Analysis and Design of Wireless Charging System for Electric Vehicles

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Charging systems are one of the fundamental components of the electric vehicle ecosystem and have a significant impact on the widespread adoption of electric vehicles. Wireless vehicle charging systems not only offer ease of use but also provide benefits such as reducing battery requirement, ensuring high safety and lowering maintenance costs. They have become a highly popular topic through academic studies and commercial ventures.

Research on wireless power transfer (WPT) systems has focused on various compensation topologies and coil structures. The key success parameters for WPT systems include power transfer capability, efficiency, ease of control, misalignment tolerance, effective charging area, size, and cost. In this study, commonly used compensation topologies and coil structures in high-power applications, such as electric vehicle charging systems, are compared in terms of their success parameters, highlighting their respective advantages and disadvantages.

Based on the comparison, a wireless EV charging system with a 1.5 kW output power at 85 kHz resonance frequency with a series-series compensation topology has been designed, considering the parameters defined by the Society of Automotive Engineers (SAE) for wireless charging of electric vehicles. Circular coil structures have been used for both the transmitter and receiver coils.

Keywords: Electric vehicles, vehicle charging systems, wireless power transfer, wireless charging.

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