

EE411 Homework 7

1. (4.2-1) Given the baseband signal (i) $m(t) = \cos 1000\pi t$; (ii) $m(t) = e^{-10|t|}$. For each one, do the following:
 - (a) Sketch the spectrum of $m(t)$.
 - (b) Sketch the spectrum of the DSB-SC signal $m(t) \cos 10000\pi t$.
 - (c) Identify the upper sideband (USB) and the lower sideband (LSB) spectra.

2. (4.2-7) Two signals $m_1(t)$ and $m_2(t)$, both band-limited to 5000 Hz, are to be transmitted simultaneously over a channel by the multiplexing scheme shown in Fig. 1. The signal at point b is the multiplexed signal, which now modulates a carrier of frequency 20,000 Hz. The modulated signal at point c is transmitted over a channel.
 - (a) Sketch signal spectra at points a, b, and c.
 - (b) What must be the bandwidth of the distortionless channel?
 - (c) Design a receiver to recover signals $m_1(t)$ and $m_2(t)$ from the modulated signal at point c.

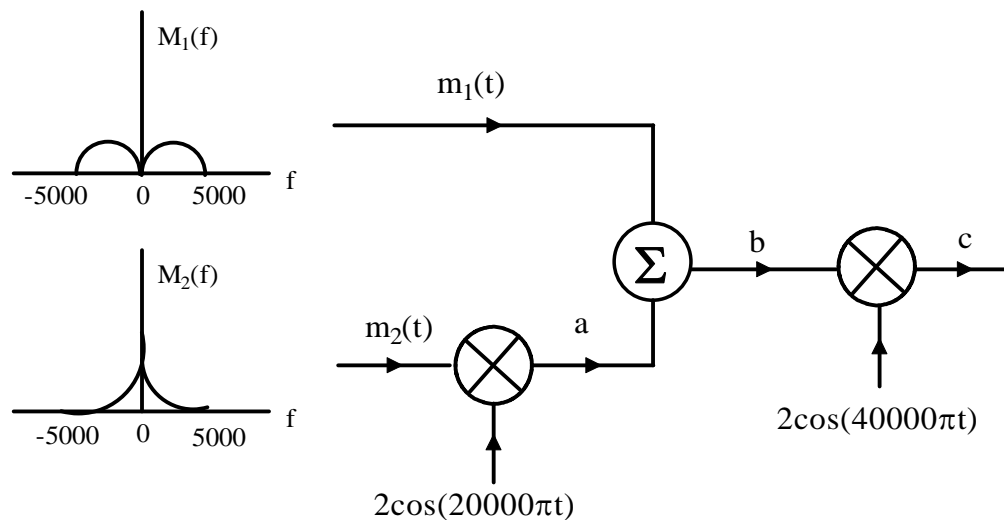


Fig. 1

3. (4.3-1) In an amplitude modulation system, the periodic message signal is given by Fig. 2 and the carrier frequency is 1 kHz. The modulator output is

$$S_{AM}(t) = 2[b + 0.5m(t)]\cos \omega_c t$$

- (a) Determine the average message power.
(b) If $b=1$, determine the modulation index and the modulation power efficiency.

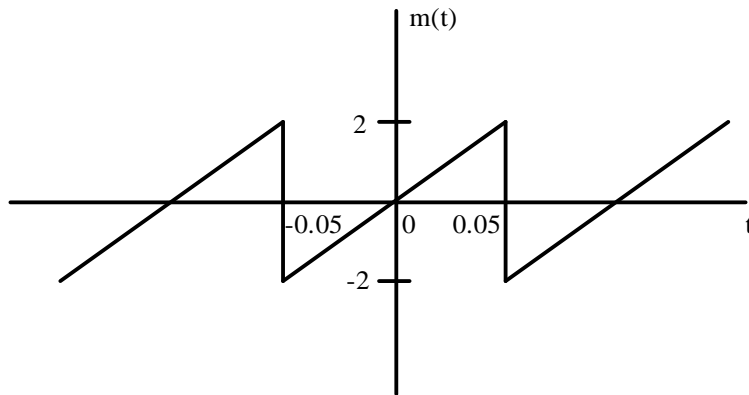


Fig. 2