Drill prob. # 3.2)

$$s_{AM}(t) = A_c[1 + K_a m(t)]\cos 2\pi f_c t$$

where $m(t) = A_m \cos 2\pi f_m t$ sinusoidal modulating wave

$$s_{AM}(t) = A_c[1 + K_a A_m \cos 2\pi f_m t]\cos 2\pi f_c t \qquad f_c \gg f_m$$

$$K_a A_m = 20\% = 0.2 \quad \Rightarrow$$

$$s_{AM}(t) = A_c[1 + \overset{\mu}{0.2}\cos 2\pi f_m t]\cos 2\pi f_c t$$

$$= A_c \cos 2\pi f_c t + A_c\mu \cos 2\pi f_c t \cos 2\pi f_m t$$

$$= \underbrace{A_c \cos 2\pi f_c t}_{\text{carrier}} + \frac{A_c\mu}{2}\left\{\underbrace{\cos[2\pi(f_c+f_m)t]}_{U.SB} + \underbrace{\cos[2\pi(f_c-f_m)t]}_{L.SB}\right\}$$

Thus: $P_c = \dfrac{A_c^2}{2}$

$$P_{USB} = P_{LSB} = \frac{\left(\frac{A_c\mu}{2}\right)^2}{2} = \frac{A_c^2\mu^2}{8} = \frac{A_c^2(0.2)^2}{8} = \frac{A_c^2}{200}$$

$$= P_c \times 10^{-2}$$

That is carrier has 98% of total power and each sideband has 1% the total power.

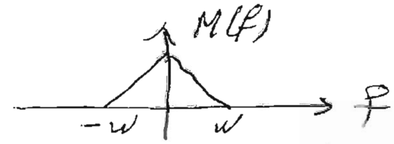
Drill prob. # 3.4)

a) $v_1(t) = A_c \cos 2\pi f_c t + m(t)$ (1)

$v_2(t) = a_1 v_1(t) + a_2 v_1^2(t)$ (2)

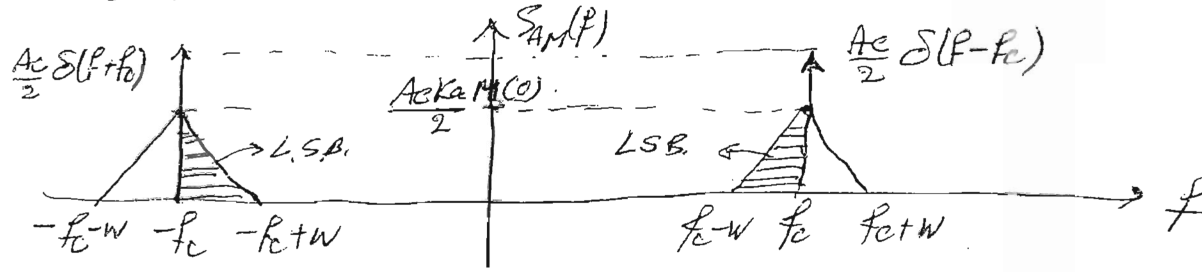
$$\Rightarrow v_2(t) = a_1\left(A_c \cos 2\pi f_c t + m(t)\right) + a_2\left(A_c \cos 2\pi f_c t + m(t)\right)^2$$

Hill prob. # 3.3) Assume



In general $s_{AM}(t) = A_c[1 + K_a m(t)] \cos 2\pi f_c t$

$$S_{AM}(f) = \frac{A_c}{2}[\delta(f-f_c) + \delta(f+f_c)] + \frac{A_c K_a}{2}[M(f-f_c) + M(f+f_c)]$$



From the plot of $S_{AM}(f)$ we see that to avoid the overlapping of L.S.B frequencies it must

$f_c - W > 0 \Rightarrow f_c > W$

3.18)

Given:

$m(t) = 20\cos(2\pi t)$ volts

$c(t) = 50\cos(100\pi t)$ volts

$\mu = A_m K_a = 75\% = 0.75$

$R = 100\ \Omega$

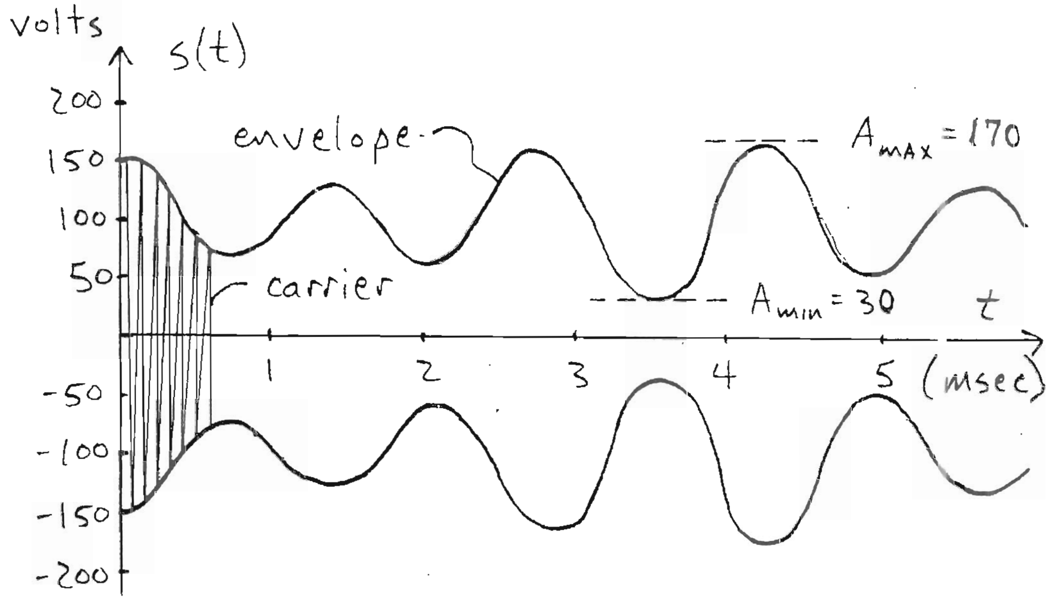
b) $s_{AM}(t) = A_c[1 + K_a m(t)]\cos 2\pi f_c t = 50[1 + \underbrace{K_a \cdot 20}_{\mu} \cos 2\pi t] \cos 100\pi t$

$= 50\cos(100\pi t) + 50 \times 0.75 \cos(100\pi t)\cos(2\pi t)$

$= 50\cos(100\pi t) + \frac{37.5}{2}\{\cos(102\pi t) + \cos(98\pi t)\}$

$P_{tot} = \frac{(50)^2}{2R} + 2 \times \frac{\left(\frac{37.5}{2}\right)^2}{2R} = \frac{2500}{200} + \frac{1406.25}{400} = 16.0156$ watts

5-2. (a.) Cont'd



(b.) $\frac{170 - 30}{2(100)}(100) = \underline{\underline{70\ \%}}$ modulation

(c.) $G(f) = \delta(f) + M(f)$

$$= \delta(f) - j\frac{(0.2)}{2}\left[\delta(f-f_1) - \delta(f+f_1)\right] + \frac{(0.5)}{2}\left[\delta(f-f_2) + \delta(f+f_2)\right]$$

$$S(f) = \frac{A_c}{2}\left[G(f-f_c) + G^*(-f-f_c)\right]$$