7.8

7.10 (1)(2)

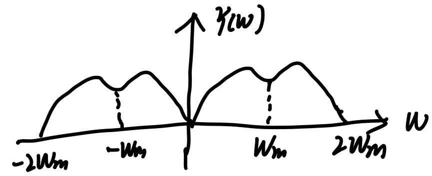
8.2(a)

8.3 (1)

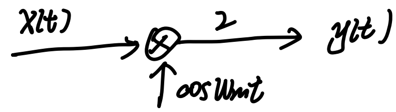
8.15

8.16

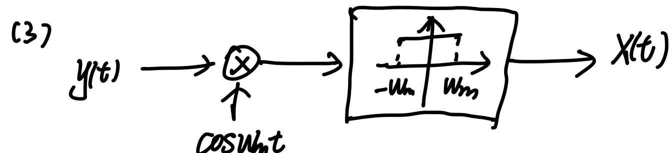
7.8 (1)



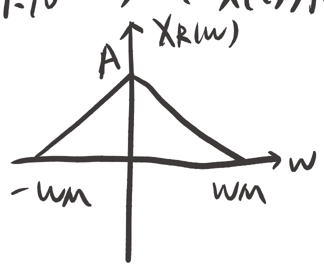
(2) $y(t) = 2x(t)\cos W_m t$

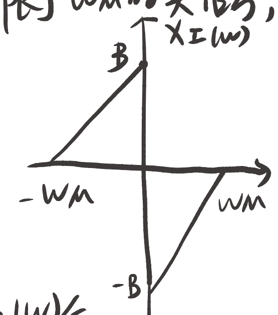


(3)

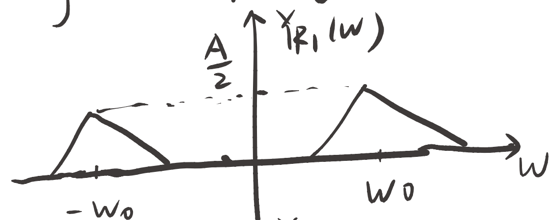


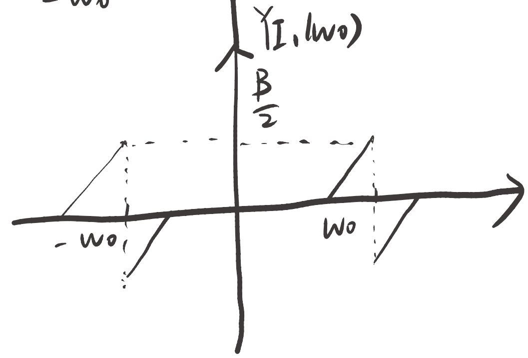
7-10 (1) ∵ $x(t)$为带限于 W_m 的实信号，则 $X(w) = X_R(w) + jX_I(w)$，$X_R(w)$为偶函数，$X_I(w)$奇



