EECS 353, Winter 2004
Introduction to Communications Systems

Homework 8
Due: Fri Mar 19, 2004

• Reading:

  1. **Lathi**: Sec. 12.2-12.3

• Exercises in Lathi:

  1. Ex. 12.1-2 p. 572

  2. A baseband system is described by Fig. 12.2 (p. 533) where \( H_p(\omega) = H_c(\omega) = 1 \). A non-ideal lowpass noise rejection filter (LPF) with transfer function \( H_d(\omega) = W/(W + j\omega) \) is implemented as the baseband receiver. Assume that the noise \( n(t) \) is white with PSD \( S_n(\omega) = N/2 \) and that the transmitted signal has PSD:

\[
S_m(\omega) = \begin{cases} 
  S_i/2B, & |\omega| \leq 2\pi B \\
  0, & \text{o.w.}
\end{cases}
\]

(a) Derive an expression for the output SNR \( \gamma = S_o/N_o \) as a function of \( W \).

(b) Derive an expression for the power of the signal distortion \( m(t) - h_d(t) \ast m(t) \) at the output of the LPF (Hint: the signal distortion has PSD \( |1 - H_d(\omega)|^2 S_m(\omega) \)).

(c) Find an expression for the output distortion as a function of \( \gamma \) (Hint: find \( W \) in terms of \( \gamma \) in the expression obtained in part (a) and plug into your expression for (b)). Plot this function for \( B = 15 \text{kHz} \).

3. Ex. 12.2-1, p 573

4. Ex. 12.2-2, p 573

5. Ex. 12.2-6, p 573