Design Methodology for Parallel Resonant Series-series (PRSS) Tuning for Wireless Inductive Power Transfer Systems

04/28/2025

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Electrical & Computer Engineering

Abstract

Wireless inductive power transfer (IPT) is a fast-growing market with demand from phone and other mobile device charging, implantable medical devices, electric vehicle charging, etc. This technology has always faced the challenge of misalignment between the generator coil and the receiver coil. This misalignment causes inefficiency in wireless power transfer and increases costs in electricity and equipment. Researchers from Utah State University and the University of Colorado propose a new design that uses parallel resonant series-series (PRSS) tuning. With the PRSS tuning design, power variations that occur with misalignment are reduced, efficiency is maintained, and zero voltage switching for primary switches can be achieved.

Problem

Current wireless power transfer systems waste a large amount of electricity in stray magnetic fields when generator coils and receiver coils aren't aligned. This increases costs of operation.

Solution

Through parallel resonant series-series tuning, we can maintain constant power for a range of coupling coefficients, reduce power variations that occur with misalignment, maintain higher efficiency, and achieve zero voltage switching.

Value Proposition

Higher efficiency in power transfer lowers electricity costs for consumers, and a simpler design lowers manufacturing costs and complexity.

Benefit

Current wireless power transfer systems waste a large amount of electricity in stray magnetic fields when generator coils and receiver coils aren’t aligned. This increases costs of operation. Current partial remedies to this problem in IPT systems use relatively complicated, expensive equipment, including complex coil structures, extra DC-DC converters, and complicated controls. Parallel resonant series-series tuning enables maintenance of constant power for a range of coupling coefficients, reduces power variations that occur with misalignment, maintains higher efficiency, and achieves zero voltage switching for primary switches.

This innovation offers higher efficiency in power transfer, lowering the amount of stray field energy that is wasted, thereby decreasing charging costs on the consumer end. Additionally, equipment and manufacturing needs are simplified. The technology nullifies the need to purchase additional supporting equipment to conserve basic function.

Market Application

The hybrid and electric vehicle manufacturing market is directly applicable to this technology. Companies in this sector often use third-party designs and parts, especially in vehicle charging. Also applicable is the wireless power transfer market in general, including mobile devices and internal medical devices.

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Funding

This invention was made with government support under Contract No. 1941524 awarded by the National Science Foundation. The government has certain rights in the invention.

USU Reference No. C24025

Publications

- M. Chawla, D. Maksimovi# and A. Kamineni, "Nearly Constant Power Tuning Network for Wireless Inductive Power Transfer Systems,"2023 IEEE Wireless Power Technology Conference and Expo (WPTCE), San Diego, CA, USA, 2023, pp. 1-6, doi: 10.1109/WPTCE56855.2023.10216214

Intellectual Property

Pending U.S. Non-Provisional Patent Application Filed April 2025