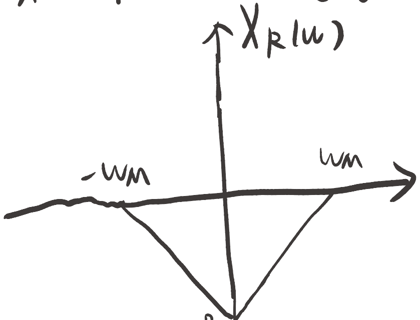


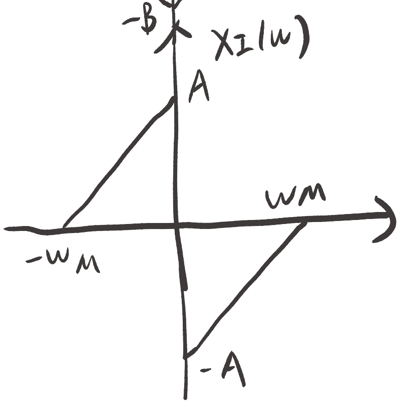
则 $Y_1(w) = Y_{R_1}(w) + jY_{I_1}(w)$



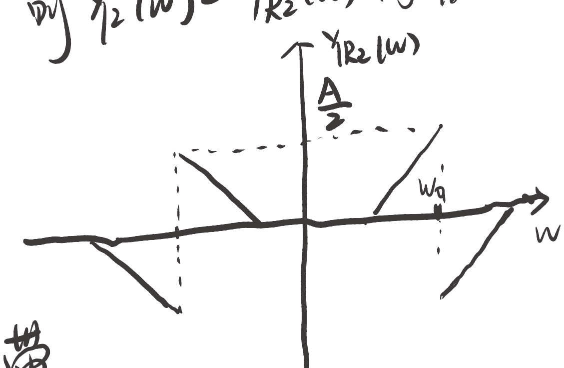


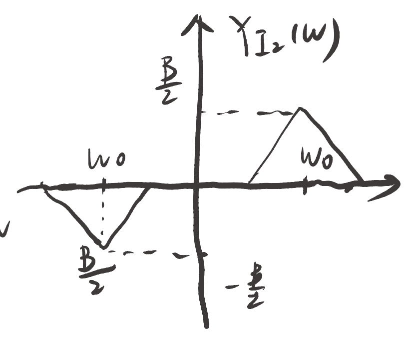
$x(t)$通过 $H(w) = -j\,\mathrm{sgn}(w)$后：





则 $Y_2(w) = Y_{R2}(w) + jY_{I2}(w)$：





$Y_1(w) + Y_2(w)$ 即可得下边带

(2) 同理可得

T 8.2 (a)

(1) $H(s)=\dfrac{\frac{1}{sC}//R}{\frac{1}{sC}//R+sL}=\dfrac{R}{R+sL+s^2RCL}$ $\quad\therefore H(\omega)=\dfrac{R}{R+j\omega L-\omega^2RCL}$

(2) $H(s)=\dfrac{1}{1+\frac{sL}{R}+s^2/CL}=\dfrac{1}{CL}\cdot\dfrac{1}{s^2+\frac{s}{CR}+\frac{1}{CL}}$ 令 $s^2+\frac{s}{CR}+\frac{1}{CL}=0\Rightarrow s_1=\dfrac{-\frac{1}{CR}+\sqrt{\frac{1}{C^2R^2}-\frac{4}{CL}}}{2}$

$s_2=\dfrac{-\frac{1}{CR}-\sqrt{\frac{1}{C^2R^2}-\frac{4}{CL}}}{2}$

设 $H(s)=\dfrac{A}{s-s_1}+\dfrac{B}{s-s_2}$，代入可得：$A=\dfrac{1}{CL}\cdot\dfrac{1}{\sqrt{\frac{1}{C^2R^2}-\frac{4}{CL}}}$ $\quad\therefore h(t)=Ae^{s_1t}u(t)+Be^{s_2t}u(t)$

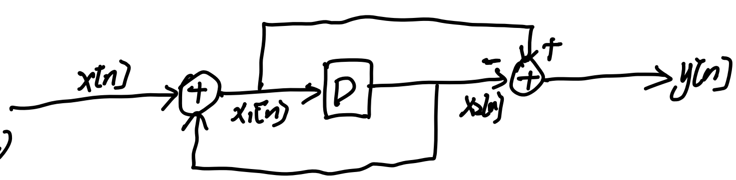
$B=\dfrac{1}{CL}\cdot\dfrac{-1}{\sqrt{C^2R^2-\frac{4}{CL}}}$ $\quad s(t)=h(t)*u(t)=\dfrac{A}{s_1}\left[(e^{s_1t}-1)u(t)\right]+\dfrac{B}{s_2}\left[(e^{s_2t}-1)u(t)\right]$

(3) $\dfrac{1}{CL}\dfrac{d^2V_0}{dt^2}+\dfrac{L}{R}\dfrac{dV_0}{dt}+V_0=V_i=\delta(t)$

代入起始松弛条件即可求解

T 8.3 (1)

(a)



由 $(X(z)-0.5X_2(z))\frac{1}{z}=X_2(z)$ $\quad\therefore X_2(z)=X(z)\cdot\dfrac{2}{1+2z}$

$\therefore X_1(z)=X(z)-\frac{1}{2}X_2(z)=X(z)\dfrac{2z}{1+2z}$

$\Rightarrow Y(z)=\frac{1}{4}(X_1(z)-X_2(z))=X(z)\left[\frac{1}{2}\dfrac{z-1}{1+2z}\right]$

