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Challenges for Inductive Power Transfer over wider areas

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Inductive power transfer is now a commercially mature technology for short range, localised powering of electronic devices. However, there are many potential applications that would be enabled by a power transfer system tolerant of greater separation between transmitter and receiver. In this paper we consider just such an application and use it to elucidate the design and performance constraints facing poor and variably coupled IPT systems.

The application here – a body worn medical sensor powered by an IPT system incorporated into the arm of a chair – has poorly constrained relative transmit and receive coil positioning, resulting in coupling factors varying over several orders on magnitude over the desired spatial operating envelope. The voltage induced in the receive coil and the resulting transferred power also vary greatly, necessitating compromises in circuit design. Furthermore, the desire to extract power at the lowest coupling level forces the use of a parallel receiver resonant circuit which will have to dissipate significant thermal losses during period of higher coupling.

In contrast to the design approach for well-coupled systems, where low losses and high efficiencies are sought, it is proposed that the transmitter power consumption be considered a relatively constant 'loss' irrespective of the received power. The key design challenges are then 1) how to create the magnetic field (complying with human exposure guidelines and with coils physically constrained by the application) for minimum power consumption; 2) how to design receiver electronics capable of very wide power range operation.

In the system described in this paper the power consumption is in the region of 3 watts (comparable with the power consumption of a typical domestic 'wi-fi' box) and the body worn sensor, which requires just 1 mW, can operate over a hemisphere ~300 mm in diameter (when favorably aligned).