Study of Resonant Coupling Using Various Magnetic and Negative Refractive Index Materials

G. Boopalan[1], C. K. Subramaniam[1]

[1]School of Electronics Engineering, VIT University, Vellore, Tamil Nadu, India

Abstract

Non contact charging of electronic equipment from mobiles to electric vehicle has created immense interest among researchers. There are various groups working on both radiative and non-radiative energy transfer. The idea based on strongly coupled magnetic resonances is of interest because of the increased distance of energy transfer. This technology based on resonant magnetic coupling with the introduction of negative refractive index materials in the environment is also novel and exciting. We simulate and analyze the effects of introduction of various materials between the resonant coils. The structure and physical parameters play an important role in efficiency and quantum of energy transfer. The array size of the various materials and structure has an important effect on the transfer coefficient. Since the permittivity and permeability of the two media have different features, the components of the electric field (or the magnetic field) changes when the observation point is moving towards the interface. This property and feature can be studied before optimizing the structure and physical nature of the system. The simulations are done using COMSOL Multiphysics a finite element analysis software. Some interesting results evolve as we introduce various medium in the environment. These aspects will be experimentally verified by studying a real time system.

Reference

1. Andre Kurs et.al, Wireless Power Transfere via Strongly Coupled Magnetic Resonances, Science, Vol. 317, 84-86(2007)
2. Yaroslav Urzhumov et. al., Metamaterial-enhanced coupling between magnetic dipoles for efficient wireless power transfer, Physical Review B 83, 205114(2011)