Time & Location: March 11, 2014 at 10:30 AM in HEC 356
Title: RF Energy Harvesting for Implantable ICs with On-chip Antenna

Nowadays, as aging population increasing yearly, the health care technologies for elder people who commonly have high blood pressure or Glaucoma issues have attracted much attention. In order to care of those people, implantable integrated circuits (ICs) in human body are the direct solution to have 24/7 days monitoring with real-time data for diagnosis by patients themselves or doctors. However, due to the small size requirement for the implanted ICs located in human organs, it's quite challenging to integrate with transmitting and receiving antenna in a single chip, especially operating in 5.8-GHz ISM band.

This research proposes an innovated idea to solve the issue of integrating an on-chip antenna with implanted ICs. By adding an additional dielectric substrate upon the layer of silicon oxide in CMOS technology, utilizing the metal-6, it can form an extremely compact 3D-structure on-chip antenna which is able to be placed in human eye, heart or even in a few mm-diameter vessels. The proposed 3D on-chip antenna is only 1/2.8 mm³ with -10 dB gain and has capability to communicating at least within 5 cm distance. The entire implanted battery-less wireless system has also been developed in this research. A designed 30% efficiency Native NMOS rectifier could generate 1 V and 1 mA to supply the designed low power transmitter including voltage-controlled oscillator and power amplifier. The entire system performance is well evaluated by link budget analysis and the simulation result demonstrates the possibility achieving the goal of implanting a tiny single chip in human organs.

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Approved for distribution by Jiann-Shiun Yuan, Committee Chair, on February 11, 2014.

The public is welcome to attend.