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The Title of Presentation:

“Trends in Power Electronics for High-Power Applications”

Abstract:

This talk focuses on present situations and future trends of power electronics intended for high-power applications. The speaker starts with medium-voltage high-power high-speed and low-speed motor drives using modular multilevel cascade converters with different circuit configurations, respectively. He shows some experimental waveforms obtained from a few downscaled systems that were designed, constructed, and tested in his laboratory.

Then, the speaker presents the 750-V, 100-kW, 20-kHz bidirectional isolated dual-active-bridge (DAB) dc-dc converter using the latest 1.2-kV 400-A SiC-MOSFET modules. This power conversion system consists of two dc-to-ac and ac-to-dc power converters and a single-phase medium-frequency transformer, as well as four auxiliary inductors. The maximum conversion efficiency from the dc input to dc-output terminals is as high as 99.4% at 25 kW, and 98.3% at 100 kW, excluding power losses of the gate-drive and control circuits. If existing Si-IGBT modules were used in the dc-dc converter, it would be impossible to attain such an extremely high efficiency.

Finally, this presentation ends with the following message: “Since the 1980s, power electronics scientists and engineers have been making a long voyage from a Silicon planet to a Silicon-Carbide planet. It takes five years from now to complete this challenging voyage. The success in the voyage will bring a new world to power electronics.”