One Month Left To Download EMC + SIPI 2021 Proceedings

by James Spangler, Contributor, How2Power.com

Due to COVID-19, the EMC + SIPI symposium was held virtually again this year, from July 27 through August 20, 2021. As always, this year's conference program was full of useful information relating to EMC, signal integrity and power integrity topics. Members of the IEEE EMC Society were recently sent a reminder that they have until December 15, 2021 to access the conference proceedings here. If you are not a member of the EMC Society, but are already an IEEE member, you can join the society for a modest fee. See the society membership page. This article is a short overview and summary of the EMC + SIPI 2021 symposium to help you to navigate the workshops, tutorials and technical papers that are available in this year's proceedings.

Schedule For The Conference

The conference lasted five weeks as shown below in Table 1.

Table 1. Weekly schedule for EMC + SIPI 2021.

Week 1	July 27-29	Clayton R Paul Global University
Week 2	August 2-6	Workshops & Tutorials
Week 3	August 9-13	Technical Sessions, Special Sessions
Week 4	August 2-13	Experiments & Demos and Sponsor/Exhibit Hall
Week 5	August 16-20	TC/TAC Collateral Meetings

Special paid educational seminars were held the first week. The instructors and the classes are listed as follows in Table 2. Many of these instructors also made presentations in the workshop and tutorials during the second week.

Table 2. Educational seminars presented during Clayton R Paul Global University.

DAY	US ET (UTC-5)	TITLE *Schedule is subject to change	LECTURER
TU	8:00 - 10:00 am	Signal Spectra	Dr. Flavia Grassi
TU	10:30 am - 12:30 pm	Non-Ideal Components	Mr. Lorandt Foelkel
TU	1:00 - 3:00 pm	Conducted Emissions	Dr. Shuo Wang
TU	3:30 - 5:30 pm	Antennas	Mr. Zhong Chen
WED	8:00 - 10:00 am	Shielding	Dr. Frank Leferink
WED	10:30 am - 12:30 pm	Power Integrity	Dr. Chulsoon Hwang
WED	1:00 - 3:00 pm	Crosstalk	Dr. Todd Hubing
WED	3:30 - 5:30 pm	PCB & System Design for EMC	Dr. Bruce Archambeault
THU	8:00 - 10:00 am	Electrostatic Discharge	Dr. David Pommerenke
THU	10:30 am - 12:30 pm	Radiated Emissions	Mr. Lee Hill
THU	1:00 - 2:00 pm	Group Session Ask the Instructors	All

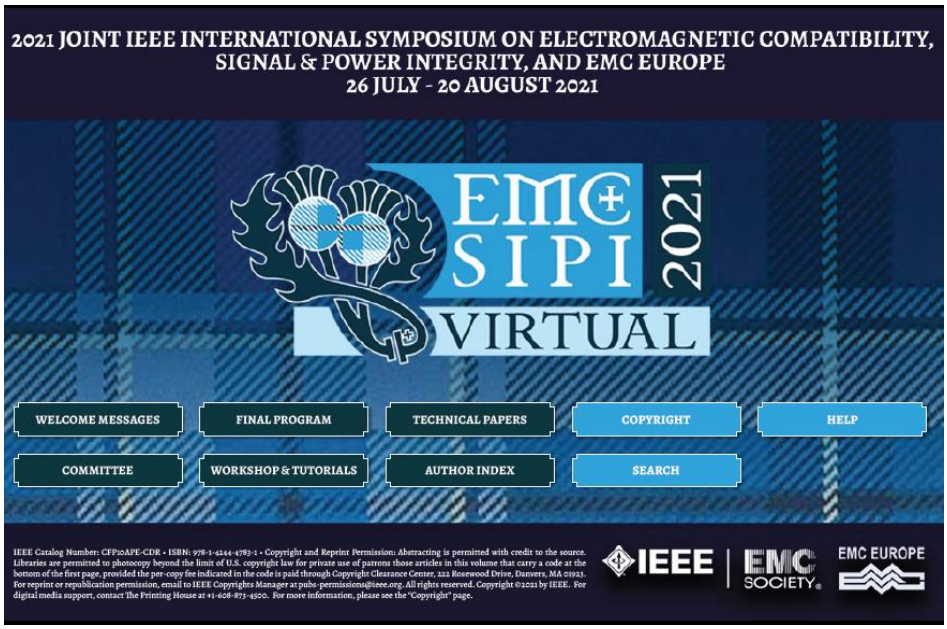
Attendees qualify for IEEE personal development hours (PDH) and continuing education units (CEU) certificates.

