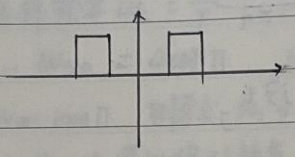
周子涵 2018011218014

第6章： 5、23、27.

5、$H(j\omega)=\begin{cases}1, & \omega_c \le |\omega| \le 3\omega_c \\ 0, & \text{otherwise.}\end{cases}$

(a). $h(t)=\left(\frac{\sin \omega_c t}{\pi t}\right) g(t)$

$\frac{\sin \omega_c t}{\pi t}$ 的 fourier transform 为 $X(j\omega)=\begin{cases}1, & |\omega| < \omega_c \\ 0, & \text{otherwise.}\end{cases}$



$H(j\omega)=H(j(\omega-2\omega_c))+H(j(\omega+2\omega_c))$

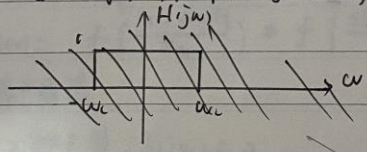
$\therefore h(t)=\frac{\sin \omega_c t}{\pi t}\cdot e^{j2\omega_c t}+\frac{\sin \omega_c t}{\pi t} e^{-j2\omega_c t}$

$\therefore g(t)=e^{j2\omega_c t}+e^{-j2\omega_c t}$

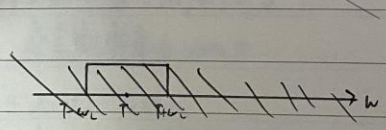
$\therefore g(t)=2\cos 2\omega_c t.$

(b). ω_c 增加时，单位冲激响应更向原点集中.

23、(a)



(b)



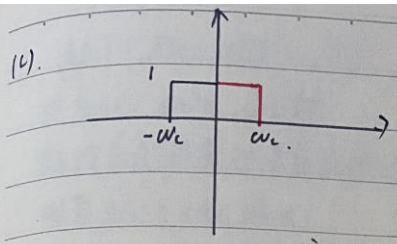
(a) $H_1(j\omega)=\begin{cases}1, & |\omega| \le \omega_c \\ 0, & \text{otherwise.}\end{cases}$ $\therefore h_1(t)=\frac{\sin \omega_c t}{\pi t}$

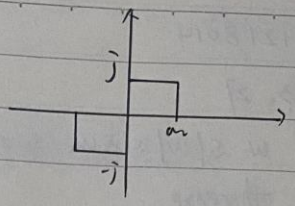
(b) $H_2(j\omega)=|H_1(j\omega)|e^{j\omega T}$

$=H(j\omega)e^{j\omega T}$

$\therefore h_2(t)=\frac{\sin[\omega_c(t+T)]}{\pi(t+T)}$

(c).





$H(j\omega) = |H(j\omega)| \cdot e^{j \angle H(j\omega)}$

设 $X(j\omega) = \begin{cases} 1 & , |\omega| < \frac{\omega_c}{2} \\ 0 & , \text{otherwise} \end{cases}$ $\quad x(t) = \frac{\sin \frac{\omega_c}{2} t}{\pi t}$

$\therefore h(t) = \frac{\sin \frac{\omega_c}{2} t}{\pi t} \left(e^{j\frac{\omega_c}{2} t} + e^{-j\frac{\omega_c}{2} t} \right)$

$= \frac{\sin \frac{\omega_c}{2} t}{\pi t} \cdot \left(2 \cos \frac{\omega_c}{2} t \right)$

$= \frac{\sin \omega_c t}{\pi t}$

2]. (a) $\frac{dy(t)}{dt} + 2y(t) = x(t)$

$\therefore H(j\omega) = \frac{1}{2+j\omega}$.

$\angle H(j\omega) = -\arctan \frac{\omega}{2}$.

(b) $\tau(\omega) = (\angle H(j\omega))' = \frac{2}{4+\omega^2}$.

(c) $Y(j\omega) = H(j\omega) X(j\omega)$

$= \frac{1}{(1+j\omega)(2+j\omega)}$

(d) $Y(j\omega) = \frac{1}{1+j\omega} - \frac{1}{2+j\omega}$

$\therefore y(t) = (e^{-t} - e^{-2t}) u(t)$

(e) (i) $Y(j\omega) = \frac{(1+j\omega)}{(2+j\omega)^2}$

$Y(j\omega) = \frac{1}{2+j\omega} - \frac{1}{(2+j\omega)^2}$

$\therefore y(t) = e^{-2t} u(t) - t e^{-2t} u(t)$

(ii) $Y(j\omega) = \frac{1}{1+j\omega}$

$y(t) = e^{-t} u(t)$

(iii) $Y(j\omega) = \frac{1}{(2+j\omega)^2 (1+j\omega)}$

$Y(j\omega) = \frac{-1}{2+j\omega} + \frac{-1}{(2+j\omega)^2} + \frac{1}{1+j\omega}$

$\therefore y(t) = -e^{-2t} u(t) - t e^{-2t} u(t) + e^{-t} u(t)$

SHOWYOURWAY

第1章 1、2、3、6、9.

1、 $\omega_s = 10000\pi$.

