



IEEE Electric Ship Technologies (Virtual)  
Symposium  
July 27-30, 2021: Tutorials  
August 3-6, 2021: Main Program

<http://ests21.mit.edu>



# Welcome Message

Welcome to the 2021 Electric Ship Technology Symposium. On behalf of the 2021 ESTS organizing committee, we would like to thank each and every one of you for attending this meeting where we will exchange ideas on the future of electric ship technologies. The Electric Ship Technology Symposium began in 2005, largely as a result of U.S. Navy interest in electric ships, an interest which has grown over the subsequent years. To this end, we particularly thank the U.S. Navy and the U.S. Office of Naval Research for their support of this technical area over the years. But of course, interest in electric ships is not limited to the U.S. Navy, or even the navies of the world; indeed, electric ship technology is of strong interest in many civilian maritime applications, and so the range of contributors to this technology is quite diverse. Thus, it is our goal that this conference welcomes all who are interested in electric ships to both learn and contribute new technical knowledge to this growing area.

We are offering tutorials the week before the official opening of the conference, and hope you will be able to take advantage of these. If you cannot attend, or happen to miss one of interest, this year we are recording the sessions and will make these recordings available online; please see <https://ests21.mit.edu/> for a link to the tutorials. The tutorials are free and open to the public.

As we collectively participate in this year's symposium, please be aware of the generous support provided by our platinum sponsor, Northrop Grumman, and our gold sponsor, Typhoon HIL. Please be sure to visit their booths during the conference as they are all important contributors to electric ship technology.

We also thank the IEEE Power and Energy Society and the IEEE Power Electronics Society for technical and financial sponsorship of this conference, without which the conference would have been impossible. The committee also thanks the IEEE Transportation Electrification Community for technical sponsorship, and for helping to advertise this event. Finally, we hope that each of you will find the conference to be enjoyable, stimulating, and enlightening.

Dr. Julie Chalfant  
MIT Sea Grant College Program, Massachusetts Institute of Technology  
Chair, ESTS 2021

Dr. Michael "Mischa" Steurer  
Center for Advanced Power Systems, Florida State University  
Co-chair, ESTS 2021