Proceedings With Workshops, Tutorials And Technical Papers

To obtain the proceedings you must down load a 1.3-Gig zip file and extract. The file will extract with a Start.pdf file. Clicking the Start.pdf file will produce the following that allows access to the presentation and technical sessions. Each of the buttons: Final Program, Technical Papers, and Workshops & Tutorials, brings up

a link to the presentations. The Author Index brings up a complete list of authors and a link to their presentations and papers.

The Final Program, "emc2021FinalProgram.pdf", is a very good overview of the conference giving abstracts of each session. This is a good way to review which papers and technical presentations need to be read in complete detail.



Week 2: Workshops And Tutorials

The second week is full of EMC review and fundamentals. There are 77 separate sessions using eight tracks Monday through Friday. The automotive track has 10 sessions with too many presentations to mention. It is better to view the Week 2: Schedule at a Glance, pages 8 and 0 of the Final Program.

There are 12 sessions around EMC Fundamentals, Basic EMC Measurements, EMC Testing Basics, and Learning EMC. The EMC Consultant's Toolkit is especially helpful for learning how the various consultants do simple tests to find and solve radiated, conducted, and susceptibility issues for various products.

The military has its own sessions. The Smart Grid and Infrastructures has sessions to help address various concerns including Intentional Electromagnetic Interferences. The testing of cables and grounding have several sessions. There are two sessions on Product Safety and Compliance concerning the global market.

Week 3: Technical Papers, August 9-13

Seventy-two papers are presented in five days with each day having nine tracks. The best way to review what is important is look at the Schedule at a Glance, Week 3: August 9-13 on pages 58 and 59 of the Final Program.

Technical Paper Of Special Interest

The session titled "Intentional EMI and HEMP" was very interesting. The paper "Conductive Electromagnetic Pulse Testing of Digital Protective Relay Circuits" by authors Bowman, Guttromson, Minteer, Mooney, and Halligan is very good describing the protection of the Electrical Grid from High Altitude nuclear weapon detonation. The abstract is given below. This lengthy paper was sponsored by the TC-5, High Power Electromagnetics.

Abstract: The electric power grid is one of the most critical national infrastructures, and determining the susceptibility of power grid elements to external factors is of significant importance for ensuring grid resilience. Reliable energy is vital to the safety and security of society. One potential threat to the power grid comes in the form of strong electromagnetic field transients arising from high-altitude nuclear weapon detonation. The radiated EM fields from these can affect the operation of electronic components via direct field exposure or from the conducted transients that arise from coupling onto long cables. Vulnerability to these pulses for many electrical components on the grid is unknown.

This research focuses on conducted pulse testing of digital protective relays in a power substation and their associated high-voltage circuit breaker circuit and instrumentation transformer circuits. The relays, yard cables, power supplies, and components representing yard equipment were assembled in a manner consistent with installation in a substation to represent the pulse's propagation in the components and wiring. Equipment was tested using pulsed injection into the yard cable. The results showed no equipment damage or undesired operations for insult levels below 180 kV peak open circuit voltage, which is significantly higher than the anticipated coupling to substation yard cables. (Best EMC Paper Finalist)

This paper is worth reading to understand the susceptibility of the electric grid. The conference also has other papers on this subject.

