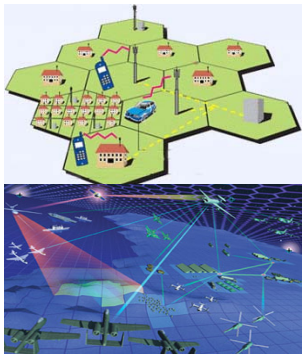

IICE Seminar
Fall 2010

Thursday, Nov. 25
9:30am, Room 215

ISEE, ZJU

Information Theory for Wireless Networks

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Abstract: Information Theory is the theoretical foundation of digital communication. Its channel coding theory characterizes the "capacity region" of a communication system. If information rate vector is kept within the capacity region, then error probability of message delivery can be taken arbitrarily close to zero. Classical channel coding theory was developed under the fundamental assumptions that users in a communication system can jointly determine their channel codes and information rates, and can communicate continuously over long time duration without unexpected disturbance. In a wireless networking environment, however, when users have bursty short messages that require timely dissemination, joint channel coding often becomes infeasible or impractical.

In this talk, we introduce a new channel coding theory for time-slotted random multiple access networks, where users cannot jointly design their channel codes. We assume each user individually chooses a set of codes each corresponding to a different rate option. In each time slot, a user chooses a communicate rate, which is the number of data bits encoded in a packet, depending on data availability and the link layer protocol. The rate information is shared neither between the users nor with the receiver. The receiver decodes the messages only when an error probability requirement is satisfied, otherwise the receiver reports a packet collision. We find that, fundamental performance of the system can be characterized by an achievable rate region in the following sense. If the communication rate vector happens to be inside the rate region, the receiver can reliably decode all messages, while if the communication rate vector happens to be outside the rate region, the receiver can reliably detect a collision. Although defined quite differently, we find the rate region equal Shannon information rate region without a convex hull operation.

Bio: J. Rockey Luo received the Ph.D. degree in Electrical and Computer Engineering from University of Connecticut in 2002. From 2002 to 2006, he was a Research Associate with the Institute for Systems Research (ISR), University of Maryland, College Park. In 2006, he joined the Electrical and Computer Engineering Department of Colorado State University as an Assistant Professor. His current research focuses on cross-layer interactions in wireless communication networks with an emphasis on the bottom layers.