# Organizing Committee

General Chair

Julie Chalfant – *Massachusetts Institute of Technology*

General Co-Chair

Michael “Mischa” Steurer – *Florida State University*

General Chair, Emeritus

Scott Sudhoff – *Purdue University*

Technical Program Chair

Andrew Lemmon – *University of Alabama*

Technical Program Co-Chair

Raghav Khanna – *University of Toledo*

Treasurer

Aaron Cramer – *The University of Kentucky*

Publicity Chair

Wayne Weaver – *Michigan Technological University*

Publication Chair

Tuyen Vu – *Clarkson University*

Tutorial Chair

John Stevens – *United States Naval Academy*

Sponsorship

Roger McGinnis – *Florida State University*

IEEE Conference Manager

Deidre Artis and John Teehan – *IEEE*

PES Liaison

Scott Sudhoff – *Purdue University*

# Technical Committee

## **Technical Program Chair**

Andrew Lemmon *University of Alabama*

## **Technical Program Co-Chair**

Raghav Khanna *University of Toledo*

## **Members**

Rolando Burgos *Virginia Tech University*

Harish Suryanarayana *ABB*

Terry Ericson *Ericson Innovations, LLC*

Mohamad Zahzah *L3 Power Paragon*

Dwight Alexander *Northrup Grumman*

Aaron Brovont *PC Krause & Associates*

Giorgio Sulligoi *University of Trieste*

Ben Ford *Hepburn & Sons*

Michael Mazzola *University of North Carolina Charlotte*

Mona Ghassemi *Virginia Tech University*

Marie Lawson *Ingalls Industries – Newport News Shipbuilding*

Jim Turso *Ingalls Industries – Newport News Shipbuilding*

Fletcher Fleming *DRS Technologies*

Salem Elsaiah *State University of New York*

Stephen Kuznetsov *Raytheon*

Patrick Lewis *Hepburn & Sons*

Brandon Grainger *University of Pittsburg*

Rob Cuzner *University of Wisconsin Milwaukee*

Michael Hontz *NSWC-Philadelphia*

Robert Irwin *NSWC-Philadelphia*

Christina DiMarino *Virginia Tech University*

Ali Bazzi *University of Connecticut*

Ali Davoudi *University of Texas Arlington*

Timothy McCoy *University of Michigan*

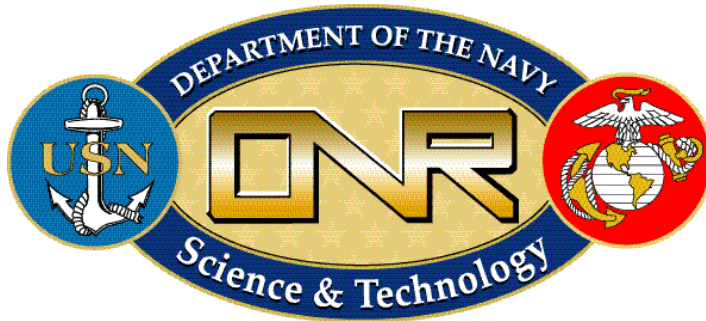
Zareh Soghomonian *FRDA, LLC*

David Wetz *University of Texas at Arlington*

Mischa Steurer *Florida State University*

# Patrons

The Electric Ship Technology Symposium gratefully acknowledges our patrons for the financial support and the United States Office of Naval Research for sponsoring much of the research presented herein.



## Platinum Patron

***NORTHROP GRUMMAN***

---

## Gold Patron



# Sponsors



# Technical Sponsor



# Keynote Speaker

## **Dr. Thomas Fu, Office of Naval Research, United States Navy**

Dr. Thomas Fu is the head of the Mission Capable, Persistent and Survivable Naval Platforms Department of the Office of Naval Research (ONR). As department head, Dr. Fu oversees a broad range of S&T programs for Navy and Marine Corps platforms and undersea weapons, with an annual budget of over \$500 million per year.



Dr. Fu is also the acting director of the Advanced Naval Platforms Division within the Mission Capable, Persistent and Survivable Naval Platforms Department. The division provides technologically superior capabilities for naval platforms through investments in basic and applied research and advanced technology development programs for advanced power systems, acoustic and non-acoustic signatures, structural reliability and lifecycle management, hydrodynamic performance, advanced propulsors, metamaterials, thermal system management, and platform autonomy and control, as well as the National Naval Responsibility for Naval Engineering.

Dr. Fu entered the Senior Executive Service in September 2015. He began his federal civilian service in 1988 at the Naval Surface Warfare Center, Carderock Division, working part-time as a mechanical engineer while in graduate school. After receiving his doctorate in mechanical engineering in 1993, he became a full-time research engineer. In 2001, Dr. Fu was promoted to senior research engineer and was named head of the Resistance & Propulsion Division in 2008. In 2010, he became deputy head of the Hydromechanics Department, which became the Naval Architecture & Engineering Department in 2012. The department—then comprised of approximately 650 engineers, scientists and other personnel—served as the Navy's technical capability for surface- and undersea-vehicle hull forms and propulsors. Dr. Fu provided day-to-day operational and technical management, as well as served as the department's director of Science & Technology and Naval Engineering Education Center program manager. In October 2014, Dr. Fu became a program officer in the Sea Warfare and Weapons Department at ONR.

Dr. Fu has authored over 140 technical publications. He earned a Bachelor of Science degree in ocean engineering from Purdue University in 1984; a Master of Science degree in physical oceanography from the Scripps Institution of Oceanography, University of California, San Diego in 1988; and a doctorate in mechanical engineering from Johns Hopkins University in 1993. Dr. Fu was a George Washington University Visiting Scholar in 2013 and adjunct faculty member in 2014. He has also been an adjunct faculty member at the University of Maryland and Oregon State University.

Dr. Fu was named the Asian-American Engineer of the Year by the Chinese Institute of Engineers-USA in 2012 and a Fellow of the American Society of Mechanical Engineers in 2018. His other awards include a Meritorious Unit Commendation (2013) and the David Packard Excellence in Acquisition Award (1998). Dr. Fu also currently serves as the Navy's NATO-Applied Vehicle Technology Panel member, and as the Editor-in-Chief of the Society of Naval Architects & Marine Engineering (SNAME), Journal of Ship Research.



