EE 484

Coding Notes

Consider an (n, k) block code. Here k is the number of information bits and n is the total number of bits. Thus, $n - k$ is the number of parity bits which is overhead. The n bits make up a codeword.

Let $P_{c,e}$ denote the probability of a codeword error when making hard decisions. Let the code be able to correct t or fewer bit errors. Then,

$$P_{c,e} = \sum_{k=t+1}^{n} \binom{n}{k} P_b^k (1 - P_b)^{n-k}$$

where P_b is the probability of a bit error before decoding which is the probability of a channel error. Recall that for BPSK

$$P_b = Q\left(\sqrt{\frac{2E_b}{N_0}}\right).$$

Now, let P_e denote the probability of a bit error after decoding and let N_e denote the expected number of bit errors in a codeword. Then,

$$\begin{aligned} P_e &= \frac{1}{n} N_e \\ &= \frac{1}{n} \sum_{k=t+1}^{n} k \binom{n}{k} P_b^k (1 - P_b)^{n-k}. \end{aligned}$$

Remember when you plot the BER vs. E_b/N_0 you have to account for the coding overhead as discussed in class.