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2017218007 文华 物联网17-2

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5-1. 解:

(1) 未调载波: $A \cos \omega_c t = 100 \cos(10^5 \pi t)$

$$m = \frac{A_m}{A} = \frac{60}{100} = 0.6 \Rightarrow$$

$$m(t) = A_m \cos(2\pi f_m t) = 60 \cos(2\pi \times 10^3 t)$$

$$\therefore S_{AM} = [1 + m \cos(2\pi \times 10^3 t)] A \cos(10^5 \pi t)$$

~~$$= 60 \cos(2\pi \times 10^3 t)$$~~

$$= [100 + 60 \cos(2\pi \times 10^3 t)] \cos(10^5 \pi t)$$

(2)

$$\text{载波: } P_c = \frac{A^2}{2R} = \frac{100^2}{2 \times 10} = 100 \text{ (W)}$$

$$\text{上下边带: } P_{USB} = P_{LSB} = \frac{(\frac{m}{2})^2}{2R} = \frac{m^2}{4} P_c = 9 \text{ (W)}$$

$$\text{总: } P_s = P_{USB} + P_{LSB} = 18 \text{ (W)}$$

$$\text{AM信号总功率: } P_{AM} = P_c + P_s = 118 \text{ (W)}$$

$$(3) \eta_{AM} = \frac{m^2}{2 + m^2} = \frac{9}{59}$$

$$(4) P_{AM} = P_c + P_s = (1 + \frac{m^2}{2}) P_c = 100 \text{ (W)}$$

5-2. 解:

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$$(1) S_1(t) \leftrightarrow S_1(\omega)$$

$$\cos \omega_c t \leftrightarrow \pi [\delta(\omega - \omega_c) + \delta(\omega + \omega_c)]$$

$$S_1(\omega) = \frac{\pi}{2} [\delta(\omega + 7\Omega) + \delta(\omega - 5\Omega) + \delta(\omega - 5\Omega) + \delta(\omega - 7\Omega)]$$

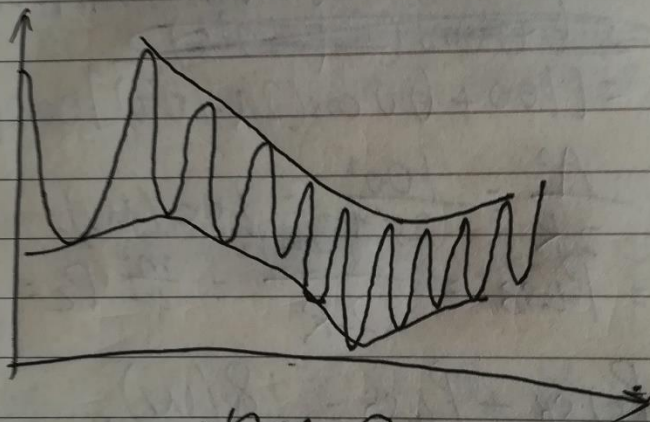
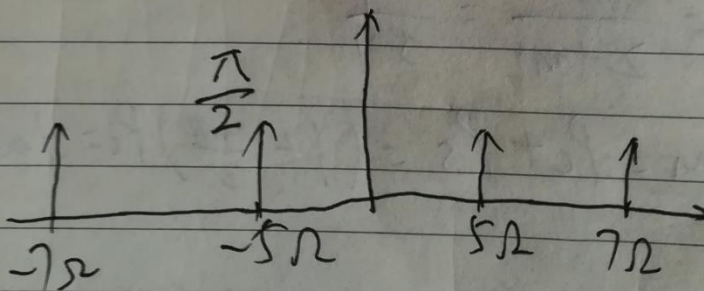


