UNIVERSITY OF TEXAS AT DALLAS
Department of Electrical Engineering

EE 6391 - Signaling and Coding for Wireless Communication Systems
Problem Set #3: Mobile Radio Propagation

Date assigned: February 17, 2005
Date due: February 24, 2005

Homework is due at the beginning of class. Late homework will not be accepted.

Reading: "Comparison of the N-path Rayleigh fading uncorrelated scattering model with measured characteristics on land mobile radio channels," R.J.C. Bultitude. Proc. Universal Personal Communications Conf., 1993.

You may use any computer program to help you solve these problems, check answers, etc.

Problem 3.1 Implement a time domain Rayleigh fading simulator using the following equation:

$$\alpha_R(t) = \sum_{n=1}^{N} \frac{C_n}{N} \cos\left(2\pi f_m \cos(\theta_n)t + \phi_n\right)$$

$$\alpha_I(t) = \sum_{n=1}^{N} \frac{C_n}{N} \sin\left(2\pi f_m \cos(\theta_n)t + \phi_n\right)$$

$$\alpha(t) = \sqrt{\alpha_R(t)^2 + \alpha_I(t)^2}$$

Using this time domain simulator, generate and plot a time sequence of 8912 samples of a Rayleigh fading signal with a duration of 1 sec for $f_m = 5$ Hz and $f_m = 20$ Hz. Assume that $N = 100$, C_n is a real Gaussian random number, and θ_n and ϕ_n are uniformly distributed random numbers on the $[0, 2\pi]$ interval. Turn in your plots of the Rayleigh fading envelope $\alpha(t)$.

From the above simulated data, compute level crossing rate (LCR) and average fade duration (AFD) for a threshold value that you select. Compare your results to the values of LCR and AFD based on the formulas that we derived in the class.

Problem 3.2

Chapter 4 - Problem 7 in *Wireless Communications* by A. Goldsmith.

Problem 3.3

Chapter 4 - Problem 8 in *Wireless Communications* by A. Goldsmith.