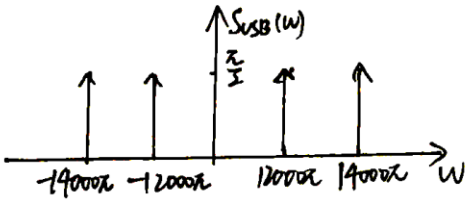
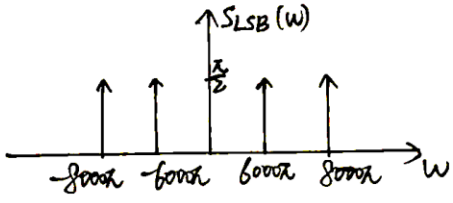
第 5 章作业

5-4. $S_{USB}(w)=\frac{\pi}{2}[\delta(w+12000\pi)+\delta(w-12000\pi)+\delta(w+14000\pi)+\delta(w-14000\pi)]$

$S_{LSB}(w)=\frac{\pi}{2}[\delta(w+8000\pi)+\delta(w-8000\pi)+\delta(w+6000\pi)+\delta(w-6000\pi)]$





5-11 (1) $S_T = 2000W$

(2) $S_T = 4000W$

5-13. (1) $\frac{S_i}{N_i} = 5000$

(2) $\frac{S_o}{N_o} = 2000$

(3) $G = 0.4$

5-4 解：$m(t)=\cos(2000\pi t)+\cos(4000\pi t)$

$\hat{m}(t)=\sin(2000\pi t)+\sin(4000\pi t)$

上边带信号：$S_{USB}(t)=\frac{1}{2}m(t)\cos\omega_c t-\frac{1}{2}\hat{m}(t)\sin\omega_c t$

$=\frac{1}{2}\cos 10^4\pi t(\cos 2000\pi t+\cos 4000\pi t)-\frac{1}{2}\sin 10^4\pi t(\sin 2000\pi t+\sin 4000\pi t)$

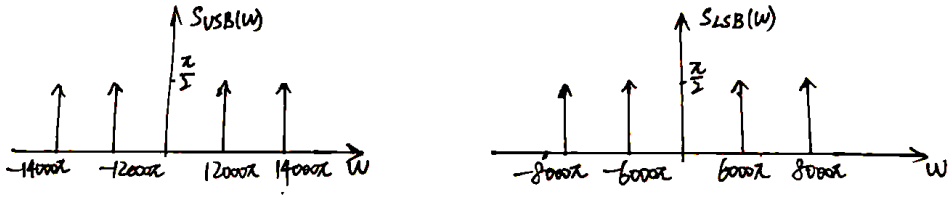
$=\frac{1}{2}\cos(12000\pi t)+\frac{1}{2}\cos(14000\pi t)$

$S_{USB}(\omega)=\frac{\pi}{2}[\delta(\omega+12000\pi)+\delta(\omega-12000\pi)+\delta(\omega+14000\pi)+\delta(\omega-14000\pi)]$

下边带信号：$S_{LSB}(t)=\frac{1}{2}m(t)\cos\omega_c t+\frac{1}{2}\hat{m}(t)\sin\omega_c t$

$=\frac{1}{2}\cos(8000\pi t)+\frac{1}{2}\cos(6000\pi t)$

$S_{LSB}(\omega)=\frac{\pi}{2}[\delta(\omega+8000\pi)+\delta(\omega-8000\pi)+\delta(\omega+6000\pi)+\delta(\omega-6000\pi)]$



5-11 解：(1) 由题知 $\frac{S_o}{N_o}=20dB=100$ $N_o=10^{-9}W$

DSB 制度增益 $G=2$

$\frac{S_i}{N_i}=\frac{1}{2}\frac{S_o}{N_o}=50$

相干解调时 $N_i=4N_o$

∴ 解调器输入端信号功率 $S_i=50N_i=200N_o=2\times10^{-7}W$

发射机输出功率 $S_T=10^{10}S_i=2\times10^3W$

(2) $G_{SSB}=1$ $N_i=4N_o$

∴ $\frac{S_i}{N_i}=\frac{S_o}{N_o}=100$

$S_i=100N_i=400N_o=4\times10^{-7}W$

$S_T=10^{10}\cdot S_i=4000W$

5-13 解：(1) 解调器输入端信号功率：$S_i = P_c + P_s = 4+1 = 5W$

输入噪声功率：$N_i = P_n(f) \cdot B = 10^{-7} \times 2 \times 5000 = 10^{-3}W$

输入信噪比：$\frac{S_i}{N_i} = 5000$

(2) 大信噪比 $A+m(t) \gg n_i(t)$ 时

理想包络检波输出 $E(t) = A + m(t) + n_c(t)$

输出信号功率 $S_o = \overline{m^2(t)} = 2P_s = 2W$

噪声功率 $N_o = \overline{n_c^2(t)} = N_i = 10^{-3}W$

输出信噪比 $\frac{S_o}{N_o} = 2000$

(3) $G = \frac{\frac{S_o}{N_o}}{\frac{S_i}{N_i}} = \frac{2000}{5000} = \frac{2}{5}$