Figure 13



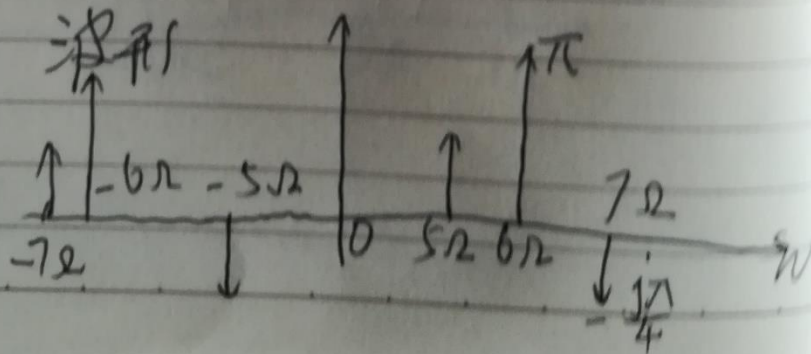
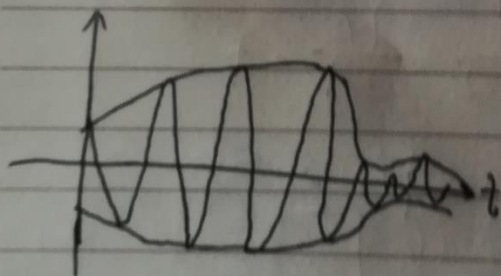
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$$(2) S_2(t) \leftrightarrow S_2(\omega)$$

$$S_2(\omega) = \pi [\delta(\omega + 6\Omega) + \delta(\omega - 6\Omega)] +$$

$$\frac{j\pi}{4} [\delta(\omega + 7\Omega) - \delta(\omega - 7\Omega) + \delta(\omega - 5\Omega) - \delta(\omega + 5\Omega)]$$



$$S_1(t) = \cos \Omega t \cos \omega_c t$$

$$\cos \Omega t \cos \omega_c t$$

5-8. 解:

$$(1) f_H = 5 \text{ kHz}, B = 2f_H = 10 \text{ kHz}$$

$$f_{\text{BW}} = 100 \text{ kHz}$$

$$(2) S_T = 60 \text{ dB} = 10^6, \alpha = 70 \text{ dB} = 10^7$$

$$S_i = \frac{S_T}{\alpha} = 10^{-1} (\text{W})$$

$$N_i = 2 P_n(f) \cdot B = 10^{-9} (\text{W})$$

$$\frac{S_i}{N_i} = 1000$$

$$(3) \frac{S_o}{N_o} = G_{\text{DSB}} \frac{S_i}{N_i} = 2 \times 1000 = 2000$$

$$(4) N_o = \frac{1}{4} N_i = 2.5 \times 10^{-5} (\text{W})$$

$$P_{n0}(f) = \frac{N_o}{2f_H} = 2.5 \times 10^{-9} (\text{W/Hz})$$

$$|f| \leq 5 \text{ kHz}$$

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5-15 解:

$$(1) \omega(t) = 2\pi f(t) = 2\pi \cdot 10^6 + 2\pi \cdot 10^3 \cos 2\pi \cdot 10^3 t$$

$$\theta(t) = \int_{-\infty}^t \omega(z) dz = 2\pi \cdot 10^6 t + 108 \sin 2\pi \cdot 10^3 t$$

$$\therefore S_{FM}(t) = A \cos \theta(t) =$$

$$= 10 \cos(2\pi \cdot 10^6 t + 108 \sin 2\pi \cdot 10^3 t)$$

$$(2) \Delta f = |10^6 \cos 2\pi \cdot 10^3 t|_{\max} = 10 \text{ kHz}$$

$$m_f = \frac{\Delta f}{f_m} = 10$$

$$B = 2(\Delta f + m) = 22 \text{ kHz}$$

(3) $f_m: 10^3 \text{ Hz} \rightarrow 2 \times 10^3 \text{ Hz}$, 频率加倍, 调制信号无变, \therefore

$$\Delta f = 10 \text{ kHz}$$

$$m_f = \frac{\Delta f}{f_m} = \frac{10^4}{2 \times 10^3} = 5$$

$$\Rightarrow B = 2(\Delta f + m) = 24 \text{ kHz}$$

(4) 变为原来的两倍.