**Princeton University**  
Department of Electrical Engineering  

**Information Sciences and Systems (ISS) Seminar**

**Speaker:** Lalitha Sankar  
WINLAB, Rutgers

**Date:** Thursday, December 7, 2006

**Time & Location:** 4:30 pm ~ Room B205 ~ EQuad

**Title:** Capacity Theorems and Cooperative Strategies for a Multiaccess Relay Channel

**Abstract:**
Node cooperation in multi-terminal networks has been shown to achieve rate and diversity gains characteristic of multi-antenna wireless channels. In the general model of cooperation, some or all nodes in a network share their resources and some nodes called relays may be dedicated to aiding other nodes. This talk focuses on a specific relay-based cooperative network, a Multi-Access Relay Channel (MARC) where multiple sources communicate with a single destination in the presence of a relay. In the first part of the talk, we present new outer bounds on the capacity region of the MARC and extend the coding strategies of decode-and-forward (DF), compress-and-forward (CF), and amplify-and-forward (AF) developed for the classic single-user relay channel to the MARC. We present a novel offset encoding technique for DF that recovers the rate region achieved by backward decoding using low-delay sliding-window decoding at the destination.

The MARC is a multi-access generalization of the classic relay channel. A natural question that arises is whether the degraded MARC, like its single-user counterpart, achieves capacity. In the second part of the talk, we present a recent result using our new outer bounds that shows that DF achieves capacity for a degraded Gaussian MARC.

In a multi-access network, cooperation can be induced between the users or by introducing a relay. A user cooperative multi-access network can be modeled as a multi-access channel with generalized feedback. We model the relay-based cooperative (hierarchical) network as a MARC. In the last part of the talk, we compare the achievable rates and outage probabilities for the two cooperation models under a fixed cost constraint and a specific cooperative strategy.

Based on joint work with Dr. Gerhard Kramer (Bell Labs) and Prof. Narayan Mandayam (WINLAB).

**Biography:**
Lalitha Sankar received the B.Tech in Engineering Physics from the Indian Institute of Technology, Bombay in 1992 and a MS in Electrical Engineering from the University of Maryland Baltimore County in 1994. From August 1994 to August 1995 she was with the Engineering R&D division of Polaroid Corporation in Cambridge, MA. Following this, she worked for a year at AT&T Microelectronics in Allentown, PA after which she was with AT&T Shannon Labs in Florham Park, NJ. Lalitha is presently a full-time graduate student at WINLAB, Rutgers. Lalitha’s research interests include information theory, communication theory, and application of game theory to wireless networks. At AT&T, Lalitha was supported by a Continuing Education Award to pursue her doctoral studies.