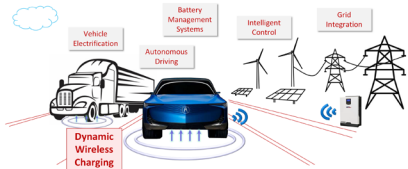


Design of Resonant Inductors for Capacitive Wireless Charging Systems

Sounak Maji and Khurram Afridi
Cornell University

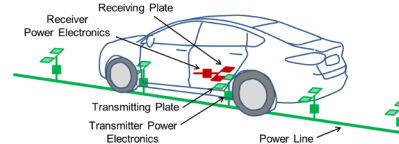
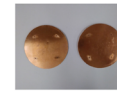
INTRODUCTION

- Penetration of EVs remains low – main hurdles are:
 - High cost
 - Limited range
- Dynamic WPT can reduce battery size and enable unlimited range
- WPT enables autonomous charging

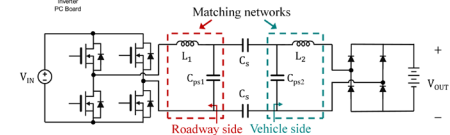


CAPACITIVE WPT SYSTEMS

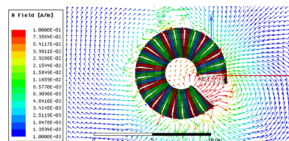
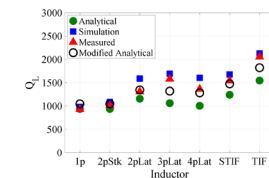
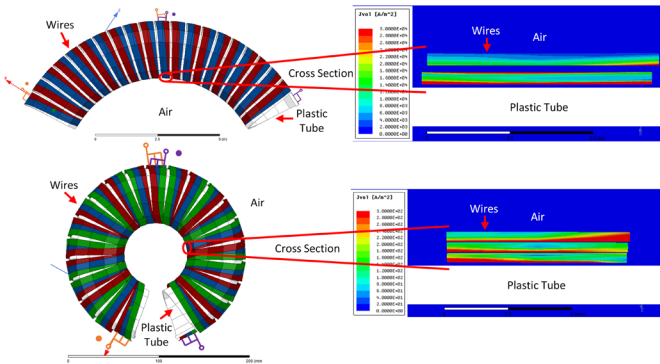
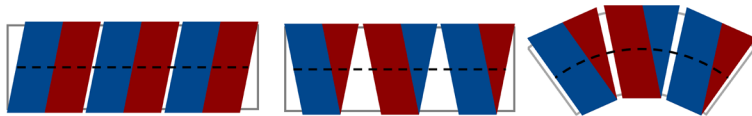
- Capacitive WPT systems:
 - Small and light
 - Easy to embed in the roadway
 - Does not limit frequency
 - Inexpensive
- Capacitive WPT couplers are simpler than inductive counterparts



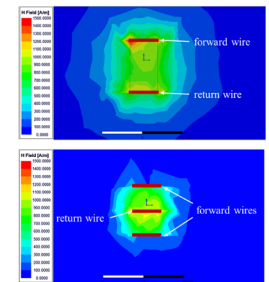
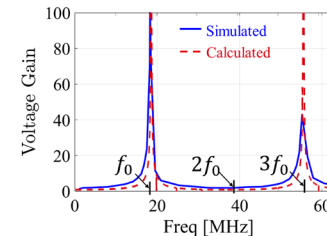
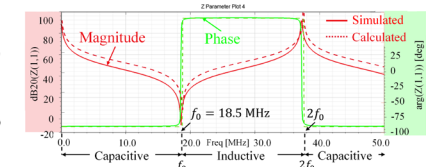
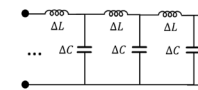
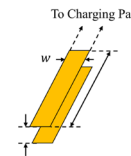
TOPOLOGY OF CAPACITIVE WPT SYSTEM



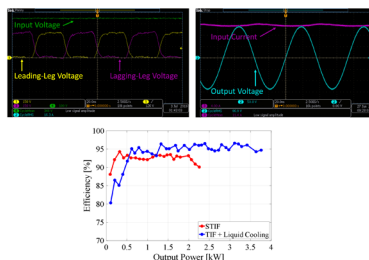
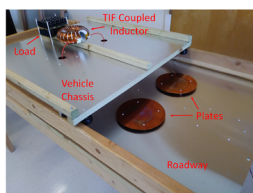
INTERLEAVED-FOIL INDUCTORS WITH AXIAL CURVATURE



PARASITICS-BASED MATCHING NETWORKS

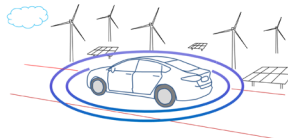


3.7-kW CAPACITIVE WPT SYSTEM



SUMMARY

- Introduced high quality factor Semi-Toroidal Interleaved-Foil (STIF) Inductor and Toroidal Interleaved-Foil (TIF) Inductor
- Analytically compared quality factors of five different solenoidal inductors with the STIF and TIF
- Demonstrated parasitics-based matching network design
- Demonstrated 3.7-kW capacitive WPT system with 94.7% efficiency



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