Course Outline

ECE 901, Spring 2008

Wireless Multipath Channel Models

1. Overview of the course
2. Multipath channel models
   (a) The Saleh–Valenzuela model [5]
   (b) The IEEE 802.15.3a ultra-wideband model [2]
   (c) The IEEE 802.15.4a ultra-wideband model [4]
   (d) Simulation of channel response, power-delay profile, delay spread
3. Introduction to point processes [1], [3], [6]
   (a) Temporal point processes
   (b) Marked point processes
   (c) Multidimensional point processes
   (d) Shot noise and its relation to multipath channel models
   (e) Computation of shot-noise statistics
4. Analytical computation of ultra-wideband channel statistics
   (a) Expected number of paths
   (b) Expected number of detectable paths
   (c) Power-delay profile
   (d) Delay-spread — average and rms
   (e) Received signal correlation function
5. Bit-error probability
   (a) The additive white Gaussian noise (AWGN) channel
   (b) Signal subspaces
   (c) Evaluation of the bit-error probability for the AWGN channel
   (d) Signaling over multipath channels
   (e) Channel state information
   (f) Average bit-error probability for ultra-wideband channels

Prerequisites: ECE 730 or consent of instructor.
Lectures: Will be based on the references listed below as well as other research papers.
Grading: Based on graded homework assignments.
Homework: May require the use of MATLAB, mathematical derivations, and summaries of research papers.

References

[1] D. J. Daley and D. Vere-Jones, *An Introduction to the Theory of Point Processes*. New York: Springer, 1988.
[2] J. Foerster, Ed., "Channel modeling sub-committee report final," IEEE, Document IEEE P802.15-02/490r1-SG3a, 2003.
[3] J. F. C. Kingman, *Poisson Processes*. Oxford, U.K.: Clarendon, 1993.
[4] A. F. Molisch et al., "IEEE 802.15.4a Channel Model – Final Report," Tech. Rep., Document IEEE 802.15.04-0662-02-004a, 2005.
[5] A. A. M. Saleh and R. Valenzuela, "A statistical model for indoor multipath propagation," *IEEE J. Select. Areas Commun.*, vol. SAC-5, no. 2, pp. 128–137, Feb. 1987.
[6] D. L. Snyder and M. I. Miller, *Random Point Processes in Time and Space*, 2nd ed. New York: Springer, 1991.