# Keynote Speaker

**Mr. Punter Pierluigi, Senior Vice President, Design and Engineering  
Fincantieri Cruise Business Unit**



Pierluigi Punter was born in Venice, Italy, and graduated from the University of Padua with a M.Sc. (Master of Science) Degree in Electrical Engineering.

He started his career in Fincantieri in 1990 as an electrical engineer in the Technical Department and was directly involved in designing power and electrical propulsion systems for cruise ships. He covered different roles inside Fincantieri, among others Head of the Electrical Design Department, Proposal Engineer, Ships Commissioning Manager, Deputy Director of Fincantieri Marghera Shipyard, Project manager for cruise ships (Queen Victoria, Eurodam, Costa Luminosa and Regent Seven Seas Explorer).

He is currently Head of the Design and Engineering Department of Fincantieri Cruise Business Unit, with a workforce of about 1,000 engineers. The Department includes all the technical branches of the cruise basic and detail design including hull, electrical, mechanical, air conditioning and interior design (cabins and public areas) as well as comfort design of the hotel areas.

He took part in the activities of working groups involved in the reorganization process.

He was a member of national and international electrical technical committees, including IEC for electrical installation on board ships, and is member of the Italian Classification Society (RINA) technical committee.

He is a member of the Fincantieri Research and Innovation Committee.

# Plenary Session

## High Power Density Electric Machines

*Chair: Michael Mazzola, UNC Charlotte*

The marine industry is beginning to electrify and needs new classes of High Power Density (HPD) generators and motors in the 5-50 MW power range. These HPD machines are 30-50% smaller and lighter than both conventional and permanent magnet machines in this power range. The power density is increased via the adoption of proven technologies from large utility generators in combination with new, proprietary product designs and thermal management systems. These products are targeted for applications in which weight and volume are the key drivers, such as electric ships, off-shore O&G, wind turbines and mobile power.

One option is to further develop High Temperature Superconducting (HTS) technologies; which has successfully been implemented in products ranging from motors and generators to transformers and transmission lines. The current focus for HTS is on large utility generators, but all designs and technologies are directly applicable to the lower power HPD products also.

A three-member team drawn from industry, academia, and government will explore the opportunities and challenges ahead for further developing and maturing the needed HPD products for both commercial and defense maritime applications. Panel members include:

- Bob Warren, Siemens Energy
- Dr. Scott Sudhoff, Purdue University
- Dr. John Amy, U.S. Navy

# Plenary Session

## Engineering Challenges of Autonomous Vessels

*Chair: Raja Suresh, General Dynamics Advanced Information Systems*

Autonomous and unmanned vessels are at the forefront of new technologies that have the potential to revolutionize marine transportation and operations in both the commercial and military sectors. Advances in many areas such as artificial intelligence, controls, power electronics, batteries, and sensing are enabling this revolution. The operational use of these vessels raises a plethora of new questions, requiring research and development to respond: What power and energy technologies will improve the efficiency and effectiveness of these vessels? What changes in design can be realized if personnel are never onboard underway? What improvements in robustness and resilience are necessary for the vessel to operate for extended periods without human intervention? Join our panel of experts as we discuss the latest advances in autonomous vessels and the need for new solutions to new problems. The panel members include:

- Dr. Raja Suresh, Director, R&D at General Dynamics Mission Systems
- Dr. Andrew Nuss, Program Manager in the Defense, Advanced Research Projects Agency's (DARPA) Tactical Technologies Office (TTO)
- Dr. Joseph Fontaine, Naval Surface Warfare Center, Crane
- Alex Lorman, Director of Maritime Engineering at ThayerMahan
- Dr. Jason Strickland, Technical Director, Unmanned Surface Warfare, Naval Sea Systems Command

# TUTORIAL PROGRAM

## Tuesday, July 27

- 10:00 am Tutorial Session I  
**Electrical Power and Propulsion Preliminary and Contract Design Process**  
*Norbert Doerry*, NAVSEA, United States  
*John Amy*, NSWC Philadelphia, United States
- 12:30 pm Tutorial Session II  
**PESNet 3.0: A Next Generation Communication and Control Network for High-frequency Modular Power Converters**  
*Jun Wang*, University of Nebraska-Lincoln/Virginia Tech

