ELECTRICAL COMMUNICATION SYSTEMS

ECE 09433

Homework 2

Please write your name, your class session, and your lecturer's name on your solutions. Numbers are from the textbook.

Problem 1 Textbook number 4-2

An AM signal is modulated by a waveform such that the complex envelop is

$g(t)=A_c\{1+a[0.2\cos(\pi 250t)+0.5\ \sin(\pi 2500t)]$

Where A_c=10. Find the value of *a* such that the AM signal has a positive modulation percentage of 90%. Hint: Look at Ex.4-3 and Eq. (5-5a), you can use Matlab to find out the max and min.

Problem 2 Textbook number 5-5

A 50,000-W AM broadcast transmitter is being evaluated by means of a two-tone test. The transmitter is connected to a 50-Ω load, and $m(t)= A_1\cos\omega_1 t + A_1\cos 2\omega_1 t$, where $\omega_1=2\pi f_1$, f_1=500Hz. Assume that a perfect AM signal is generated.

(a) Evaluate the complex envelope for the AM signal in terms of A_1 and ω_1.

(b) Determine the value of A_1 for 90% modulation.

(c) Find the values for the peak current and average current into the 50-Ω load for the 90% modulation case (assume $\omega_c >> \omega_1$, where ω_c is the carrier frequency).

Problem 3 Textbook number 5-12

A DSB-SC signal can be generated from two AM signal as shown in Fig. 5-12. Using mathematics to describe signals at each point on the figure, prove that the output is a DSB-SC signal. (AM signal has complex envelope $A_c(1+m(t))$). (The positive input of the op amp is grounded)

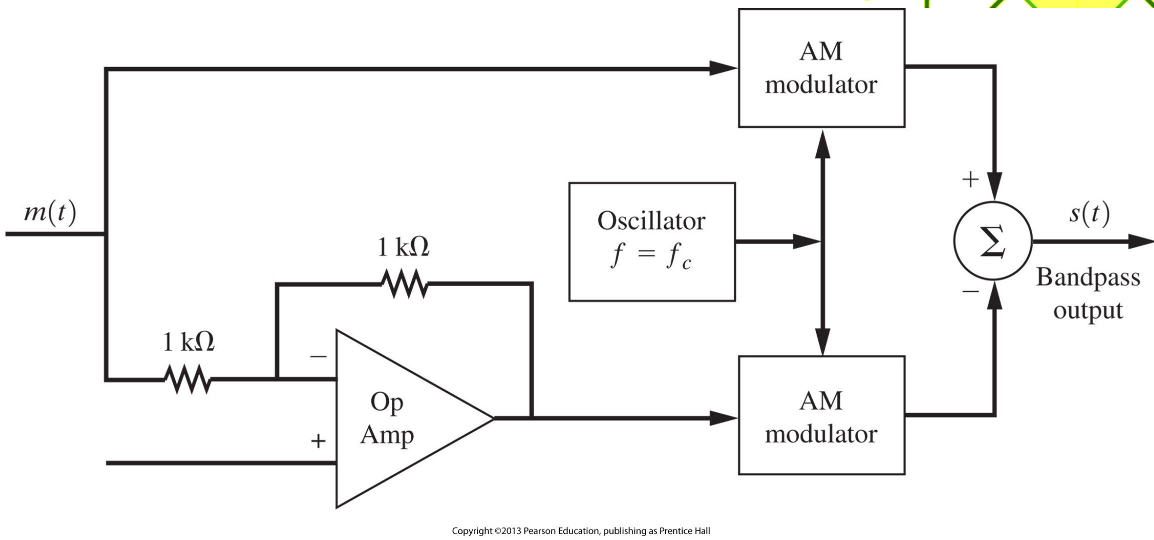

Fig. 5-12

Problem 4 Textbook number 5-13

Show that the complex envelope $g(t) = m(t) - j\hat{m}(t)$ produces a lower SSB signal, provided that m(t) is a real signal.

Problem 5 Textbook number 5-16

An SSB-AM transmitter is modulated with a sinusoid m(t)=5 $\cos\omega_1 t$, where $\omega_1=2\pi f_1$, f_1=500Hz, and A_c=1.

(a) Evaluate $\hat{m}(t)$

(b) Find the expression for a lower SSB signal

(c) Find the RMS value of the lower SSB signal

(d) Find the peak value of the lower SSB signal

(e) Find the normalized average power of the lower SSB signal

(f) Find the normalized PEP (peak envelope power) of the SSB signal