Enhancing wireless power transfer through field distribution design

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Demand of and research on high efficiency wireless power transfer systems has increased significantly during the last decade. Portability and convenience of the devices are often cited as primary reasons for increased demand of wireless power transfer systems, as well as lack of accessibility in the case of implantable biomedical devices. Low-frequency resonant inductively coupled devices are frequently chosen for wireless power transfer, due to their convenience, and in the case of biomedical devices, safety.

Researchers have explored a number of techniques in order to overcome the limitations of current wireless power transfer systems. Some of these techniques rely on metamaterials and their exotic properties. Polarizable particles within metamaterials are responsible for the field enhancement and near-field control capabilities of these materials. This field enhancement is the main reason why metamaterials have been considered as a means of achieving higher efficiencies in wireless power transfer systems. Nevertheless, research on metamaterials is still in relatively early stages and a widely accepted solution that demonstrates the usefulness of metamaterials in wireless power systems has yet to be found.

In this work, we propose designing a metamaterial capable of reshaping the electromagnetic field distribution generated by coils used in wireless power transfer systems. An enhancement on the wireless power transfer efficiency of the system is expected by appropriately reshaping the field distribution of these coils. The near-field control capabilities of metamaterials is instrumental in achieving the field-reshaping described herein. In this presentation, we will show how a judiciously chosen metamaterial and its field shaping that can be inductive of increased mutual coupling and, therefore, enhanced power transfer efficiency.