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Editorial

Power Electronics Converters for On-Board Electric Power Systems

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With the aim of arriving at more efficient and sustainable transport, the search for improvements in power electronics converters is the key to systems with a high efficiency and reliability. In addition, a high level of power density is desired.

Recent material technologies such as silicon carbide (SiC) and gallium nitride (GaN) have a higher energy band and breakdown voltage enabling the creation of high-voltage and wideband gap (WBG) devices [1,2]. Due to the high switching speed of WBG devices, it is possible to increase the switching frequencies and to reduce the switching losses, leading to greater energy savings. Additionally, it is possible to reduce the volume and weight of the passive elements used, drastically reducing the amount of raw material needed to make the final product. The gain in terms of energy savings is considerable, offsetting the initial investment during its lifetime, even with an initial higher cost when compared to the implementation of Silicon (Si) semiconductors [3,4]. However, with the advances in the semiconductor industry, this investment has been reduced, enabling greater profitability in the application of WBG semiconductors in the short term [5].

Over recent decades, there has been a greater electrification of both civil and military aircraft, giving rise to the concept of more electric aircraft (MEA). This has resulted in the replacement of pneumatic, mechanical, and hydraulic systems with electrical systems, which brings benefits in terms of environmental impact, cost savings, maintenance, noise pollution, reliability, as well as aiding in power management and increasing the efficiency of the power distribution system [6,7]. Regarding electric power system (SEP) architecture in aircrafts, alternating current (AC) feed systems can operate at a fixed frequency (115 V/400 Hz), or variable frequency (115 V/360–800 Hz), as observed in Boeing 787. High-voltage direct current (HVDC), 400VCC and +/−270VCC, is normally used.

In the context of vehicle electrification, a transition is observed from the first battery electric vehicle (BEV) models, which were equipped with 250–400 V batteries, to models equipped with 400–800 V batteries, promoting weight and volume reduction, consequently increasing the autonomy of the vehicle, as well as reducing the recharge time of the batteries. As well as that observed in MEA, high voltage levels in direct current bring new challenges for the development of power electronics converters topologies with specific configurations to allow a reduced current and voltage efforts in semiconductors [8–10].

Finally, the use of several power electronics converters in direct current energy distribution microgrids encourages the development of more sophisticated and efficient control and energy management systems. This has attracted great interest from the industry and academia for the development of "Smart Power Electronics Converters". These is a more sophisticated version of power electronics converters that make it possible to keep the on-board microgrid stable and reliable as more energy resources and electronic loads are connected to the system [11–16].

Therefore, the purpose of the Special Issue entitled "Power Electronics Converters for On-board Electric Power Systems" is to discuss the future of on-board microgrids in the context of more electric aircrafts (MEA), electrical vehicles (EV), electric ships (ES), and electric trains (ET). The power densities of power electronics converters and electrical machines are expected to increase dramatically. Challenges related to power generation, conversion, and distribution are expected to be overcome with a focus on high-performance power electronics converters, associated with sophisticated control strategies, optimization methods, energy management systems, energy storage systems, and power quality issues.

Conflicts of Interest: The authors declare no conflict of interest.

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