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A Dynamic Approach to Wireless Power Transfer in Electric Vehicles using Two Receiver Coils

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Abstract: This paper presents a dynamic approach to wireless power transfer (WPT) for electric vehicles (EVs) utilizing two receiver coils, implemented and simulated in MATLAB 2021a. The proposed system aims to enhance power transfer capability and efficiency during dynamic charging scenarios, such as highway driving or automated parking, where misalignment between the transmitter and receiver coils is inevitable. The system employs a VEENA Rectifier based topology, consisting of an AC source, a highfrequency (HF) inverter, a resonant inductive link with two receiver coils, a rectifier, and a battery. The use of two receiver coils allows for increased power capture and improved tolerance to lateral misalignment. The HF Inverter converts the AC source to a high-frequency AC signal, enabling efficient power transfer through the resonant inductive link. The Rectifier converts the received high-frequency AC back to DC for battery charging. A dynamic control strategy is implemented to optimize the power transfer based on the relative position and orientation of the transmitter and receiver coils. This strategy involves adjusting the operating frequency and duty cycle of the HF inverter to maximize power transfer efficiency under varying misalignment conditions. The simulation results, obtained using MATLAB 2021a, demonstrate the effectiveness of the proposed approach in achieving stable and efficient power transfer during dynamic charging scenarios. The performance of the system is evaluated in terms of power transfer efficiency, output power, and tolerance to misalignment. The findings highlight the potential of the proposed dynamic WPT system with two receiver coils for practical implementation in EV charging infrastructure, contributing to the advancement of wireless charging technology.

Keywords: Wireless Power Transfer (WPT), Electric Vehicles (EVs), Dynamic Charging, Two Receiver Coils, Misalignment Tolerance, VEENA Rectifier, MATLAB Simulation etc



