by

Analog & Digital Communication

$TL - 302$

Selected Exercises On Analog Modulation Schemes

ABD: EveryShipout initializing macros

Amplitude modulation schemes

1. The modulating signal.

$$m(t) = 2\cos 4000\pi t + 5\cos 6000\pi t$$

is multiplied by the carrier

$$c(t) = 100\cos 2\pi f_c t$$

where f_c=50 KHz.

Determine and sketch the spectrum of Standard DSB Amplitude modulation.

2. A message signal $m(t) = \cos 2000\pi t + 2\cos 4000\pi t$ modulates the carrier $c(t) = 100\cos 2\pi f_c t$, where f_c=1 MHz to produce DSB signal.

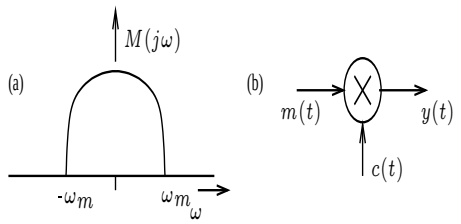
(a) Determine the set of frequencies present in the DSB AM signal.

(b) Determine and sketch the spectrum of the USB spectrum.

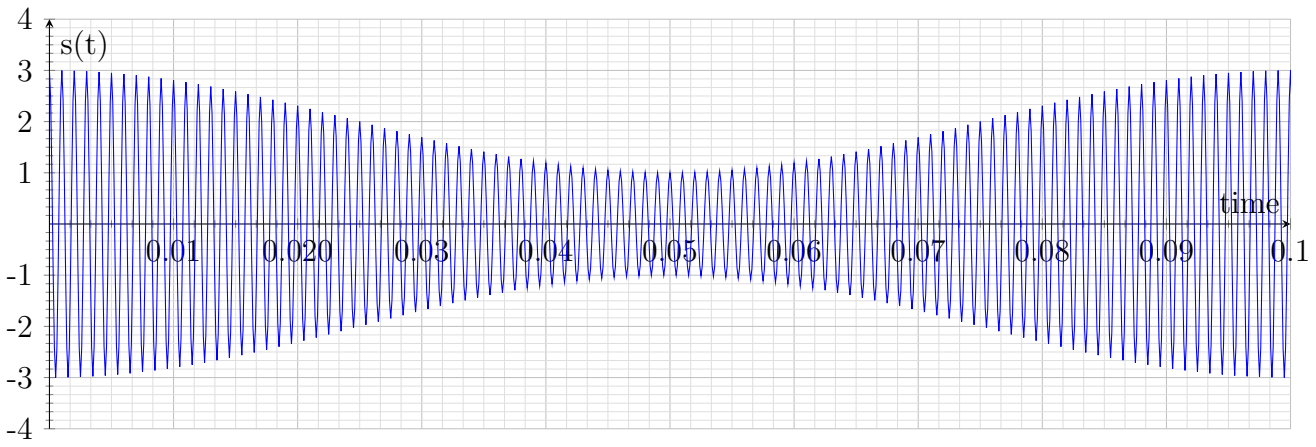
3. The message $m(t)$ has a Fourier transform illustrated below. This signal is applied to the system illustrated in figure (a) to generate signal $y(t)$.

(a) Plot the spectrum of $y(t)$ i.e. $Y(\omega)$.

(b) Show that if $y(t)$ is transmitted, the receiver can pass it through the same circuit in figure (b) to obtain $m(t)$ back.



4. Consider the following Amplitude Modulated waveform illustrated below:



(a) Determine the frequency of carrier and message signal.

(b) What is the modulation index of this scheme.

(c) Write the expression for modulated carrier $s(t)$.

5. A standard DSBAM system operates with modulation index of 75%. The total transmit power transmitter is 10kW. How much of it is in carrier and in the message?

6. A standard DSB-AM system operates 1MHz, a modulating sinusoid of frequency 2500 HZ is applied to carrier with a modulating index of 75%. The power occupied by carrier is 400 W.

(a) Calculate the frequencies of side bands and total bandwidth.

(b) The total power transmitted.

(c) Power in sidebands and efficiency of the system.

7. A sinusoidal modulating waveform of amplitude 5V and a frequency of 2KHz is applied to a FM generator with carrier amplitude 10 volts and frequency of 100 KHz, which has frequency sensitivity of 40 Hz/volt. Calculate the frequency deviation, modulation index and bandwidth.

(a) Write the expression of FM modulated waveform $s(t)$.

(b) Find the frequency deviation ΔF.

(c) Find the modulation index β.

(d) What is the BW of the FM signal.

8. An FM modulated waveform is given as $s(t) = 20\cos(8\pi \times 10^6 t + 9\sin(2\pi \times 10^3 t))$. Calculate frequency deviation, bandwidth and power of FM wave.