



MIT Lincoln Laboratory Seminar Series at Northeastern University 2009



Northeastern
UNIVERSITY

"To promote strong collaboration and inspire new ideas"

24 September
3:00 PM

Dana Research Center 442
100 Forsyth Street



Dr. Dan Bliss

**Advanced Sensor
Techniques**

MIMO Wireless Communication

Abstract

Wireless communication using multiple-input multiple-output (MIMO) systems enables increased achievable spectral efficiency and reliability for a given total transmit power. The increased capacity is achieved through the introduction of antenna arrays at both the transmitter and receiver. These arrays are used to take advantage of the multiple spatial modes provided by complicated multipath environments. Actual link performance is sensitive to a particular channel environment, receiver approach, and space-time code. Environmental characteristics include channel spatial correlation and external interference. Because of computational complexity, suboptimal receivers are often employed in real systems. Space-time coding describes the mapping from information bits to the transmitted waveforms employed by MIMO systems.

In this talk, a number of MIMO wireless communication topics are discussed. An introduction to MIMO communication is provided. The sensitivity of theoretical capacity to environmental factors is considered. These factors include channel complexity and external interference. Channel phenomenology and its effect on capacity is investigated using parametric models, asymptotic calculations, and experimental data. A theoretical performance comparison of various receiver approaches is presented. Innovative space-time coding concepts are introduced. Experimental performance results for a space-time turbo and low-density parity check coding techniques are presented as a function of channel characteristics and receiver design.

About the Speaker

Dr. Daniel W. Bliss is a senior member of the technical staff at MIT Lincoln Laboratory in the Advanced Sensor Techniques Group. Since 1997, he has been employed by MIT Lincoln Laboratory, where he focuses on multiantenna adaptive signal processing, primarily for communication systems. He also investigates parameter estimation techniques and bounds, primarily for geolocation. His current research topics include ultrawide bandwidth (UWB) communication, geolocation techniques using vector sensor arrays, MIMO radar concepts, algorithm development for multichannel multiuser detectors (MCMUD), MIMO communication channel phenomenology, space-time coding, and information theoretic bounds for MIMO communication systems.

Prior to joining the Laboratory, Dr. Bliss was employed by General Dynamics, where he designed avionics for the Atlas-Centaur launch vehicle and performed research and development of fault-tolerant avionics. As a member of the superconducting magnet group at General Dynamics, he performed magnetic field calculations and optimization for high-energy particle-accelerator superconducting magnets. His doctoral work was in the area of high-energy particle physics, searching for bound states of gluons, studying the two-photon production of hadronic final states, and investigating innovative techniques for lattice-gauge-theory calculations.

Dr. Bliss received his Ph.D. and M.S. degrees in physics from the University of California at San Diego and his B.S.E.E. degree in electrical engineering from Arizona State University.

15 October



**Dr. Jeremy
Kepner**

Embedded Digital
Systems Group

29 October



**Michael
Zhivich**

Information Systems
Technology Group

3 December



**Dr. Christ
Richmond**

Advanced Sensor
Techniques Group