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Efficient Power and Wideband Data Transmission in Near Field

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Abstract: Wireless power transmission is on the rise for a variety of applications from electric vehicles to smartphone and implantable microelectronic devices (IMD). Unlike pacemakers, extreme size constraints and high power consumption prevent many IMDs such as cochlear and retinal implants from using primary batteries as their energy source. Moreover, such devices need to deliver a sizable volume of information from external artificial sensors to the nervous system while interfacing with large neural populations at high stimulus rates. Nonetheless, the skin barrier should remain intact and the temperature should be maintained well within the safe limits. In this talk I will cover the fundamentals of efficient short-range power and wideband data transmission across inductive links. I will discuss the optimization procedure to achieve the highest possible power transmission efficiency using two, three, and four coil systems, including mm-sized coils that can be used in very small implants distributed in an area of interest in the body. I will review some of the latest techniques to establish wideband bidirectional communication links across the skin, and also touch on efficient methods to convert the received AC power on the IMD to DC and stabilize it at a desired level despite coupling variations due to coil misalignments.

Maysam Ghovanloo received the B.S. degree in electrical engineering from the University of Tehran, and the M.S. degree in biomedical engineering from the Amirkabir University of Technology, Tehran, Iran in 1997. He also received the M.S. and Ph.D. degrees in electrical engineering from the University of Michigan, Ann Arbor, in 2003 and 2004.

Dr. Ghovanloo developed the first modular Patient Care Monitoring System in Iran where he also founded a startup to manufacture physiology and pharmacology research laboratory instruments. From 2004 to 2007 he was an Assistant Professor in the Department of ECE at the North Carolina State University, Raleigh, NC. Since 2007 he has been with the Georgia Institute of Technology, School of Electrical and Computer Engineering, where he is a Professor and the founding director of the GT-Bionics Lab. He has 8 issued patents and authored or coauthored more than 200 peer-reviewed conference and journal publications on implantable microelectronic devices, integrated circuits and micro-systems for IMD applications, and modern assistive technologies.

Dr. Ghovanloo was the general chair of the *IEEE Biomedical Circuits and Systems* (BioCAS 2015) in Atlanta, GA in Oct. 2015. He is an Associate Editor of the *IEEE Transactions on Biomedical Engineering* (TBME) and *IEEE Transactions on Biomedical Circuits and Systems* (TBioCAS). He is serving on the technical program committee for the *IEEE Custom Integrated Circuits Conference* (CICC). He served as an Associate Editor of *IEEE Transactions on Circuits and Systems, Part II* (2008-2011), as well as a Guest Editor for the *IEEE Journal of Solid-State Circuits* and *IEEE Transactions on Neural Systems and Rehabilitation Engineering*. He has also served on the Imagers, MEMS, Medical and Displays subcommittee of the *International Solid-State Circuits Conference* (ISSCC) from 2009-2014. He has received the National Science Foundation CAREER Award, the Tommy Nobis Barrier Breaker Award for Innovation, and Distinguished Young Scholar Award from the Association of Professors and Scholars of Iranian Heritage.