

Transfer of Power and Data Over Coupled LC Resonators

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Abstract:

Numerous applications are arising where an active circuit is powered by a remote unit, which also exchanges bidirectional data. In our application, an active circuit is implanted in the brain, powered by a small battery worn in an external earpiece. The implanted circuit stimulates and senses a dense array of electrodes on command, and communicates digitized waveforms to the external unit.

Two flat coils coupled magnetically offer a practically useful transcranium wireless connection. Carrier frequencies of 10 to 30 MHz propagate with little loss through human tissue, and are well-suited for transmission through coils with a 3-cm diameter.

We have exploited a little-known property of coupled resonators which results in self-regulation of received load voltage over a range of coil separations and axial misalignments. We supplement this with circuit methods to regulate voltage over 10X changes in load current. A robust power link has been realized to deliver a regulated 20 mW to the implant.

A 4Mb/s data link that keys the implant load has also been realized over the same coupled resonators. With full CDR included, the uplink consumes 100X lower power than the previous state-of-the-art.

About the Speaker:



Asad Abidi received the BSc degree in Electrical Engineering from Imperial College, London in 1976, and the PhD from the University of California, Berkeley in 1982. He worked at Bell Laboratories, Murray Hill until 1985, and then joined the faculty of the University of California, Los Angeles where he is Distinguished Chancellor's Professor of Electrical Engineering. With his students, he has developed many of the radio circuits and architectures that enable today's mobile devices.

Among other awards, Professor Abidi has received the 2008 IEEE Donald O. Pederson Award in Solid-State Circuits and the Best Paper Award from the IEEE Journal of Solid-State Circuits in 2012. The University of California, Berkeley's Department of EECS recognized him as a Distinguished Alumnus in 2015. He is a Fellow of IEEE since 1996, and was elected to the US National Academy of Engineering and to TWAS, the world academy of sciences.