8.4 解: $x(t)=\sin 200\pi t+2\sin 400\pi t$ $g(t)=(\sin 200\pi t+2\sin 400\pi t)\sin 400\pi t$

$X(j\omega)=\pi j(\delta(\omega+200\pi)-\delta(\omega-200\pi))+2\pi j(\delta(\omega+400\pi)-\delta(\omega-400\pi))$

$y(t)=x(t)\cdot\sin^2 400\pi t=\frac{1}{2}x(t)\cdot(1-\cos 800\pi t)=\frac{1}{2}x(t)-\frac{1}{2}x(t)\cos 800\pi t$

$Y(j\omega)=\frac{1}{2}X(j\omega)-\frac{1}{2}X(j\omega)*\pi[\delta(\omega-800\pi)+\delta(\omega+800\pi)]$ 由于带限于400π

$\therefore y(t)=\sin 200\pi t+2\sin 400\pi t$

8.9 解: (a) ∵ $y_1(t)=x_p(t)*\sin\omega_c t$ $x_p(t)$截止于ω_c ω_c的频谱只在$2\omega_c$处

相乘后 $y_1(t)$的频谱截止于$2\omega_c$ ∴当$\omega>2\omega_c$时 $Y(j\omega)=0$

(b) 从$y_1(t)$中恢复$x_1(t)$时，应先滤除$x_2(t)$的部分 则$\omega_0=\omega_c$

$\cos\omega_c t$、$\sin\omega_c t$频谱幅度为$\frac{1}{2}$ 乘以$\cos\omega_c t$后频率幅度又降为原来的$\frac{1}{2}$

故A=4. 才能彻底恢复

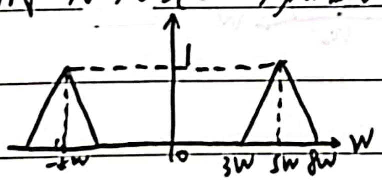
8.21 解: (a) $y(t)=\cos(\omega_c t+\theta_c)\cdot x(t)$

$w(t)=\cos(\omega_c t+\theta_c)\cdot y(t)=x(t)\cdot\cos^2(\omega_c t+\theta_c)$

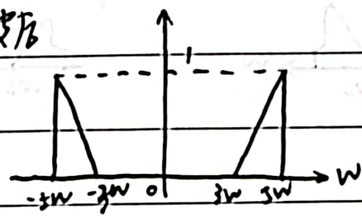
$=\frac{1}{2}(1+\cos 2(\omega_c t+\theta_c))\cdot x(t)$ 得证

(b) 由于不能发生混叠 故 $\omega_M<\omega_{co}<(2\omega_c-\omega_M)$ 和θ_c无关

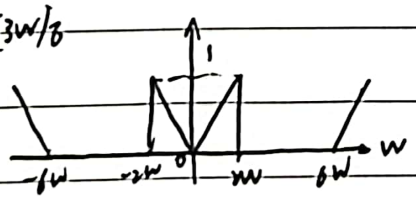
8.22 解: $x(t)\cdot\cos(5\omega t)$频谱为



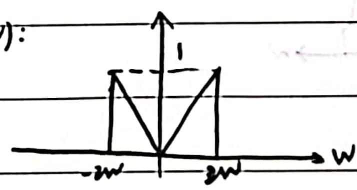
滤波后



过3w后



$Y(j\omega)$:



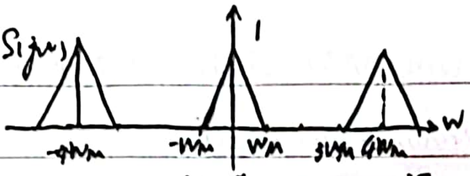
8.12 解: $\omega>2\omega_M$ 即 $\frac{2\pi}{T}>400\pi$ ⇒ $T_{max}=0.5\times10^{-3}s$

∴要传10路信号 故 $\Delta\le0.5\times10^{-4}s$

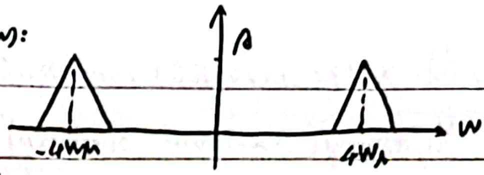
8.24 解: $\omega_M=\frac{\pi}{2T}$. $\omega_s=\frac{2\pi}{T}=4\omega_M$ 时域$x(t)\cdot s(t)$对应于频域$X(j\omega)*S(j\omega)$

