Department of Electrical Engineering
IIT Madras, Chennai 600 036.

EE 5141 Introduction to Wireless and Cellular Communications
February – May 2021

Computer Assignment 4 Submission Instructions

- Teams of two students
- Submit the following
  - Required plots
  - Include brief explanation of observations, as appropriate
  - Listing of code written by you
- The submitted file should be in .pdf format
- Mention name and roll number of both team members
- Use following naming convention for file you
  - roll_number_assign#.pdf
  - example: EE19M001_assign1.pdf
- Assignment submission via Moodle
  - Do not send via email
- Honour Code:
  - Add this line to your assignment and an electronic signature
  - I certify that this assignment submission is my own work and not from obtained from any other source

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Computer Assignment #4 (Due date: March 26, 2021)

1. Consider the DBPSK transmitter developed for assignment #3. Generate a random sequence of about 512 symbols and apply pulse shaping with a square-root raised cosine (SRRC) pulse (roll off 0.35). Use an over-sampling ratio of 8x symbol rate and a truncation length of 10 symbols for the SRRC pulse. The symbol rate is 25 Ksymbols/sec. The receive filter is a matched SRRC filter. Assume perfect synchronization and ideal sample timing selection.

   (a) Simulate DBPSK performance in AWGN and plot the simulated BER curve along with the analytical expression for BER of DBPSK ($P_e(\gamma) = \frac{1}{2} e^{-\gamma}$)

   (b) In class we discussed a method to obtain the BER of DBPSK in Rayleigh fading from the BER in AWGN by generating a large number of Rayleigh random variables and obtaining the instantaneous SNR as $\alpha^2 \frac{E_b}{N_0}$, where $\alpha^2 = X^2 + Y^2$, and X, Y are IID zero-mean Gaussian random variables with variance = 0.5. Using the instantaneous SNR, compute the instantaneous BER (using the analytical expression for BER in AWGN). Use averaging as needed and obtain the BER in fading.

   (c) The analytical expression for bit error rate for DBPSK in Rayleigh fading is $0.5/(1+\Gamma)$. Compare with the BER plot obtained in part (b)

Note: the BER graphs obtained in parts a,b,c must be plotted in single graph to facilitate comparison.