Technical Committees

There are 17 technical committees in the IEEE EMC Society. They help organize the conference and are involved with selecting the papers, workshops and educational sessions. The committees are listed below for the EMC Society.

TECHNICAL PROGRAM

SIPI VIRTUAL

TECHNICAL COMMITTEES

TC 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.
TC 2 EMC Measurements	The committee reviews the adequacy of measurement procedures and measurement instrumentation specifications for radiated and conducted emission and immunity tests. Also discussed is the rationale for product emission limits and immunity test levels including performance requirements. The committee also supports EMC standards and procedures that deal with measurements and their uncertainty and how they are interpreted and applied.
TC 3 Electromagnetic Environment	The charter of TC3, the Technical Committee on Electromagnetic Environment is to encourage research on the: • 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 man-made intentional and unintentional emissions of electromagnetic energy.
TC 4 Electromagnetic Interference 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
TC 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 and other electromagnetic threat environments. These environments include electromagnetic pulse (EMP), intentional EMI environments (i.e., narrowband and wideband), lightning electromagnetic currents and fields, electrostatic discharge and geomagnetic storms. In addition this committee deals with the commercial data security issue through electromagnetic information leakage activities. Interactions with subsystems, systems and platforms are included.
TC 6 Spectrum Engineering	This committee is concerned with the analysis, design, and measurement techniques for intentional RF transmitting and receiving equipment to prevent interference and promote efficient spectrum use through technology and operational based approaches,such as software design, dynamic spectral allocation, waveform control, as well as frequency coordination and management procedures.
TC 7 Low Frequency EMC	This technical committee is concerned with low-frequency EMC including Power Quality in electric power systems. The committee is focusing on application of fundamental EMC concepts also to 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

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TC 8 Aeronautics and Space EMC	This committee is concerned with EMI/EMC issues in aircraft, spacecraft & space launch vehicles, robotic and crewed. The space environment provides unique challenges in the design, development, test and operation of space systems to avoid EMI and achieve EMC. Aeronautics & space EMC covers a wide range of topics on the part, board, box, system, multi-system, planetary and interplanetary levels. The harshness of the atmospheric, launch and space environments necessitates a broader view of EMC issues than traditional terrestrial projects, often leading to creative methods and solutions that can benefit our society's efforts elsewhere on Earth.
TC 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.
TC 10 Signal and Power Integrity	This committee is concerned with the design, analysis, simulation, modeling and measurement techniques useful in maintaining the quality of electrical signals and power distribution network in printed circuit boards, ICs and within systems. These activities encompass all aspects of signal and power integrity from the integrated circuit level to the system level.
TC 11 Nanotechnology and Advanced Materials	Concerned with modelling, simulation and experimental characterization of nanomaterials and nanodevices for EMC applications. Nanotechnology is the understanding and controlling of matter at 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 and/or nanofibres have been designed and tested for gaskets and absorbing screens with outstanding performance and capabilities. Innovative nanostructured 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 require adequate modelling and simulation approaches for signal integrity and also to avoid electromagnetic interference problems.
TC 12 EMC for Emerging Wireless Technologies	This committee is concerned with the EMC design, analysis, modeling, measurement, and testing aspects of emerging wireless products, such as Internet of Things and 5th Generation of Wireless Communication. The committee encourages research including but not limited to the following areas: • Innovative Wireless Component Design for System Integration: wireless component design with integrated EMC functions and/or meeting certain EMC specifications • Radio-Frequency Interference and De-sense: characterization and mitigation of interference from digital circuits to wireless antennas • EMC and OTA Measurement & Testing of Wireless Systems: development of methods and standards for wireless performance and compliance testing • Wireless Coexistence: interference control/mitigation among various wireless radios, as well as related testing methods and standard development • Wireless Product or Subsystem EMC: wireless-specific EMC design for Autonomous cars, Phased Array, and others.

