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Title **The Cutting Edge of Power Electronics for High-Power Applications**

Abstract :

Power electronics is the technical field that includes power conversion systems based on switching, or on/off, operation of power semiconductor devices such as MOSFETs and IGBTs (insulated-gate bipolar transistors), and applications of the power conversion systems. At present, power electronics technology is applied to a broad range of fields from information and home appliances to industry, transportation (vehicles, ships and airplanes), and electric power utilities, as well as renewable-energy harvesting. Power electronics emerged in 1957, accompanied by the invention of the so-called “silicon-controlled rectifiers” or “thyristors” by research scientists in General Electric in the USA. However, the term “power electronics” did not exist at that time. Since the 1970s, it has been used, and it is currently a firm technical term in electrical and electronic engineering. In fact, the IEEE William E. Newell Power Electronics Award was established in 1978. Since then, it has been recognized as the “Noble Prize” in the field of power electronics amongst its related research scientists and engineers. This talk presents circuit configurations, controls and applications of the next-generation high-power converters that are characterized by combing the latest power semiconductor device and circuit technologies with the latest high-speed, high-performance digital control and sensor technologies, showing experimental waveforms obtained from different downscaled systems designed, constructed and tested in the speaker’ s laboratory. Moreover, his talk describes a 750-V, 100-kW, 20-kHz bidirectional isolated dc-dc dual-active-bride converter consisting of the latest 1.2-kV, 400-A SiC-MOSFET/SBD dual modules and a 20-kHz transformer using a nano-crystalline soft magnetic material, focusing on conversion efficiency and power-loss breakdown. It is interesting that the SiC dual (two-in-one) module is the same in appearance, that is, size, shape, and terminal/pin arrangement as the latest 1.2-kV, 300-A Si-IGBT dual (two-in-one) module.