Adaptive Geometric and Dimensions Alignment Guided Approach Design Optimization for Efficiency Improvement of WPT Systems

SPEAKERS

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About The Speakers:

Osama Mohammed:
Osama A. Mohammed (Fellow, IEEE) is currently a Distinguished Professor of electrical engineering and the Associate Dean of Research with the College of Engineering and Computing, Florida International University (FIU), Miami, FL, USA. He is the Director of the Energy Systems Research Laboratory, FIU. He has more than 19 patents awarded with several more filed and has authored or coauthored more than 850 articles in refereed journals and other IEEE refereed international conference records.

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Ahmed S. Soliman (S'20, IEEE) received the B.Sc. and M.Sc. in Electrical Power Engineering from Ain Shams University, Cairo, Egypt, in 2012 and 2019, respectively. He received his second M.Sc. degree in Electrical Engineering, July 2023, from Florida International University (FIU) where he is currently a Doctoral Candidate with the Electrical and Computer Engineering Department, Miami, Florida, USA. He is working as a Research Assistant (RA) with the Energy Systems Research Laboratory (ESRL), directed by Prof. Osama A. Mohammed, Distinguished Professor and Associate Dean of Research.

ABSTRACT

This lecture will focus on Wireless Power Transfer systems WPTs with their different configurations for electric vehicles EVs applications. The detection of the secondary-side coil in wireless power transfer systems (WPTSs) for electric vehicles (EVs) is essential for establishing whether the car is in the effective charging zone. However, most sensor-based detection methods currently in use necessitate altering the vehicle's structure, which has a number of drawbacks, including restricted vehicle adaptability, compromised structural integrity of the original magnetic coupler, and potential magnetic interferences with primary-side coil operation.

Driven by the current issues, the lecture will focus on the design considerations for two different coil types, mainly ring and spiral circular coils, that are widely adopted in WPTSs. A detailed analytical estimation for inductive characteristics is provided for WPT. Then, design optimization of the WPT system based on coil geometrical parameters and relative placement is proposed. COMSOL software is used to accurately determine the inductive parameters to validate theoretical analysis for our developed 500W charging coils.

Finally, the coupling coefficients of various coreless and cored charging pads are investigated with different geometric dimensions and coil alignments, with I-core being recommended to avoid bifurcation phenomena.