UNIVERSITY OF TEXAS AT DALLAS
Department of Electrical Engineering

EE 6391 - Signaling and Coding for Wireless Communication Systems
Problem Set #2: Mobile Radio Propagation

Date assigned: February 2, 2006
Date due: February 9, 2006

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

Reading: "Propagation measurements and models for wireless communication channels," J. Andersen. T. Rappaport, S. Yoshida, IEEE Comm. Mag, Han. 1995.

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

Problem 2.1
Chapter 3 - Problem 10 in *Wireless Communications* by A. Goldsmith.

Problem 2.2
Chapter 3 - Problem 15 in *Wireless Communications* by A. Goldsmith.

Problem 2.3 Rayleigh Fading Simulator with MATLAB
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 17824 samples of a Rayleigh fading signal with a duration of 2 sec for $f_m = 10$ Hz and $f_m = 30$ 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.