsburgh, PA 15212

http://www.carnegiesciencecenter.org/

Recipient of the 2003 National Award for Museum Service, Carnegie Science Center inspires and entertains by connecting science and technology with everyday life. In addition to providing valuable scientific experiences, Carnegie Science Center engages in outreach programs that serve Pittsburgh's diverse community.



COMPANION PROGRAM

PHIPPS CONSERVATORY AND BOTANICAL GARDENS

A

Monday, August 6
Depart 12:30 PM
Depart Conservatory for High Tea 2:30 PM
Return to hotel by foot 4:30 PM

Real estate baron Henry Phipps donated the gardens to the city in 1893. This Victorian glasshouse is one of the world's largest botanical gardens. Explanations of its nineteen indoor and outdoor gardens will be provided by a Conservatory docent. See the lush tropical palms, orchids, ferns, and desert plants, as well as sculpture and Bonsai exhibits. Another must-see is the butterfly forest and the outdoor rose garden. After the event, the bus will take you to the historic Omni William Penn Hotel for Victorian High Tea complete with scones, tea sandwiches, pastry, and, of course, tea.

Cost per person: $63
Includes transportation, docent tour, High Tea, step-on guide.

KENNYWOOD PARK

B

Tuesday, August 7
Depart noon
Return 9 PM

This traditional amusement park still has structures and rides dating back to its opening in the early 1900s. It is one of only two amusement parks listed in the National Register of Historic Places. Kennywood has made use of the hilly Pittsburgh terrain to create coasters that would not be feasible in most amusement parks. In fact, until recently it was called The Roller Coaster Capital of the World. Two of its wooden coasters, the Thunderbolt and the Jack Rabbit, place the lift chain in the middle of the ride, not at the beginning.

Cost per person: $54
Includes bus transportation and admission to the park.
Youths two and under free. Meals will be on your own in the park.

ON THE STRIP AND BEHIND THE SCENES

C

Tuesday, August 7
Depart 9:30 AM
Return 12:30 PM

This bustling wholesale district is an invigorating adventure into one of the city's most colorful areas -- a real Pittsburgh melting pot. In days gone by, the Strip, then known as the Produce Yards, came alive at 2 AM when trucks began unloading their produce, night owls sought out Primanti's late night eatery, and the city's chefs came in pursuit of the day's freshest fare. Now it swarms with activity as new restaurants, coffeehouses, night clubs, and brew pubs add life to the night. During the day, plunge into the Strip's exciting sights, smells, and tastes from a multitude of stores featuring authentic foreign foods, boutiques, art, Pittsburgh stores, vintage furniture stores, and colorful street vendors. A special mini-class on roasting and brewing coffee will be given by La Prima Expresso Company at their production headquarters. See how biscotti are made at The Enrico Biscotti Company. Visit St Stanislaus, a Polish Roman Catholic Church built in 1891.

Cost per person: $61
Includes transportation, special demonstrations, tastings, and step-on guide.

CARNEGIE SCIENCE CENTER

D

Wednesday, August 8
Depart 11 AM
Depart Carnegie Science Center 3:30 PM

Join us for a day of exploration at the Carnegie Science Center. As you explore the four floors of exhibits, take time to visit the miniature railroad and village, stop at "roboworld," try your skills at the Sportsworks, hop aboard the USS Requin Submarine, and so much more! Highmark SportsWorks® offers nearly thirty interactive experiences in three thematic areas: LifeWorks, Physics of Sports, and Sports Challenge. Here you can get fastened into a bungee harness and do some high-flying tricks on Bounce, see just how fast your fastball is in a Pitching Cage with radar, and go on a wild simulator ride into the human body with Body Cam, where you will explore cutting-edge surgical techniques.

Cost per person: $51
Includes transportation, admission to the Science Center, and admission to the Omnimax Theatre. Lunch will be on your own at the River View Café.

