CT303 - Digital Communications
Autumn 2020

Lab 5: Matched Filter — Submit by 20/10/20, 12 noon

1. Let a binary PCM signaling scheme be given by $s_1(t)$ for bit 1 and $s_2(t)$ for bit 0, where

$$\begin{aligned} s_1(t) &= +A, 0 \leq t \leq T \\ &= 0, \text{ elsewhere, and} \\ s_2(t) &= -A, 0 \leq t \leq T \\ &= 0, \text{ elsewhere.} \end{aligned}$$

Generate a random bit stream and let the corresponding Binary PCM NRZ-L waveform be represented by $x(t)$. Sample $x(t)$ with a sampling rate $f_s = 10/T$ to obtain a sequence $x(n)$ and add AWGN to give the sampled received waveform $r(n)$. Using the matched filter (or correlators) discussed in class, detect the message from the received signal $r(n)$, and compare with the original message bits to compute the bit error probability P_B. Note that you will have to repeat the above experiments for several bit streams in order to come up with a reliable estimate of P_B. Repeat the same experiment with increasing Gaussian noise variance, and plot P_B against the noise variance. Also observe the effect of different choices for A and T on P_B.