Electrical Engineering and Computer Science
Syracuse University

ELE 551, Fall 2010

Homework #6

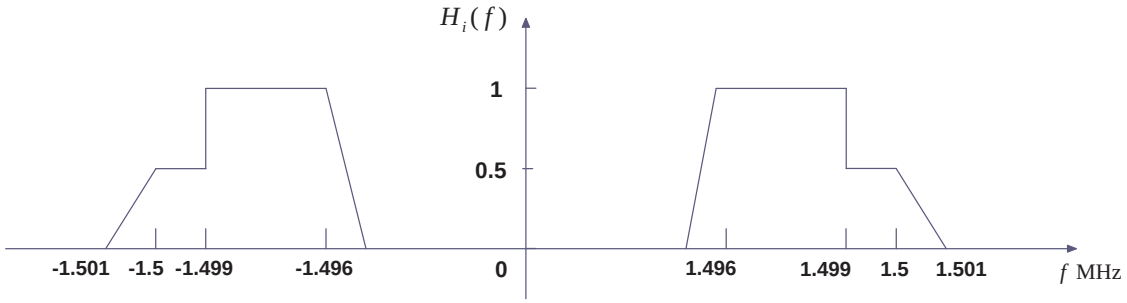
Due on **October 28, 2010, Thursday** In Class

1. [10 points] (L&D Exercise 4.5-2) Consider a VSB amplitude modulation system. The baseband signal is an audio signal of bandwidth 4 kHz. The carrier frequency is 1500 kHz. Suppose that the transmission vestigial filter $H_i(f)$ has a (symmetric) frequency response as shown in the following figure.

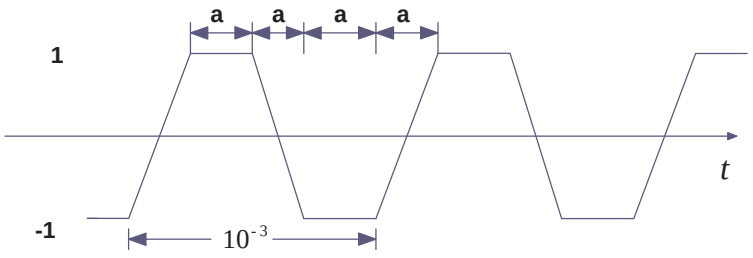
(a) Design and illustrate a receiver system block diagram.

(b) Find the bandwidth of this transmission.

(c) Describe and sketch the necessary low-pass filter response $H_0(f)$ for distortionless reception.



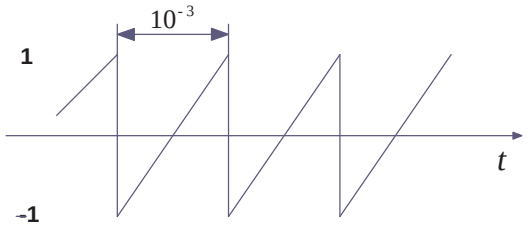
2. [10 points] (L&D Exercise 5.1-1) Sketch $\phi_{FM}(t)$ and $\phi_{PM}(t)$ for the modulating signal $m(t)$ shown in the following figure, given $w_c = 10^8$, $k_F = 10^5$, and $k_p = 25$.



3. [10 points] (L&D Exercise 5.1-2) A baseband signal $m(t)$ is the periodic sawtooth signal shown in the figure on the next page.

(a) Sketch $\phi_{FM}(t)$ and $\phi_{PM}(t)$ for this signal $m(t)$ if $w_c = 2\pi \times 10^6$, $k_F = 2000\pi$, and $k_p = \pi/2$.

(b) Show that this PM signal is equivalent to another PM signal modulated by a periodic rectangular message signal. Explain why it is necessary to use $k_p < \pi$ in this case. [Note that the PM signal has a constant frequency but has phase discontinuities corresponding to the discontinuities of $m(t)$.]



4. [10 points] (L&D Exercise 5.1-4) Over an interval $|t| \leq 1$, an angle-modulated signal is given by

$$\phi_{EM}(t) = 10 \cos 13,000\pi t$$

It is known that the carrier frequency $w_c = 10,000\pi$.

(a) Assuming a PM signal with $k_p = 1000$, determine $m(t)$ over the interval $|t| \leq 1$.

(b) Assuming an FM signal with $k_f = 1000$, determine $m(t)$ over the interval $|t| \leq 1$.