

**Assignment # 4**

Simulate the performance of  **$M$ -ary pulse amplitude modulation ( $M$ -PAM)** over an **AWGN channel**.

In the simulation, you are required to generate a random binary sequence, convert it into  $M$ -ary symbols, generate  $M$ -PAM signals, add an independent Gaussian noise sample to each signal, apply the ML rule at the receiver, count the number of errors and compute the error rate.

The variance of the Gaussian noise as well as the signal energy should match the specified SNR. Run the simulations until an error rate of  $10^{-5}$  is obtained for each value of  $M$ . A total of at least 100 errors should be accumulated before the simulation is terminated for each SNR value to make BER estimation accurate to 1% margin.

You need to submit a complete report that contains:

1. Simulation methodology used in the work.
2. A plot showing the symbol error probability (log-scale) vs. SNR in dB for  $M = 2,4,8,16$ .
3. A plot showing the bit error probability (log-scale) vs. SNR in dB for  $M = 2,4,8,16$ .
4. Copy of the working source file in one folder named (HW4\_studentID.zip) via e-mail.
5. All the above in hard-copy and soft-copy via e-mail.

**The Assignment is due on Sunday April 5, 2015 in-class.**

**Note:** Please copy this and sign on each H.W. assignment:

*I testify to Allah that I will not refer to the solutions of the assignments of EE 571 by any means and in any form and from any source, before I submit the assignment to my instructor*