$10000\pi > 2\omega_m$

$\omega_m < 5000\pi$

∴ $X(j\omega)$ 在 $\omega \geq 5000\pi$ 时保证为0.

2、 $\omega_c = 1000\pi$

采样频率 $\omega_s = \frac{2\pi}{T}$

∴ $\omega_{sa} = 4000\pi$ $\omega_{sb} = 1000\pi$ $\omega_{sc} = 20000\pi$.

$\omega_m = 1000\pi$ 利奈求 $\omega_s > 2000\pi$

∴ a, c 可以得到恢复.

3、(a). $|\omega| > 4000\pi$ 时, $X(j\omega) = 0$

∴ 奈奎斯特率为 8000π.

(b) $|\omega| > 4000\pi$ 时, $X(j\omega) = 0$

∴ 奈奎斯特率为 8000π.

(c) $x(t) = \left(\frac{\sin 4000\pi t}{\pi t}\right)\left(\frac{\sin 4000\pi t}{\pi t}\right)$

∴ $X(j\omega) = \mathcal{F}\left\{\frac{\sin 4000\pi t}{\pi t}\right\} * \mathcal{F}\left\{\frac{\sin 4000\pi t}{\pi t}\right\}$,

为三角波

$|\omega| > 8000\pi$ 时, $X(j\omega) = 0$

∴ 奈奎斯特率为 16000π

6、 $W(t) = X_1(t) \cdot X_2(t)$

$W(j\omega) = \frac{1}{2\pi} X_1(j\omega) * X_2(j\omega)$

$|\omega| > \omega_1 + \omega_2$ 时

$W(j\omega) = 0$.

∴ $\omega_s = 2(\omega_1 + \omega_2)$

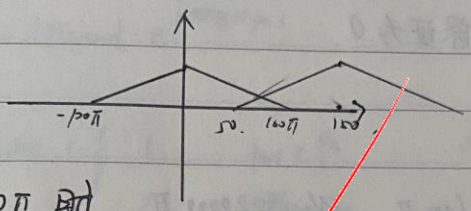
∴ $T_{max} = \frac{\pi}{\omega_1 + \omega_2}$.

9. $x(t)=\left(\frac{\sin 50\pi t}{\pi t}\right)^2$.

$|\omega|>100\pi$ 时, $X(j\omega)=0$.

$G(j\omega)=\frac{1}{T}\sum_{k=-\infty}^{+\infty} X(j(\omega-k\omega_s))$

$T=\frac{2\pi}{\omega_s}=\frac{1}{75}$



$\therefore \omega_s=50\pi$ 时

可确保 $G(j\omega)=75\,X(j\omega)$

第3章 1, 3, 22, 28.

1. $Y(j\omega)=2X(j(\omega-\omega_c))$

$y(t)=2e^{j\omega_c t}x(t)$

$x(t)=y(t)\,m(t)$

$\therefore m(t)=\frac{1}{2}e^{-j\omega_c t}$.

3. $x(t)=g(t)\cos 2000\pi t$.

$=\frac{1}{2}\,x(t)\sin(4000\pi t)$

$\therefore X'(j\omega)=\frac{1}{4\pi}X(j\omega)*\frac{\pi}{j}[\delta(\omega-4000\pi)-\delta(\omega+4000\pi)]$

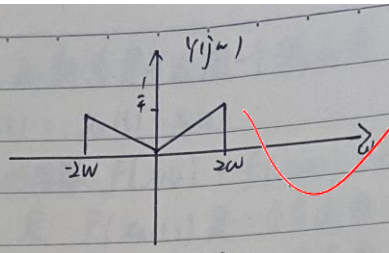
$=\frac{1}{4j}X(j(\omega-4000\pi))-\frac{1}{4j}X(j(\omega+4000\pi))$

$\because X(j\omega)=0$, $|\omega|>2000\pi$.

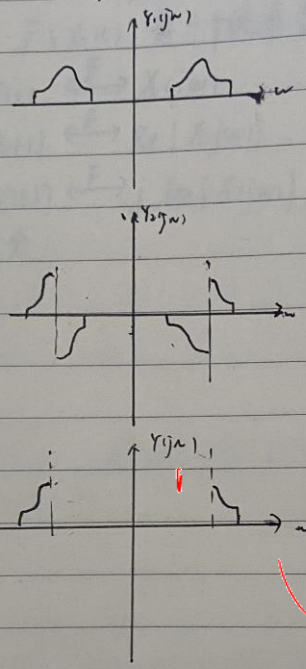
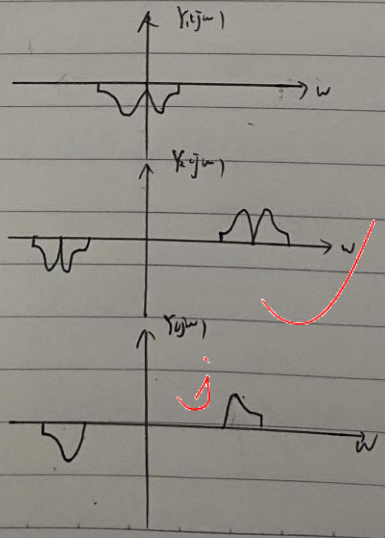
理想低通截止频率为 2000π

$\therefore y(t)=0$.

22.



28. (a)



(b)