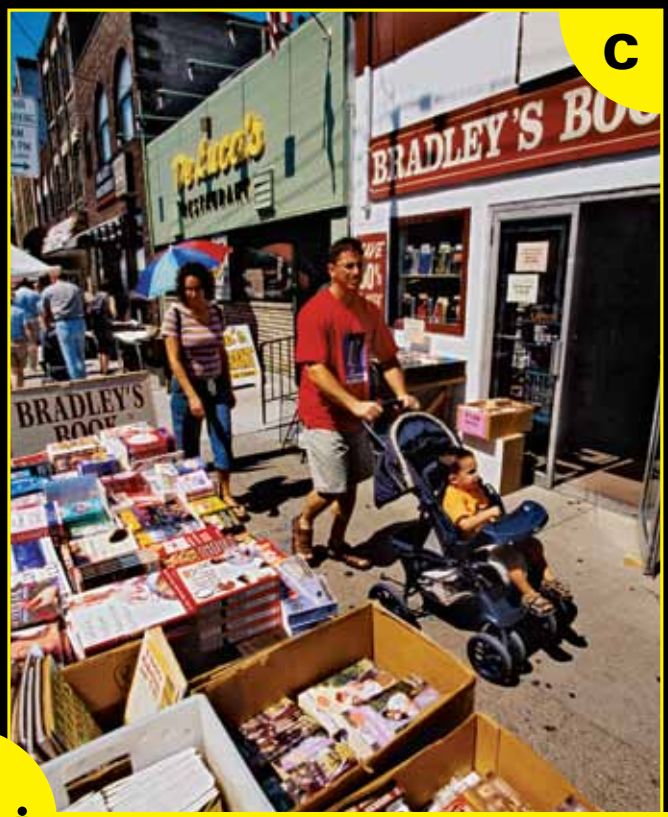
FALLINGWATER AND KENTUCK KNOB

E

Thursday, August 9
Depart 8:15 AM
Return 5:00 PM

Fallingwater is nestled in the heart of the Laurel Highlands in the small village of Mill Run, PA. It is one of the most widely acclaimed works of architect Frank Lloyd Wright. Fallingwater, which still looks current today, was completed in 1939 for the family of Pittsburgh department store owner Edgar J Kaufmann. The key to the setting of the house is the waterfall over which it is built. According to the New York Times, "Fallingwater is Wright's greatest essay in horizontal space; it is his most powerful piece of structural drama; it is his most sublime integration of man and nature." Since considerable walking and steps are involved, good walking shoes are strongly advised. Please notify the tour coordinators if you require special assistance. After lunch, you will be off to Wright's Kentuck Knob, an extraordinary home on eighty acres of land high above the Youghiogheny River gorge. Commissioned by the Hagen Family, it was sold to Lord and Lady Palumbo in the late 1980s. They have filled the home and grounds with their collection of art, which is on display for visitors.

Cost per person: $91
Includes bus transportation, entrance fees to both homes, guides, and lunch.



PITTSBURGH PIRATES GAME

The EMC 2012 committee has arranged for the opportunity to purchase discount tickets to Pittsburgh Pirates baseball games. The tickets are $25 each in the lower outfield box. Eligible Game Dates: August 6, 7 & 8 at 7:05 PM Pittsburgh Pirates vs. Arizona Diamond Backs. August 10 at 7:05 PM Pittsburgh Pirates vs. San Diego Padres. Guests will receive a choice of a limited edition Clemente replica jersey or Pirates hat for every ticket purchased.

CARNEGIE MUSEUMS OF ART AND NATURAL HISTORY

Friday, August 10
Depart 10:45 AM
Depart Museums 3:45 PM

Industrialist and philanthropist Andrew Carnegie opened the doors to the Carnegie Museum in 1895. It is now part of his lasting gift to Pittsburgh. The Carnegie Museum of Natural History is one of the six largest natural history museums in the nation, with more than twenty million specimens from all areas of natural history and anthropology. The Carnegie Museum of Natural History is the world's third-largest repository of dinosaur fossils. The Carnegie Museum of Art is nationally and internationally recognized for its distinguished collection of American and European works from the 16th century to the present. The current summer exhibit is *Impressionism in a New Light: From Monet to Stieglitz.*

Cost per person: $65
Includes transportation, admissions, lunch, and step-on guide

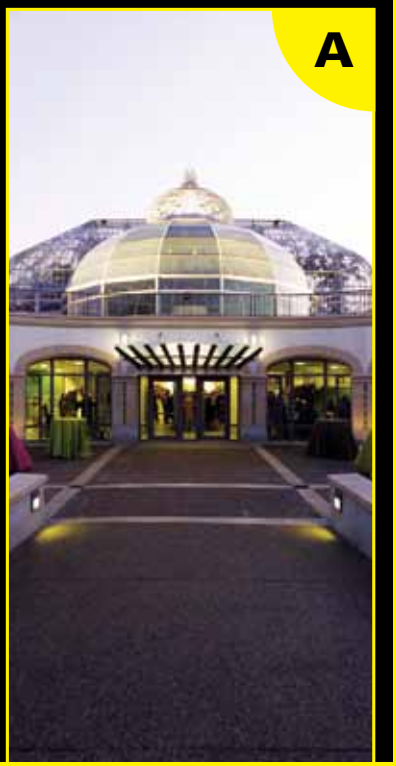
YOUTH TECHNICAL PROGRAM OPPORTUNITIES FOR LEARNING

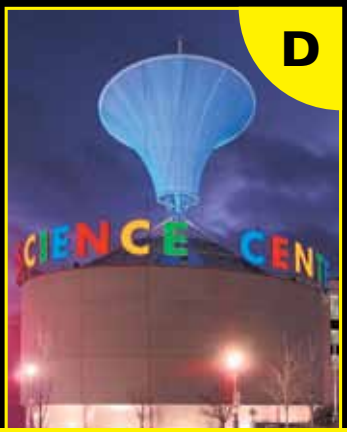
Tuesday (Workshop) 10 AM – 11:30 AM
Wednesday (Workshop) 10 AM – 11:30 AM
Thursday (Exhibit Tour 10 AM – Noon)

This year's Youth Technical Program will be given by a speaker from Apple. He will talk about the advancements of technology leading up to some of your favorite Apple gadgets. He will speak about how they work and how even companies like Apple have to consider Electromagnetic Compatibility when designing their devices.

The Youth Technical Program will consist of two 1.5 hour workshops where youth companions of symposium participants will be introduced to the world of Electromagnetic Compatibility (EMC) and get some hands-on experience either building a project or using EMC measurement equipment. In addition to the two workshops, on Thursday morning the Youth Technical Program and all companions (adults and youths) are invited to join a guided tour of the exhibition hall where the experts will show us their newest and coolest EMC devices.











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