# Maximizing Wireless Power Transfer Using Ferrite Rods Within Telemetric Devices for Rodents

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## Abstract

A number of medical and research applications require implantable devices to locally stimulate internal organs and communicate the internal vital signals to the outer world. Wireless power transfer (WPT) technique is used to supply power to these devices. The power is transferred wirelessly from a stationary primary coil to a movable secondary coil. The secondary device is implanted in a small rodent, which moves freely inside a cage around which the primary is wrapped. However, the continuously changing orientation of the rodent leads to coupling loss/problems between the primary and secondary coils. We propose configurations of the secondary coil employing different size of ferrite rods placed at specific locations within the coil.

Three dimensional finite element analysis (FEA) using COMSOL Multiphysics® software is used to find the magnetic flux density distribution surrounding these secondary configurations. The simulation results show a significant increase of flux through the coil using the ferrite arrangement, with improved coupling at most orientations. The secondary coil configurations were constructed and experiments were conducted to test their performance. Measurements show that ferrite rods improved power transfer, where the long ferrite (4LF) configuration is highest received power. Experiments show the maximum power collected by 4LF was 127 mW when parallel to the primary coil.

## Figures used in the abstract

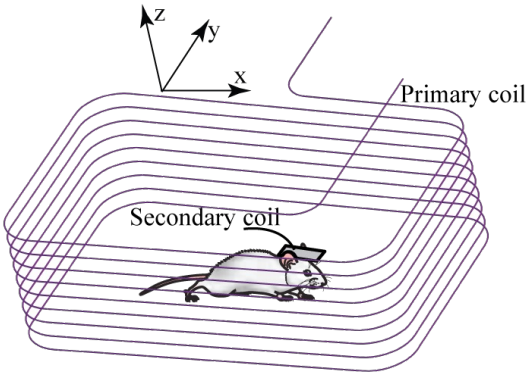


**Figure 1**: Small Rodent WPT concept.

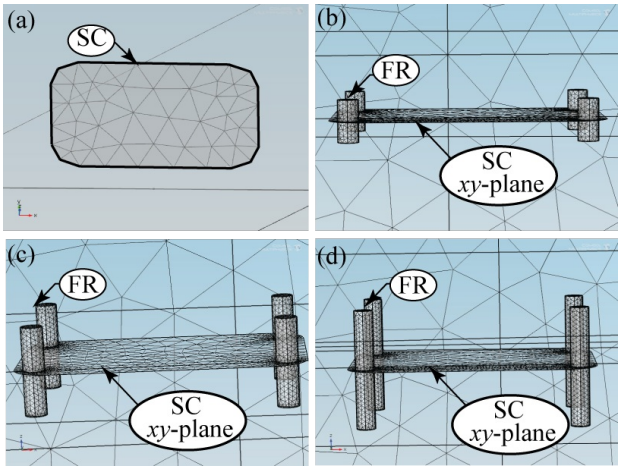


**Figure 2**: Meshing of secondary; (a) air core, (b) 4SF, (c) 4MF and (d) 4LF.

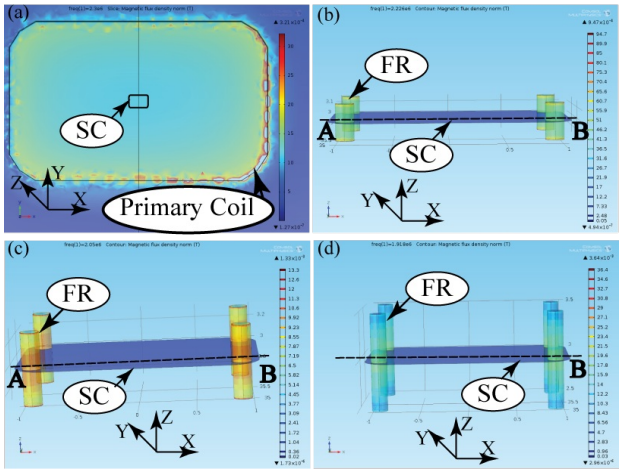


**Figure 3**: Magnetic flux density; (a) plotted on the x-y plane within and around the primary coil, (b) 4SF, (c) 4MF and (d) 4LF configuration.

**Figure 4**: Waterfall plot of the magnetic flux density within the ferrite rods and the air space around them, where they intersect the plane corresponding to the secondary coil windings (coil x-y plane); (a) 4SF, (b) 4MF and (c) 4LF.