Advanced Wireless Power Transfer Technologies

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Wireless power transfer technology is technology in which power is delivered without any metal-to-metal contact, which can make practical applications very convenient. In the past decade, this technology has been well developed from different perspectives, including both near- and far-field systems. Specifically, based on energy-contained fields, it can be classified into inductive power transfer, capacitive power transfer, and microwave power transfer. Inductive technology has attracted the most attention from researchers and is becoming mature and commercially available. This Special Issue focuses on the most recent achievements in the theory and practice of wireless power transfer, especially in terms of real-world applications. In total, four papers are included.

The first paper \cite{1} is presented by Iero et al., who evaluated silicon and GaN devices in low-power wireless power transfer systems. Based on their comparison, it was shown that GaN HEMTs have advantages compared to conventional silicon devices. Especially in the high frequency range, up to MHz, GaN devices have better potential in terms of their switching capability with high efficiency. Meanwhile, the authors also pointed out that the operation of GaN devices needs to be paid attention to under all operating conditions to make full use of this advantage.

The second paper \cite{2} is presented by Campi et al., who proposed a novel two-receiver based structure to support dynamic power transfer for electric vehicles. Conventionally, multiple transmitters and one receiver are used in a dynamic system. While a vehicle moves along the transmitters, the received power fluctuates greatly, which can significantly affect the charging performance. In this paper, the authors proposed the installation of two receivers at the vehicle side: one at the front and the other one at the end. In this way, the sum of the received power was shown to be stable, and the variation was limited to 2.8%, which makes it a very impressive and practical design.

The third paper \cite{3} is presented by Liu et al., who investigated the resonance mechanism of 6.78 MHz resonant wireless power transfer technology. A GaN HEMT was utilized to realize a high-frequency class-E amplifier as the excitation for power transfer. Zero-voltage switching control was derived based on high-frequency circuits. In this paper, a prototype with over 80% transfer efficiency at 40 cm transfer distance was demonstrated. This provides the potential to support different applications in battery charging.

The fourth paper \cite{4} is presented by Cheng et al., who studied metal object detection technology in inductive power transfer to prevent nearby metal materials from being heated. This study aimed to improve the performance of an inductive system by detecting metal objects through inductance variations. Two novel multi-layer detection coil layouts were proposed that did not have any blind spots. In addition, the impacts of the detection layer, trace width, and turn-number of the coils were investigated. The testing result is very impressive, and it was shown that this system could detect a one-cent coin at various positions.

The papers in this Special Issue provide new explorations in the wireless power transfer field, which could be potential guidelines for practical applications. Together with...
the co-guest editor, Dr. Chong Zhu, we wish to thank the authors for their contributions to this Special Issue.

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

References