

IEEE NSW Joint Chapter – Industry Applications, Industrial Electronics and Power Electronics

IEEE Lecture by Prof. Iqbal Husain, ABB Distinguished Professor

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High Power Density Electric Machines and WBG Power Electronics for Electric Vehicles

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Abstract

The transition to electric road transport technologies has gained significant momentum with record-high new electric vehicle registrations taking place in recent years. New electric vehicles are being offered with improved performances and capability such as increased acceleration and extended range. These capability and performance enhancements are met with an increased demand in the propulsion system. Widespread research in the area of electric machines for traction applications is pushing the boundaries for maximum speed and power density with design innovations utilizing both conventional and emerging materials. Electric machines with higher operating speeds are feasible using higher mechanical gear ratios. Consequently, higher torque-density and power density can be achieved. Recent evolution of Wide Bandgap (WBG) semiconductor-based drives with their capabilities of higher frequency and higher temperature operation is also a catalyst to increase the operating speed of traction machines. WBG drives improve efficiency, power density, and controllability on a system level. In the future, designs will need to evolve to meet new requirements such as moving to higher system voltages. DC-link voltage level up to 800-V standard is being considered to support charge rates up to 350kW. While the battery system is a critical piece in the propulsion system of an electric vehicle, the electric motor drive is the key component that contributes to its core strength of smooth acceleration and responsiveness on-demand power which is reflected in the higher performance of

the vehicle. This seminar will present the design and analysis of high power density electric machines and SiC inverter for electric vehicle traction application developed through research at the FREEDM Center in North Carolina State University.

Biography



Prof. Iqbal Husain is the Director of the Future Renewable Electric Energy Delivery and Management (FREEDM) Engineering Research Center and the ABB Distinguished Professor at North Carolina State University where he joined in Fall 2011. He received the B.Sc. degree from Bangladesh University of Engineering and Technology, Bangladesh, and the M.S. and Ph.D. degrees from Texas A&M University, College Station, Texas.

Prof. Husain's research interests are in the areas of control and modeling of electrical drives, design of electric machines, inverters for distributed power generation, inverter controls for grid synchronization, and modeling and control of electric and hybrid vehicle systems.