

**SPECIAL ISSUE**

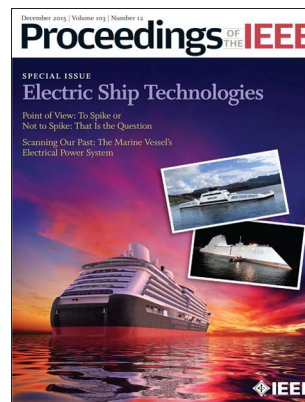
## ELECTRIC SHIP TECHNOLOGIES

Edited by S. J. Dale, R. E. Hebner, and G. Sulligoi

- 2229 History and State of the Art in Commercial Electric Ship Propulsion, Integrated Power Systems, and Future Trends**  
 By J. F. Hansen and F. Wendt  
*|INVITED PAPER|* This paper describes the history of electric ship propulsion development and application in commercial ships, and the role of power electronic drives in optimizing the efficiency of an integrated power system.
- 2243 History and the Status of Electric Ship Propulsion, Integrated Power Systems, and Future Trends in the U.S. Navy**  
 By N. Doerry, J. Amy, and C. Krolick  
*|INVITED PAPER|* This paper describes the history and the present status of electric propulsion and the integrated power system (IPS) approaches and ship classes developed by the U.S. Navy, from the early 1900s through today.
- 2252 Early-Stage Design for Electric Ship**  
 By J. Chalfant  
*|INVITED PAPER|* This paper gives a tutorial and a review of the design of naval ships, and gives an overview of the various design stages, specific ship design methodologies, measures for evaluation designs, and design of ship systems.
- 2267 Hybrid Electric Drive for Naval Combatants**  
 By D. Alexander  
*|INVITED PAPER|* This paper presents an overview of the development and the present state of the art of hybrid propulsion drive systems as it applies to high performance naval combatants.
- 2276 Integrated Power Systems—An Outline of Requirements and Functionalities for Ships**  
 By T. J. McCoy  
*|INVITED PAPER|* This paper outlines the architecture options available for the ship designers when implementing integrated power systems, and discusses the design implications and pitfalls inherent in the power system architecture selection.
- 2285 Advances in Power Conversion and Drives for Shipboard Systems**  
 By F. Wang, Z. Zhang, T. Ericson, R. Raju, R. Burgos, and D. Boroyevich  
*|INVITED PAPER|* This paper describes the advances made in power semiconductors through the introduction of wide-bandgap semiconductors such as silicon carbide (SiC) that has enabled and will continue to enable advances in motor drives and integrated power systems for an integrated and optimized ship power system.
- 2312 Control Architecture for High Power Electronics Converters**  
 By H. L. Ginn, III, N. Hingorani, J. R. Sullivan, III, and R. Wachal  
*|INVITED PAPER|* This paper presents various partitioning strategies of hierarchical control architectures for use in high power electronics control systems. Various parameters and functions that must be addressed are defined.

**DEPARTMENTS**

- 2219 POINT OF VIEW**  
 To Spike or Not to Spike: That Is the Question  
 By W. Maass
- 2225 SCANNING THE ISSUE**  
 Electric Ship Technologies  
 By S. J. Dale, R. E. Hebner, and G. Sulligoi
- 2410 SCANNING OUR PAST**  
 The Marine Vessel's Electrical Power System: From its Birth to Present Day  
 By E. Skjong, E. Rødskar, M. Molinas, T. A. Johansen, and J. Cunningham
- 2425 FUTURE SPECIAL ISSUES/SPECIAL SECTIONS**
- 2426 2015 INDEX**



**On the Cover:** This month's cover drives home the topic of electric ship technologies with a 3-D cruise ship model along with photographic inserts of the world's first electrically powered car ferry (copyright: Normed, www.siemens.com/press ) and the Zumwalt-class guided-missile destroyer DDG 1000 (source: U.S. Navy photo courtesy of General Dynamics/Released).

[Continued on page 2218 ►]

## SPECIAL ISSUE: Electric Ship Technologies

### 2320 Motors for Ship Propulsion

By J. L. Kirtley, Jr., A. Banerjee, and S. Englebretson

**|INVITED PAPER|** This paper describes the features of several major classes of motors that are suitable for ship propulsion. These motor types include dc (commutator) motors, induction motors, synchronous motors, doubly fed machines, and superconducting motors, including the homopolar machine.

### 2333 Electric Propulsion Motor Development for Commercial Ships in Japan

By T. Yanamoto, M. Izumi, M. Yokoyama, and K. Umemoto

**|INVITED PAPER|** This paper outlines the commercial development of electric propulsion for ships in Japan, which is aimed at special purpose vessels, such as ice breakers and arctic observation ships, and focuses on the developments and status of superconducting propulsion motors in Japan.

### 2344 Dynamic Load and Storage Integration

By R. E. Hebner, K. Davey, J. Herbst, D. Hall, J. Hahne, D. D. Surls, and A. Ouroua

**|INVITED PAPER|** This paper describes the developments and application of energy storage in a ship system to facilitate ride-through capability for gas turbine generators, and to provide power grid stability during switching of large loads.

### 2355 Power Flow Control and Network Stability in an All-Electric Ship

By M. Cupelli, F. Ponci, G. Sulligoi, A. Vicenzutti, C. S. Edrington, T. El-Mezyani, and A. Monti

**|INVITED PAPER|** This paper compares the approaches to power flow control and network stability of an integrated ship power system through reducing the dynamics of large loads to operate in compatibility with the dynamics of a traditional generating system, or through the methods of “smarter” generators through its power electronic interface.

### 2381 Shore-to-Ship Power

By G. Sulligoi, D. Bosich, R. Pelaschiar, G. Lipardi, and F. Tosato

**|INVITED PAPER|** This paper presents the requirements and technologies for providing ship power from a shore connection when the ship is in port. This requirement is increasingly driven by the environmental consideration of reducing emission from the ship power generation when in port.

### 2401 Role of Power Hardware in the Loop in Modeling and Simulation for Experimentation in Power and Energy Systems

By C. S. Edrington, M. Steurer, J. Langston, T. El-Mezyani, and K. Schoder

**|INVITED PAPER|** This paper reports on the development and benefits for modeling and simulation in ship power systems and how this is used for verification, validation, and experimentation of power components and integration using power hardware in the loop for testing and demonstration of the system.

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