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SC 1 Smart Grid	This special committee is concerned with coordinating the EMC Society activity on providing EMC principles for those organizations and associated documentation and specifications that address the efficient use of the AC power grid including the control of power entering a house or building. Such control may be from a meter at the point of power entry into these facilities to control incorporated into appliances and other electronic devices in these facilities. Such controllers may be sources of undesirable RF emissions and at the same time vulnerable to the RF environment which speaks to the need for EMC. It is expected that the coordination aspect of this special committee will involve several EMCS Technical Committees.
SC 5 Power Electronics EMC	This committee is concerned with power electronics converters EMI/EMC issues. These are mainly, converters that use switching frequency schemes to control the output parameters, such as voltage and current. These converters, including inverters, can be found as interface between the raw power and the electrical grid to provide the end-user with the desired operating power. Applications can range from grid-connected PV systems, wind farms, automotive, aerospace, and communication systems.

Standards Advisory and Coordination Committee (SACCom)	The IEEE EMC Society Standards Advisory and Coordination Committee is responsible for providing technical liaison between the IEEE EMC Society Standards Development Committee and various non-IEEE entities involved with EMC standards activities. In particular, the SACCom will include the following: • Propose to the EMCS board of directors (BOD), the appointment of representatives to various non-IEEE standards developing entities. • To monitor the activities of various non-IEEE standards developing organizations with a view toward making recommendations to the EMCS board of directors on any required coordination of those activities within the society. • To communicate and coordinate with non-IEEE standards developing activities and the EMCS Standards Development Committee on matters relating to the development of EMC related standards.
Standards Development and Education Committee (SDECom)	The IEEE EMC Society Standards Development & Education Committee is responsible for guiding the development of IEEE EMC Standards, the training of those involved in the standards making process and the education of the EMC Society community on all aspects of EMC Standards. The IEEE EMC Society is the primary international developer of fundamental test, measurement and verification standards for EMC.
Education Committee (EdCom)	This committee's mission is to promote EMC education related activities of the IEEE EMC Society. Our vision is to provide opportunities for individuals and organizations involved with electrotechnology and products to become aware of EMC at levels consistent with their needs, and our goals are to establish an awareness of EMC fundamentals throughout industry and academia as well as to enhance EMC education through the development of improved education techniques, materials, opportunities, and communications.

About The Author

Jim Spangler is a Life Member of the IEEE with over 40 years of electronics design experience and is president of Spangler Prototype (SPI). His power electronics engineering consulting firm's priority is helping companies to place products into production, assisting them to pass government regulations and agency standards such as UL, FCC, ANSI, IES, and the IEC.

For many years, he worked as a field applications engineer (FAE) for Motorola Semiconductor, On Semiconductor, Cirrus Logic, and Active Semiconductor, assisting customers in using semiconductors. He published numerous application notes and conference papers at a variety of conferences: APEC, ECCE, IAS, and PCIM. Topics included power factor correction, lighting, and automotive applications. As an FAE, he traveled internationally giving switch-mode power supply seminars in Australia, Hong Kong, Taiwan, Korea, Japan, Mexico, and Canada.

Jim has a master's degree from Northern Illinois University (NIU), and was a PhD candidate at Illinois Institute of Technology (IIT). He taught senior and first-level graduate student classes: Survey of Power Electronics, Fields and Waves, and Electronic Engineering at IIT and Midwest College of Engineering.

Jim is a member of the IEEE: IAS, PELS, PES; the Illuminating Engineering Society (IES), and the Power Sources Manufacturers Association (PSMA) where he is the past co-chair of the Safety and Compliance Committee. He is the Chapter Secretary of the Chicago IEEE-PSES society.

For further reading on power supply-related safety and compliance issues, see How2Power's special section on Power Supply Safety and Compliance.

For further reading on power supply EMI and EMC topics, see How2Power's Power Supply EMI Anthology.