$\omega_L=2\omega_M$ $\omega_h=6\omega_M$ $\omega_c=4\omega_M$

频谱如下，$X(jw)*S(jw)$



$Y(jw)$:



$X(jw)*F(\cos W_c t)$ 的频谱和 $Y(jw)$ 最多相差一个常数

$\therefore y(t) \propto x(t)\cos W_c t$

(b) 类似地 $W_c = 2W_m$ $W_n = 6W_m$ 将 $X(jw)*S(jw)$ 为

$$W(jw) = \frac{1}{2\pi}[X(jw)*S(jw)] = \frac{1}{T}\sum_{k=-\infty}^{+\infty} e^{-j\frac{2k\pi}{T}\Delta} X(j(w-2\pi\frac{k}{T}))$$

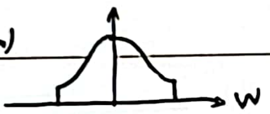
$$Y(jw) = \frac{AW_c}{2\pi} e^{-j\frac{2\pi}{T}\Delta} X(j(w-\frac{2\pi}{T})) + \frac{AW_c}{2\pi} e^{j\frac{2\pi}{T}\Delta} X(j(w+\frac{2\pi}{T}))$$

故 $y(t) = \frac{AW_c}{2\pi} x(t)\cdot\cos(\frac{2\pi}{T}t - \frac{2\pi}{T}\Delta)$

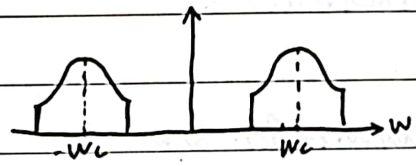
$\therefore W_c = \frac{2\pi}{T}$. $\theta_c = \frac{-2\pi}{T}\Delta$

(c) W_m 最大为 $\frac{\pi}{T}$.

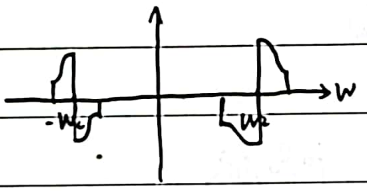
8.28 (a) 令 $X(jw)$



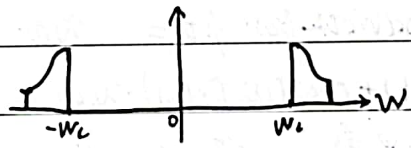
$Y_1(jw)$:



