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Medical Applications of MRC

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ABSTRACT

Consistent powering is a limiting reagent for many medical implants and sensors. Powering in-vivo devices in animal studies requires either transcutaneous wiring (limiting mobility and increasing the chance of infection) or an implanted battery (limited lifetime and limits size of device). Wireless power transfer (WPT) would be able to overcome these challenges and permit the use of more advanced implantable devices in a research setting. Magnetic resonance coupling (MRC), an advanced form of inductive charging, allows good transfer efficiencies over significant air gaps, but works best a specific location and frequency, limiting mobility in animal studies. Using band-pass filter theory, an MRC system was simulated and optimized, as well as a design for a continuous WPT animal cage system utilizing MRC with 896 cm^2. Both the frequency response and the actual power transfer of the systems were tested; downstream rectification circuitry was also developed to demonstrate WPT. Results indicate using multiple coils in series in a circle orthogonal to the individual coils produced a homogenous magnetic field and frequency response, and using passive coils increased coupling and efficient power transfer. While MRC is traditionally not a robust system, our results show the application can be extended charging over a wide range of space, allowing animal mobility and current experiments to be aided with electronic implants.

KEYWORDS

Implants, MRC, wireless power