则 $H(z)=\dfrac{1}{4}\cdot\dfrac{z-1}{z+\frac{1}{2}}$，$H(\Omega)=\dfrac{1}{4}\dfrac{e^{j\Omega}-1}{e^{j\Omega}+\frac{1}{2}}$

(b)

$y[n]=x[n]-2x[n-1]+x[n-2]$

$\therefore Y(z)=X(z)(1-2z^{-1}+z^{-2})$

$H(z)=1-2z^{-1}+z^{-2}$

$H(\Omega)=1-2e^{-j\Omega}+z^{-2j\Omega}$

T 8.15

原式为：$y[n]-0.75y[n-1]+0.125y[n-2]=x[n]-0.5x[n-1]$

令 $n=1\Rightarrow y[-1]=-8$ $\qquad$ 令 $n=0\Rightarrow y[-2]=-40$

$\therefore\frac{1}{8}\left[Y_u(z)z^{-2}-8z^{-1}-40\right]-\frac{3}{4}\left[Y_u(z)z^{-1}-8\right]+Y_u(z)=-\frac{1}{2}X_u(z)z^{-1}+X_u(z)$

得：$Y_u(z)=\dfrac{1-\frac{1}{2}z^{-1}}{1-\frac{3}{4}z^{-1}+\frac{1}{8}z^{-2}}X_u(z)+\dfrac{z^{-1}-1}{1-\frac{3}{4}z^{-1}+\frac{1}{8}z^{-2}}$

故 $Y_{uzs}(z)=\dfrac{2}{1-\frac{1}{2}z^{-1}}-\dfrac{1}{1-\frac{1}{4}z^{-1}}$

$Y_{uzi}(z)=\dfrac{2}{1-\frac{1}{2}z^{-1}}-\dfrac{3}{1-\frac{1}{4}z^{-1}}$

零状态响应： $y_{zs}[n]=2\cdot(\frac{1}{2})^n u[n]-(\frac{1}{4})^n u[n]$

零输入响应： $y_{zi}[n]=2\cdot(\frac{1}{2})^n u[n]-3\cdot(\frac{1}{4})^n u[n]$

全响应： $y[n]=4\cdot(\frac{1}{2})^n u[n]-4(\frac{1}{4})^n u[n]$

T8.16 $e^{-2t}\int_{-\infty}^{t}e^{2\tau}x(\tau)\,d\tau=\int_{-\infty}^{t}e^{-2(t-\tau)}x(\tau)\,d\tau=x(t)*e^{-2t}u(t)$

方程改写为 $y''(t)+4y'(t)+3y(t)=2x(t)+2x(t)*e^{-2t}u(t)$

单边拉氏变换：

$$s^2Y_u(s)-sy(0^-)-y'(0^-)+4[sY_u(s)-y(0^-)]+3Y_u(s)=2X_u(s)+2X_u(s)\cdot\frac{1}{s+2}$$

$\therefore Y_u(s)=\dfrac{2}{s^2+3s+2}X_u(s)+\dfrac{s-1}{s^2+4s+3}$ 其中 $X_u(s)=L_u\{u(t)\}=\dfrac{1}{s}$

则零状态响应： $Y_{uzs}(s)=\dfrac{2}{s^2+3s+2}\cdot\dfrac{1}{s}=\dfrac{1}{s}-\dfrac{2}{s+1}+\dfrac{1}{s+2}$

$y_{zs}(t)=u(t)-2e^{-t}u(t)+e^{-2t}u(t)$

零输入响应： $Y_{uzi}(s)=\dfrac{s-1}{s^2+4s+3}=-\dfrac{1}{s+1}+\dfrac{2}{s+3}$

$y_{zi}(t)=2e^{-3t}u(t)-e^{-t}u(t)$

综上：全响应： $y(t)=2e^{-3t}u(t)+e^{-2t}u(t)-3e^{-t}u(t)+u(t)$ $t\geq 0$

零状态： $y_{zs}(t)=u(t)-2e^{-t}u(t)+e^{-2t}u(t)$

零输入： $y_{zi}(t)=2e^{-3t}u(t)-e^{-t}u(t)$

自由响应： $2e^{-3t}u(t)+e^{-2t}u(t)-3e^{-t}u(t)$

强迫响应： $u(t)$

稳态响应： $u(t)$

暂态响应： $2e^{-3t}u(t)+e^{-2t}u(t)-3e^{-t}u(t)$