## Wednesday, July 28

- 10:00 am Tutorial Session III  
**High Temperature Superconducting Technology for Electric Ships**  
*Sastry Pamidi*, FAMU-FSU College of Engineering
- 12:30 pm Tutorial Session IV  
**Electric Power Load Analysis (EPLA)**  
*John Amy*, Naval Surface Warfare Center Philadelphia Division  
*Norbert Doerry*, Naval Surface Warfare Center Carderock Division

## Thursday, July 29

- 10:00 am Tutorial Session V  
**Supporting Technology Development In-Service Operation of Shipboard Power Systems with Fit-For-Purpose Modeling and Simulation**  
*Graham Dudgeon*, MathWorks, Inc
- 12:30 pm Tutorial Session VI  
**Control Hardware in the Loop Fundamentals**  
*Matt Baker and Andy Sellers*, Typhoon HIL  
*Jim Turso*, Huntington Ingalls Industries

## Friday, July 30

- 10:00 am Tutorial Session VII  
**Green Electrification of Ships and Ports**  
*John Prousalidis*, National Technical University of Athens
- 12:30 pm Tutorial Session VIII  
**Model Predictive Control for Ship Power Systems**  
*Greg Sinsley*, US Naval Academy

# MAIN PROGRAM

## Tuesday, August 03

10:00 am Opening Remarks and Keynote Address

**Mr. Punter Pierluigi**

Senior Vice President, Design and Engineering  
Fincantieri Cruise Business Unit

10:30 am Technical Session A1L-A

Electric Propulsion and Power Generation

**Co-chairs:** *Dwight Alexander*, Northrup Grumman; *Zareh Soghomonian*, FRDA, LLC

**Stabilization of Generator Frequency Under Pulsed Load Condition Using Regenerative Propeller Braking**

*Ronald Matthews, Lee Rashkin, Steven Glover, Norbert Doerry*

**Endurance Life of Nanostructured Insulation Material for High Torque Density Propulsion Motors**

*Hiep Nguyen, Yifei Wang, Joanne Ronzello, Jack Chapman, Yang Cao*

**Assessing the Implementation of Power Take off (PTO) System Onboard Liquefied Natural Gas (LNG) Carriers**

*Apostolos Souflis-Rigas, John Prousalidis, George Dimopoulos*

11:00 am Technical Session A2L-B

Real-Time Simulation of Shipboard Subsystems

**Co-chairs:** *Harish Suryanarayana*, ABB; *Ali Davoudi*, University of Texas Arlington

**The Role of Sensitivity Analysis in Stress Testing Real Time Models of Power Systems Controllers**

*Behshad Mohebbali, Karl Schoder, Mark Stanovich, Michael Mischa Steurer, Gordon Erlebacher*

**A General Common-Bus Architecture for Multiple-Interface Power Hardware-in-the-Loop Studies**

*Thiago Szymanski, James Langston, Michael Mischa Steurer*

**A Reconfigurable Megawatt-Scale Power Hardware-in-the-Loop Simulation System for Virtual Motors**

*Lu Wang, Yanjun Shi, Dionne Soto, James Langston, Matthew Bosworth, John Hauer, Michael Mischa Steurer*

**Shipboard Zonal Load Center Modeling and Characterization on Real-Time Simulation Platform**

*Md Multan Biswas, Tyler Deese, James Langston, Harsha Ravindra, Karl Schoder, Michael Mischa Steurer, Herbert Ginn, Christian Schegan*