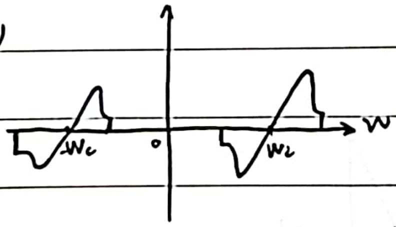
$Y_2(jw)$



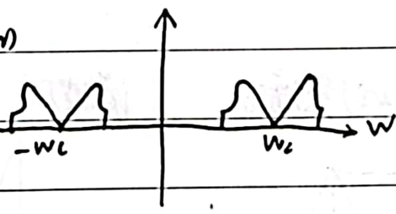
$Y(jw)$



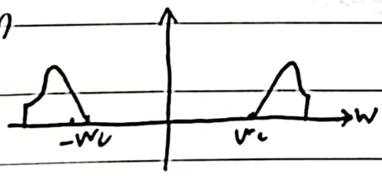
(b) $Y_1(jw)$



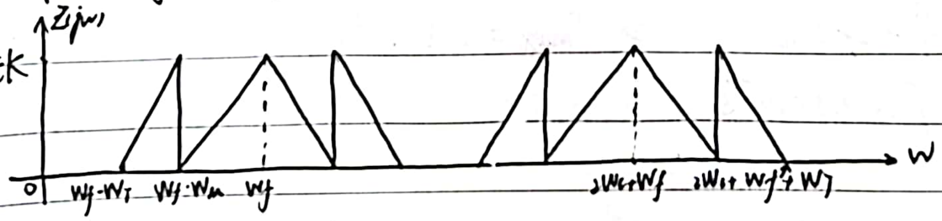
$Y_2(jw)$



$Y(jw)$



8.36 解：(a) $Z(jw)$ 如图

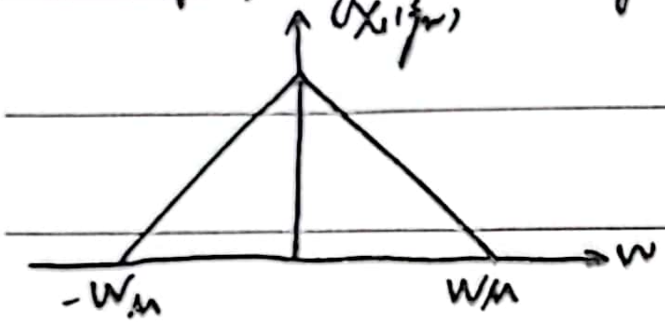


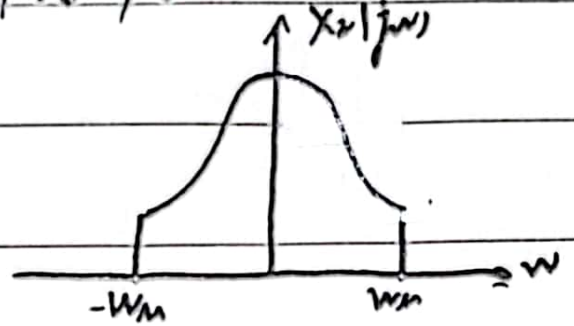
(b) $2W_c + W_f - W_1 > W_f + W_m \Rightarrow W_1 < 2W_c - W_m$

(c) $y(t) = x_1(t)\cos W_c$. 则 $X(jw)$ 在 $W=W_f$ 不能混叠 $\Rightarrow G = \frac{2}{K}$ $\alpha = W_f - W_m$

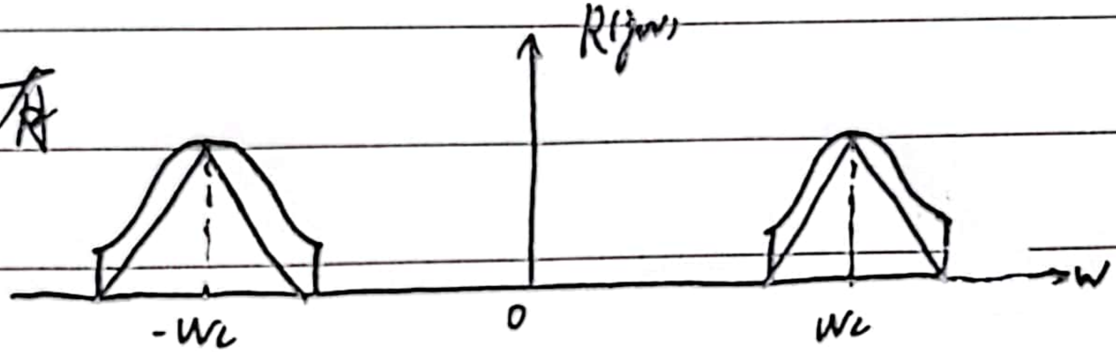
$\beta = W_f + W_m$

8.40. 解：令 $X_1(j\omega)$ 和 $X_2(j\omega)$ 如图所示





则 $R(j\omega)$ 有



$r(t)\cdot\cos w_c t \Rightarrow \frac{1}{2}\{\frac{1}{2}X_1(j\omega)+\frac{1}{2}jX_2(j\omega)+\frac{1}{2}X_1(j\omega)-\frac{1}{2}jX_2(j\omega)\}=\frac{1}{2}X_1(j\omega)$

$r(t)\cdot\sin w_c t \Rightarrow \frac{1}{2}\{[\frac{1}{2}X_1(j\omega)+\frac{1}{2}jX_2(j\omega)]\cdot(-j)+j[\frac{1}{2}X_1(j\omega)-\frac{1}{2}jX_2(j\omega)]\}=\frac{1}{2}X_2(j\omega)$

得证