Analog Integrated Circuit Design for Implantable Neural Interfaces

ABSTRACT:

Recent advances in neuroscience and micromachining have made it possible to monitor the activity of hundreds of neurons in the brain and extract meaningful information from these signals. By recording neural signals in motor cortex -- the region of the brain that sends commands down the spinal cord to muscles throughout the body -- it is now possible to predict the trajectory of a monkey's hand in real time. Commercial clinical trials in paralyzed humans are currently underway in this new field of neuroprosthetics. Despite the success of these initial experiments, the hardware used to amplify and record neural signals still consists of large, power-hungry, rack-mounted electronics. Wires from the implanted microelectrode array must break the skin, so there is always a risk of infection.

At the University of Utah, we are developing integrated mixed-signal CMOS circuits for massively parallel neural recording (i.e., 100 or more electrodes) in a fully-implanted device. Power and data links must be wireless, and the power consumption of the device must be kept very small to prevent tissue damage due to heating. Many circuit design challenges are encountered when developing low-noise biosignal amplifiers, signal processing modules, and RF transmitters that dissipate only microwatts of power. I will discuss some of the circuits we have designed for this unique application and describe a complete Integrated Neural Interface (INI) currently under development at Utah.



Reid R. Harrison Time: 4:00pm March 3rd

Place: PH 203

BIOGRAPHY:

Reid Harrison is an assistant professor in the Electrical and Computer Engineering Department at the University of Utah, Salt Lake City, UT, where he holds an adjunct appointment in the Bioengineering Department. He earned a B.S. in electrical engineering from the University of Florida in 1994. After working at the Jet Propulsion Laboratory and at Los Alamos National Laboratory for a brief time, he joined the Computation and NeuralSystems program at the California Institute of Technology, Pasadena, CA, where he earned his Ph.D. in 2000. He received the National ScienceFoundation Career Award in 2002. His research interests include low-power analog and mixed-signal CMOS circuit design, integrated electronics for neural interfaces and other biomedical devices, and hardware for biologically inspired vision system

