

1. Session Title

Advanced Power Electronics and Drives for Commercial Vehicle Electrifications

2. Abstract

The global interest in electrification has significantly increased in recent years. The majority of current efforts to reduce carbon emissions are directed toward integrating electrified vehicles (EV) into all forms of ground transportation. The possibility of electrifying urban commercial vehicles (such as buses and trucks) is of special relevance to minimize emissions with optimum solutions due to more regular and predictable duty cycles. In this session, the panelists from the automotive industry and academia will discuss cutting-edge technologies on high energy efficiency, high power density, and high reliability of traction drives for commercial vehicle electrifications.

Specifically, Dr. Yash Singh from Eaton Research Labs will first give a talk on the various facets of power conversion for commercial vehicles based on fuel cells. Increased range and cost-effective system design are made possible by high power density and power conversion efficiency. BEVs are becoming more and more popular in the passenger car market, but they are encountering major opposition in the commercial vehicle market for a variety of reasons, including low energy density and a prolonged charging process. Hydrogen-based fuel cells can be an alternative energy source for commercial vehicles because of their faster refueling time and high energy density. Dr. JiangBiao He from the University of Kentucky will present the technologies of developing Silicon Carbide (SiC) fault-tolerant power converters in commercial EV applications, to currently achieve high efficiency and fault-tolerant operation capability. Another key aspect of commercial electrification is the reliability of the system and the power electronics. Dr. Santhosh from Cummins will present system and sub-system level reliability and improvement scopes for future commercial electric vehicles. Finally, Mr. Harsha will discuss the heavy-duty (HD) traction e-drive application requirements. In the presentation, it will be discussed how HD requirements for the electric drive (e-motor and inverter) applications differ from LD (low duty) requirements and what difficulties are typically encountered in terms of operating voltages, efficiency, performance, and dependability. Specific design features for inverters, motors, and batteries will be covered in the topics because they are essential for the rapid spread of electrification in the HD market.

3. Session Organizers

Organizer : Dr. Akm Arafat, Principal Control Engineer, Drive System Design Inc.



Dr. Akm Arafat is working as a Principle Control Engineer in Drive System Design Inc. (DSD). He received the B.Sc. degree in Electrical and Electronic Engineering from the Bangladesh University of Engineering and Technology at Dhaka, Bangladesh in 2009. Later he received MSc, and PhD degrees in electrical engineering from the University of Akron, Ohio,

USA in 2015 and in 2018, respectively. Prior to working for DSD, he was a technical specialist, power electronics, advanced engineering, Corporate Research & Technology, Cummins. He studied advanced multiphase electric machines and drives while earning his MSc and PhD, and he invented fault-tolerant controls and diagnosis methods targeting the transportation sectors. His current research focuses on power electronics, electric machines, and controls used in on- and off-highway, aerospace, and maritime applications for electric and hybrid transportation systems. He has 17 US patents (14 published and 3 filed) in the areas of motor controls/design and power electronics. He has written and published 29 research papers in prestigious IEEE journals and conferences.

4. Session Panelists/Speakers

Panelist 1: Dr. Yash Veer Singh, Eaton Research Lab, Southfield, MI

Title: Power Conversion for Fuel Cell Based Commercial Vehicles

Panelist 2: Dr. JiangBiao He, University of Kentucky, KY

Title: Fault-tolerant WBG power converters for commercial electric vehicles

Panelist 3: Dr. Santhosh Krishnamoorthi, Cummins Inc., Columbus, IN

Title: Reliability of Drive System and Power electronics for future commercial electric vehicles

Panelist 4: Harsha Nanjundaswamy, Global Chief Engineer, BorgWarner Inc, IN

Title: Heavy duty traction e-drive application requirements