11:30 pm Technical Session A3L-C

Dielectric Challenges 1

**Co-chairs:** *Mona Ghassemi, Virginia Tech; Mike Mazzola, University of North Carolina Charlotte*

**On the Likelihood of Partial Discharge Inception in Laminated Busbars from Electrified Ships**

*Gian Carlo Montanari, Riddhi Ghosh, Paolo Seri, Paul Defriece, Jesse Schmeller*

**Electret: A Remedy for Partial Discharge and Surface Flashover in Shipboard Power Applications**

*Farhina Haque, Omar Faruqe, Chanyeop Park*

**Surface Flashover Characteristics of Solid Dielectrics in Shipboard Atmospheric Conditions**

*Omar Faruqe, Farhina Haque, Han Berdiyev, Chanyeop Park*

**Characterizing the Surface Charge Distribution and Its Impact on the DC Surface Flashover Voltage of Insulators**

*Ning Guo, Minuk Lee, Jeong Ho Choi, Tushar Damle, Lukas Graber*

12:00 pm Technical Session A4L-D

Power System Control and Stability

**Co-chairs:** *Fletcher Fleming, DRS Technologies; David Wetz, University of Texas at Arlington*

**Active Damping Poles Repositioning for DC Shipboard Microgrids Control**

*Andrea Alessia Tavagnutti, Daniele Bosich, Giorgio Sulligoi*

**Modeling and Stability Analysis of Radial and Zonal Architectures of a Bipolar DC Ferry Ship**

*Sachin Yadav, Nils van der Blij, Pavol Bauer*

**Degradation Aware Predictive Energy Management Strategy for Ship Power Systems**

*Satish Vedula, Mehrzad Mohammadi Bijaieh, Ellis Oti Boateng, Olugbenga Moses Anubi*

**Low-Bandwidth Modular Mathematical Modeling of DC Microgrid Systems for Control Development with Application to Shipboard Power Systems**

*Mehrzad Mohammadi Bijaieh, Satish Vedula, Olugbenga Moses Anubi*

12:30 pm Technical Session B1L-E

Model-Based Systems Engineering 1

**Co-chairs:** *Terry Ericson*, Ericson Innovations, LLC; *Mohamad Zahzah*, Ultra EMS

**Naval Smart Grid Preliminary Integration Onboard Electric Ships** *Andrea Vicenzutti, Giorgio Sulligoi, Vittorio Bucci, Serena Bertagna, Michele Cataneo, Paolo Borghese*

**Early Stage Modeling of Naval DC Power System for Digital Twin Development Miles**

*Leonard-Albert, Davis Hobbs, Jack Hannum, Enrico Santi, Kristen Booth*

**Concept Design Methodology to Enable Naval Smart Grid Onboard Electric Ships**

*Giorgio Sulligoi, Giorgio Trincas, Andrea Vicenzutti, Luca Braidotti, Michele Cataneo*

**Subdivision Blocks and Component Placement in Early-Stage Ship Design**

*Marisa Hoosen, Julie Chalfant*

## **Wednesday, August 04**

10:00 am Opening Remarks and Plenary Session 1

**High-Density Machines**

Chair: Michael Mazzola, UNC Charlotte

11:30 am Technical Session B2L-A

Model-Based Systems Engineering 2

**Co-chairs:** *Terry Ericson*, Ericson Innovations, LLC; *Mohamad Zahzah*, Ultra EMS

**Integrating Electrical and Operational Load Models for Control Evaluation**

*Mark Stanovich, Greg Sinsley, Harsha Ravindra, Daniel F. Opila, John Stevens, Michael Mischa Steurer*

**Evolution of Operability-Based Performance Metrics for Assessment of Mission Performance**

*Musharrat Sabah, Isuje Ojo, Aaron Cramer*

**Reduced Order Model of a Four Zone Medium Voltage DC Electric Ship**

*Wayne Weaver, Rush Robinett III, David Wilson, Steven Glover*

**On Estimating the Port Power Demands for Cold Ironing Applications**

*Fabio D'Agostino, Giacomo Piero Schiapparelli, Stefanos Dallas, Dimosthenis Spathis, Vassilis Georgiou, John Prousalidis*

12:00 am Technical Session B2L-B  
Modeling & Analysis of Shipboard Subsystems  
**Co-chairs:** *Harish Suryanarayana*, ABB; *Ali Davoudi*, University of Texas  
Arlington

**Hybrid Analytical and Data-Driven Modeling Techniques for Digital Twin Applications**

*Andrew Wunderlich, Kristen Booth, Enrico Santi*

**Averaged-Value Modeling and Modelability Analysis for an Operational Megawatt-Scale Medium-Voltage Modular Multilevel Converter**

*Lu Wang, Yanjun Shi, Dionne Soto, James Langston, Matthew Bosworth, John Hauer, Michael Mischa Steurer*

**Modeling of Sources and Power Electronic Converters Installed in a Medium Voltage AC/DC Testbed**

*Zachary Bailey, Alexander Johnston, David Wetz, Gregory Turner, Christian Schegan, John Heinzl*

