Electrical & Computer ENGINEERING

SEMINAR

THURSDAY
OCTOBER 6, 2005

Scaife Hall Auditorium
Room 125

4:00 PM
Refreshments—3:30 PM

RICHARD BARANIUK
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Richard G. Baraniuk is the Victor E. Cameron Professor of Electrical and Computer Engineering Department at Rice University. His research interests lie in new theory and algorithms for DSP, including multiscale analysis and wavelets, digital imaging and image processing, inverse problems, and networking and communications. He was elected a Fellow of the IEEE in 2001 and has received national young investigator awards from the National Science Foundation and the Office of Naval Research, the Rosenbaum Fellowship from the Isaac Newton Institute of Cambridge University, and the ECE Young Alumni Achievement Award from the University of Illinois. He has received the George R. Brown Award for Superior Teaching at Rice twice and the C. Holmes MacDonald National Outstanding Teaching Award from Eta Kappa Nu. In 1999 he founded the Connexions Project (cnx.rice.edu), a rapidly growing collection of free, open-access educational materials and an open-source software toolkit to help authors publish and collaborate, instructors rapidly build and share custom courses, and students explore the links among concepts, courses, and disciplines.

COMPRESSED SENSING: A NEW FRAMEWORK FOR COMPUTATIONAL SIGNAL PROCESSING

Sensors, DSP algorithms, and DSP hardware are under increasing pressure to accommodate ever larger and higher-dimensional data sets; ever faster capture, sampling, and processing rates; ever lower power consumption; communication over ever more difficult channels; and radically new sensing modalities. Fortunately, over the past few years, there has been an enormous increase in computational power and data storage capacity, which provides a new angle to tackle these challenges. We could be on the verge of moving from a "digital signal processing" (DSP) paradigm, where analog signals are sampled periodically to create their digital counterparts for processing, to a "computational signal processing" (CSP) paradigm, where analog signals are converted directly to any of a number of intermediate, "condensed" representations for processing using optimization techniques. At the foundation of CSP lie new uncertainty principles that generalize Heisenberg's between the time and frequency domains and the concept of sparsity. As an example of CSP, I will overview "Compressed Sensing", an emerging field based on the revelation that a small number of linear projections of a sparse signal contain enough information for signal reconstruction and processing. The implications of CS are promising for many applications, including imaging systems and sensor networks and arrays. In particular, I will present a new, collaboration-free framework for distributed source coding that we term Distributed Compressed Sensing (DCS). DCS in some sense parallels the Slepian-Wolf theory and enables the recovery of multiple signals by exploiting their joint sparsity structure. In some settings, DCS encoding is best possible; that is, each sensor transmits no more information than would be required using full collaboration.

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For more information:
http://www.ece.cmu.edu/seminar

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