

# Illinois Center for Wireless Systems

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## ICWS Seminar Series



### Cognitive Wireless Communication and Sensing in Time, Frequency and Space

Akbar Sayeed  
University of Wisconsin-Madison

Friday, February 23, 2007, 3:00 p.m.  
141 Coordinated Science Laboratory

Multipath signal propagation, a salient feature of wireless channels, results in detrimental signal fading and yet it is also a key source of diversity to combat the effects of fading and to increase the capacity and reliability of wireless communication systems. While technological advances in reconfigurable RF front-ends and antenna arrays are enabling new modes for sensing and adapting to multipath in time, frequency and space, our current understanding of the design and fundamental performance limits of such cognitive wireless systems is still in its infancy. One emerging insight is that unlike the prevalent assumption of rich multipath, physical channels exhibit a sparse multipath structure as the dimension of the spatio-temporal signal space (time-bandwidth-antenna product) increases. I will present three examples of exploiting multipath sparsity with reconfigurable transceivers. First, I will discuss the impact of signaling duration and bandwidth on channel learning, capacity and reliability in the wideband/low-SNR regime. Second, I will discuss the adaptation of array configurations for maximizing capacity as a function of operating SNR. Finally, I will present results on a distributed communication architecture -- Active Wireless Sensing -- in which an access point equipped with an antenna array interrogates an ensemble of wireless sensor nodes with wideband space-time waveforms for rapid retrieval of sensor information.

**Akbar M. Sayeed** received the B.S. degree (1991) from the University of Wisconsin-Madison, and the M.S. (1993) and Ph.D. (1996) degrees from the University of Illinois at Urbana-Champaign, all in Electrical and Computer Engineering. He was a postdoctoral fellow at Rice University (1996-1997) and he has been with the University of Wisconsin-Madison since 1997 where he is currently Associate Professor of Electrical and Computer Engineering. His current research interests include wireless communications, multi-dimensional communication theory, statistical signal processing, information theory, and applications in wireless networks. Dr. Sayeed is a recipient of the Robert T. Chien Memorial Award (1996) for his doctoral work at Illinois, the NSF CAREER Award (1999), the ONR Young Investigator Award (2001), and a UW Grainger Junior Faculty Fellowship (2003). He is a Senior Member of the IEEE, served as an Associate Editor for the IEEE Signal Processing Letters (1999-2002), and is currently serving on the signal processing for communications technical committee of the IEEE Signal Processing Society.

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