**Optimization Design of Medium-Voltage Modular Converter with Terminal Transient Response Constraint**

*Qian Li, Igor Cvetkovic, Dushan Boroyevich, Rolando Burgos*

12:30 pm Technical Session B4L-C

Dielectric Challenges 2

**Co-chairs:** *Mona Ghassemi*, Virginia Tech; *Mike Mazzola*, University of North Carolina Charlotte

**Behaviour of Surface Electric Field in DC Ship Spacers Under Real Operation Conditions: Voltage Transients and Ripple, Temperature Gradient and Pollution**

*Robin Ramin, Gian Carlo Montanari, Peter Cheetham, Michael Mischa Steurer*

**Modeling and Measurement of Internal Partial Discharges in Voids Artificially Made Within 3D-Printed Polylactic Acid (PLA) Block**

*Moein Borghei, Mona Ghassemi, Behzad Kordi, Derek Oliver*

**Effects of 7-Level ANPC SiC Inverter on Motor Stator Insulation and Cable Insulation in an Electric Ship Propulsion Drive**

*Arshiah Mirza, Ali Bazzi*

**Discrimination of Single- and Multi-Source Corona Discharges Using Deep Residual Network**

*Moein Borghei, Mona Ghassemi*



## **Thursday, August 05**

10:00 am Opening Remarks and Keynote Speaker

**Dr. Thomas Fu**

Mission Capable, Persistent and Survivable Naval Platforms Department  
Office of Naval Research, United States Navy

10:30 am Technical Session C1L-A

EMI, EMC, and Common-Mode Behavior

**Co-chairs:** *Rob Cuzner*, University of Wisconsin Milwaukee; *Aaron Brovont*, PC Krause & Associates

**Common-Mode Capacitance of Bus-Bar-Based Common-Mode Inductors**

*Harshita Singh, Scott Sudhoff, Robert Swanson*

**Eliminating Common Mode Conducted Emissions in Three-Phase Four-Leg Inverters**

*Alexander Julian, Giovanna Oriti, Arthur Krener*

**Impact of Output Terminations on Conducted Emissions Evaluation of Interface Converters**

*Andrew Lemmon, Aaron Brovont*

11:00 am Technical Session C2L-B

Power System Control and Risk Mitigation

**Co-chairs:** *Fletcher Fleming*, DRS Technologies; *David Wetz*, University of Texas at Arlington

**Advanced Load Shedding for Integrated Power and Energy Systems**

*Bang Nguyen, Tuyen Vu, Colin Ogilvie, Harsha Ravindra, Mark Stanovich, Karl Schoder, Michael Mischa Steurer, Charalambos Konstantinou, Christian Schegan*

**Redundant Actuators Without Direct Communication for Reactor Control Rod Positioning**

*Arthur Devine, Daniel F. Opila*

**A Low Latency Parallel Bus Interface for High-Speed Multi-FPGA RT-Simulations**

*Michele Difronzo, Herbert Ginn, Andrea Benigni*

**Evaluation of Communication Network Models for Shipboard Power Systems**

*Juan Ospina, Charalambos Konstantinou, Mark Stanovich, Michael Mischa Steurer*

11:30 pm Technical Session C3L-C  
Protection, Reconfiguration, Survivability  
**Co-chairs:** *Marie Lawson*, Ingalls Industries – Newport News Shipbuilding; *Ali Bazzi*, University of Connecticut

**Robust 5 kA, 1 kV Solid-State DC Circuit Breaker for Next Generation Marine Power Systems**

*Rostan Rodrigues, Yuzhi Zhang, Utkarsh Raheja, Pietro Cairoli, Luca Raciti, Antonello Antoniazzi*

**System Inductance for MVDC Circuit Breakers**

*Norbert Doerry, John Amy Jr.*

**Multiple Line-to-Ground Fault Characterization and Mitigation in MVDC Shipboard Electrical Systems**

*Jacob Gudex, Robert Cuzner*

**Deep Learning-Based Fault Detection, Classification, and Locating in Shipboard Power Systems**

*Soroush Senemmar, Jie Zhang*

12:00 pm Technical Session C4L-D  
Energy Storage and Pulsating Loads

**Co-chairs:** *Ben Ford*, Hepburn & Sons; *Stephen Kuznetsov*, Raytheon

**Using Power Hardware-in-the-Loop Simulation to Study Control of Energy Storage Within Limited-Inertia Power System**

*James Langston, Kazuki Watanabe, John Hauer, Karl Schoder, Mark Stanovich, Harsha Ravindra, Michael Mischa Steurer*

