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1. a)

$$P_{AM} = \frac{1}{2} | A_c [1 + c \cdot \cancel{m(t)}^{0}] |^2 \cdot \frac{1}{R_L}$$

$$= \frac{A_c^2}{2R_L} = 15 kW$$

$$\Rightarrow \frac{A_c^2}{2 \cdot 75} = 15 kW \rightarrow A_c = \sqrt{30 \cdot 75 \cdot k} = 1500 V$$

b)

Analisando o sinal modulado

$$s(t) = A_c [1 + c \cdot m(t)] \cdot \cos(w_c t)$$

temos que a amplitude máxima é dada quando $\max[m(t)] = \max[\cos(w_c t)] = 1$. Assim:

$$\max[s(t)] = \max\{A_c [1 + m(t)] \cos(w_c t)\}$$

$$= A_c \{[1 + 1] \cdot 1\} = 2 A_c$$

$$= 2 \cdot 1500 = 3000 V$$

A potência de pico da envoltória complexa é calculada por:

$$P_{PEP}^{AM} = \frac{A_c^2}{2 \cdot R_L} \{1 + \max[m(t)]\}^2$$

$$= \frac{1500^2}{2 \cdot 75} \cdot \{1 + 1\}^2 = \frac{1500^2}{150} \cdot 4$$

$$= 60.000 W$$

c) $\bar{P}_{AM} = \frac{\langle s^2(t)\rangle}{R_L} = \frac{1}{R_L}\left[\frac{A_c^2}{2} + \frac{A_c^2}{2}\langle m(t)^2\rangle\right]$

$= \frac{A_c^2}{2R_L}\left[1 + \langle \cancelto{0,5}{m(t)^2}\rangle\right] = \frac{1500^2}{2\cdot 75}\left[1+0,5\right]$

$= 22\,500\ W$ //

d)

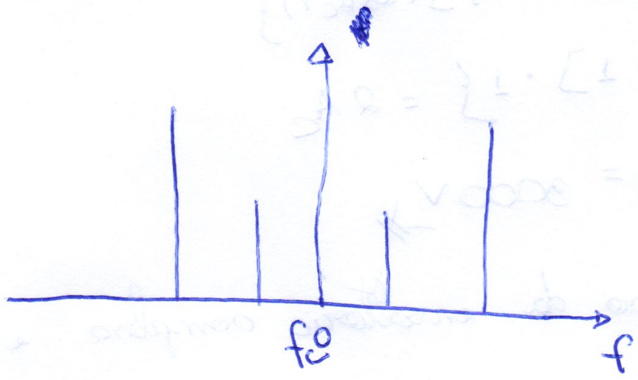
$\eta_{AM}^{mod} = \frac{\langle m(t)^2\rangle}{1+\langle m(t)^2\rangle}\cdot 100 = \frac{0,5}{1,5}\cdot 100 = 33,33\ \%$

2.a)

$s(t) = A_c \cdot m(t) \cdot \cos(w_c t)$

$= 2\cdot\left[\cos(1000\pi t) + 2\cos(2000\pi t)\right]\cos(w_c t)$ //

b)



c) A potência média normalizada é dada por:

$\bar{P}_{AM} = E[s^2(t)] = \langle [A_c\, m(t)\cos(w_c t)]^2\rangle$

$= \frac{A_c^2}{2}\langle m^2(t)\rangle$

onde

$$m^2(t) = (\cos(w_1 t) + 2\cos(2w_1 t))^2$$

$$= \cos^2(w_1 t) + 4\cos(w_1 t)\cdot\cos(2w_1 t) + 4\cos^2(2w_1 t)$$

logo,

$$\bar{P}_{AM} = \frac{A_c^2}{2}\langle \cos^2(w_1 t) + 4\cos(w_1 t)\cdot\cos(2w_1 t) + 4\cos^2(2w_1 t)\rangle$$

$$= \frac{A_c^2}{2}\left(\frac{1}{2} + \frac{4}{2}\right) = \frac{2^2}{2}\cdot\frac{5}{2} = 5\,w$$

d) $P_{PEP} = \frac{1}{2}[\max|A_c\, m(t)|]^2$

analisando $m(t)$

$$m(t) = \cos(w_1 t) + 2\cos(2w_1 t)$$

A amplitude de pico se dá quando $\cos(w_1 t) = \cos(2w_1 t) = 1$.

Assim.

$$\max[m(t)] = 1 + 2 = 3$$

Portanto,

$$P_{PEP} = \frac{A_c^2}{2}[3]^2 = \frac{(2)^2\cdot(3)^2}{2} = 18\,w$$

3. A transformada de Hilbert de $m(t)$ implica em uma defasagem de -90° para todas as componentes da frequência e $+90^\circ$ para as frequência negativas.

b)

$$s(t) = A_c\left[m(t)\cos(w_c t) \mp \hat{m}(t)\,\text{sen}(w_c t)\right]$$

$$= 1\left[5\cos(1000\pi t)\cos(2\pi f_c t) + 5\,\text{sen}(1000\pi t)\,\text{sen}(2\pi f_c t)\right]$$

c) $P_{RMS} = \sqrt{\langle s(t)^2\rangle}$

$$\langle s^2(t)\rangle = \langle A_c^2\left[25\cos^2(1000\pi t)\,\text{sen}^2(2\pi f_c t) + 25\,\text{sen}^2(1000\pi t)\,\text{sen}^2(2\pi f_c t)^2 + 50\cos(1000\pi t)\,\text{sen}(1000\pi t)\cos(2\pi f_c t)\,\text{sen}(2\pi f_c t)\right]\rangle$$

$$= A_c^2\left[25\cdot\frac{1}{2}\cdot\frac{1}{2} + 25\cdot\frac{1}{2}\cdot\frac{1}{2} + 50\cdot 0\right]$$

$$= \frac{A_c^2\cdot 25}{2} = 12{,}5\ W$$

Portanto,

$$P_{RMS} = \sqrt{12{,}5} = 3{,}535\ W$$

d)

$$\bar{P}_{AM} = \langle s^2(t)\rangle = 12{,}5\ W$$

e) $P_{PEP} = \frac{A_c^2}{2}\max\left[m^2(t) + \hat{m}^2(t)\right]$

- $m^2(t) = 25\cos^2(1000\pi t)$
- $\hat{m}^2(t) = 25\,\text{sen}^2(1000\pi t)$

$$P_{PEP} = \frac{A_c^2}{2}\left[25\cos^2(1000\pi t) + 25\,\text{sen}^2(1000\pi t)\right]$$

$$= \frac{1}{2}[25] = 12{,}5\ W$$