Tutorial Proposal Title: Tiny Inductively Powered Battery Chargers

Presenter: Gabriel A. Rincón-Mora, Ph.D., Professor, IEEE Fellow, IET Fellow
Georgia Institute of Technology
Rincon-Mora@gatech.edu

Abstract: Although microsystems today require less power than ever before, they still cannot fit large enough batteries to sustain them for months or years at a time. Ambient energy is appealing in this respect, but only when an ambient source is available, which is often not the case for embedded microsensors inside the human body, engines, machines, and larger mechanical infrastructures. Transmitting power wirelessly is more practical in these applications. Unfortunately, tiny power receivers capture a small fraction of the power that a wireless source can deliver. So output power is low and its effects on the transmitting coil are barely noticeable. Power receivers should therefore draw as much power as possible, but only as much as breakdown voltages and power losses allow. This talk shows how the state of the art in inductively coupled power receivers can draw and output the highest power possible from tiny coils that are centimeters away from their transmitting sources.

Outline:

Inductively Powered Systems

Inductive Power

Resonant Bridges

Switched Bridges

Switched Resonant Bridge

Comparison

Switched Prototype

Conclusions

Relevant Publications:

1. O. Lazaro and G.A. Rincón-Mora, "A non-resonant self-synchronizing inductively coupled 0.18-µm CMOS power receiver and charger," IEEE Journal of Emerging and Selected Topics in Power Electronics (ESTPE), vol. 3, no. 1, pp. 261–271, Mar. 2015.

2. O. Lazaro and G.A. Rincón-Mora, "180-nm CMOS wideband capacitor-free inductively coupled power receiver and charger," IEEE Journal of Solid-State Circuits (JSSC), vol. 48, no. 11, pp. 2839–2849, Nov. 2013.

3. O. Lazaro and G.A. Rincón-Mora, "Inductively coupled 180-nm CMOS charger with adjustable energy-investment capability," IEEE Transactions on Circuits and Systems II (TCAS II), vol. 60, no. 8, pp. 482–486, Aug. 2013.

4. R.D. Prabha, D. Kwon, O. Lazaro, K.D. Peterson, and G.A. Rincón-Mora, "Increasing electrical damping in energy-harnessing transducers," IEEE Transactions on Circuits and Systems II (TCAS II), Special Issue on Energy Harvesting, vol. 58, no. 12, pp. 787–791, Dec. 2011.

5. N. Xing and G.A. Rincón-Mora, "Generating the Highest Power with a Tiny and Distant Inductively Coupled Coil," IEEE International Symposium on Industrial Electronics (ISIE), Santa Clara, California, Jun. 8–10, 2016.

6. O. Lazaro and G.A. Rincón-Mora, "Minimizing MOSFET power losses in near-field electromagnetic energy-harnessing ICs," IEEE International Systems-on-Chip Design Conference (ISOCC), Jeju, Korea, Nov. 17–18, 2011.

Presenter's Biography: Gabriel A. Rincón-Mora worked for Texas Instruments in 1994-2003, was an Adjunct Professor at Georgia Tech in 1999-2001, and has been a Professor at Georgia Tech since 2001 and a Visiting Professor at National Cheng Kung University in Taiwan since 2011. He is a Fellow of the IEEE and a Fellow of the IET, and his scholarly products include 9 books, 4 book chapters, 38 patents issued, over 170 publications, over 26 commercial power-chip designs, and over 110 invited talks. Awards include the National Hispanic in Technology Award from the Society of Professional Hispanic Engineers, the Charles E. Perry Visionary Award from Florida International University, a Commendation Certificate from the Lieutenant Governor of California, the IEEE Service Award from IEEE CASS, the Orgullo Hispano and the Hispanic Heritage awards from Robins Air Force Base, and two "Thank a Teacher" certificates from Georgia Tech. Georgia Tech inducted him into the Council of Outstanding Young Engineering Alumni in 2000 and Hispanic Business magazine named him one of "The 100 Most Influential Hispanics" in 2000. He has served as Distinguished Lecturer, General Chair, Technical Program Chair, Associate Editor, Guest Editor and Co-Editor, and Chapter Chair and Vice-Chair on multiple occasions for IEEE, several international conferences, and several journal publications.