**Strategies for Preserving the Battery SOC in DC Shipboard Power Systems**

*Andrea Alessia Tavagnutti, Daniele Bosich, Giorgio Sulligoi*

**Battery Management System (BMS) Test Stand Utilizing a Hardware-in-the-Loop (HIL) Emulated Battery**

*Cole Tschritter, David Wetz, Gregory Turner, John Heinzl*

**The Optimal Control of an Electric Warship Driven by an Operational Vignette**

*Joseph Young, David Wilson, Marvin Cook*

**Priority-Based Management of Energy Resources During Power-Constrained Operation of Shipboard Power System**

*James Langston, Harsha Ravindra, Michael Mischa Steurer, Tom Fikse, Christian Schegan, Joseph Borraccini*

## **Friday, August 06**

- 10:00 am Plenary Session II  
**Engineering Challenges of Autonomous Vessels**
- 11:30 pm Technical Session D1L-A  
Electrical Power Conversion for DC Distribution  
**Co-chairs:** *Giorgio Sulligoi*, University of Trieste; *Patrick Lewis*, Hepburn & Sons
- Medium Voltage Ring-Bus Grid Design Employing Current-Fed, Three-Port Dual Active Bridge Converters with Average Power Flow Control**  
*Zachary Smith, Brandon Grainger*
- Two-Phase Milli/Microchannel Cooling for SiC Power Module Using Dielectric Fluid Coolant**  
*Bo Tian, Wei Chang, Enrico Santi, Chen Li, Tianyu Zhang, Lang Yuan*
- Design of a High-Frequency Transformer and 1.7 kV Switching-Cells for an Integrated Power Electronics Building Block (iPEBB)**  
*Narayanan Rajagopal, Ravisekhar Raju, Taha Moaz, Christina Dimarino*
- Preliminary Investigation Into Liquid-Cooled PEBBs**  
*Joushua Padilla, Julie Chalfant, Chryssostomos Chryssostomidis, Chathan Cooke*
- 12:00 pm Technical Session D2L-B  
Electrical & Thermal Modeling of Converter Components  
**Co-chairs:** *Harish Suryanarayana*, ABB; *Ali Davoudi*, University of Texas Arlington
- Packaging of an 8-kV Silicon Carbide Diode Module with Double-Side Cooling and Sintered-Silver Joints**  
*Zichen Zhang, Jiaxiang Zhang, Jiayu Xu, Khai Ngo, Guo-Quan Lu, Emily Cousineau, Paul Paret, Sreekant Narumanchi*
- Electrothermal Management Using In-Situ Junction Temperature Monitoring for Enhanced Reliability of SiC-Based Power Electronics**  
*Dehao Qin, Gokhan Ozkan, Christopher Edrington, Zheyu Zhang*
- Empirical Procedure for Estimating Mutual Coupling in High-Performance Power Modules**  
*Ali Shahabi, Andrew Lemmon, Brian Deboi, Troy Beechner, Robert Mayo*
- vemPEBB: Rapid PEBB Thermal Management Tool**  
*Sam Yang, Juan Ordonez, Yue Xu, Igor Cvetkovic*

**Component Evaluation and PSpice Modeling for Charge Pump Based Cell Voltage Balancer Development**

*Mostafa Negm, Manuel Morales, William Lynch*

12:30 pm Technical Session D3L-C

MVDC Power Distribution

**Co-chairs:** *MikeMazzola*, University of North Carolina Charlotte; *Mona Ghassemi*, Virginia Tech

**Coaxial Insulated Bus Pipe, a Low Magnetic Signature Solution for Medium Voltage Direct Current Shipboard Power Distribution**

*Terrence Northington, Patrick Lewis, Ehsan Alavi, Dustin Carver, Matthew Bosworth*

**Application of IEC-61800-5 Insulation Coordination to Shipboard Equipment Scaling Studies**

*Robert Cuzner, William Koebel*

**HTS Technology Driven Shipboard Power Distribution Architecture – Electrical**

*Peter Cheetham, Srikar Telikapalli, Taylor Stamm, Chul Kim, Sastry Pamidi*

**HTS Technology Driven Shipboard Power Distribution Architecture – Cryogenics**

*Srikar Telikapalli, Peter Cheetham, Chul Kim, Sastry Pamidi*