第五次作业答案

4.14

4.16 (3)

4.18 (2)(5)

4.19 (1)(4)

4.14 零输入响应：由 $\lambda^2+3\lambda+2=0$ 解为 $\lambda=-1/\lambda=-2$ $\therefore y_{zi}(t)=Ae^{-t}+Be^{-2t}$，$t>0$

代入条件 $\begin{cases}A+B=1\\-A-2B=2\end{cases}$ 得 $\begin{cases}A=4\\B=3\end{cases}$ $\therefore y_{zi}(t)=(4e^{-t}-3e^{-2t})u(t)$

零状态单位冲激响应：由 $\begin{cases}h''(t)+3h'(t)+2h(t)=\delta'(t)+3\delta(t)\\h(0_-)=0,\ h'(0_-)=0\end{cases}$ 采用级联的方法

$\therefore h_1(t)=\delta'(t)+3\delta(t)$，$\begin{cases}h_2''(t)+3h_2'(t)+2h_2(t)=0\\h_2(0^+)=0,\ h_2'(0^+)=1\end{cases}$ 可得 $h_2(t)=(e^{-t}-e^{-2t})u(t)$

$\therefore h(t)=h_1(t)*h_2(t)=(2e^{-t}-e^{-2t})u(t)$

① $y_{zs}(t)=u(t)*h(t)=\int_0^t(2e^{-\tau}-e^{-2\tau})d\tau\ u(t)=(\frac{3}{2}-2e^{-t}+\frac{1}{2}e^{-2t})u(t)$

$\therefore y(t)=(\frac{3}{2}+2e^{-t}-\frac{5}{2}e^{-2t})u(t)$

② $y_{zs}(t)=e^{-3t}u(t)*h(t)=\int_0^t e^{-3(t-\tau)}\cdot(2e^{-\tau}-e^{-2\tau})d\tau\cdot u(t)=(e^{-t}-e^{-2t})u(t)$

$\therefore y(t)=(5e^{-t}-4e^{-2t})u(t)$

4.16(3) 零输入响应：由 $\lambda^2-\lambda-2=0$ 得 $\lambda=-1/\lambda=2$ $\therefore y_{zi}[n]=A\cdot(-1)^n+B\cdot 2^n$，$n\geq 0$

代入条件得 $\begin{cases}-A+\frac{1}{2}B=0\\A+\frac{1}{4}B=-\frac{1}{2}\end{cases}$ 得 $\begin{cases}A=-\frac{1}{3}\\B=-\frac{2}{3}\end{cases}$ $\therefore y_{zi}[n]=[-\frac{1}{3}\cdot(-1)^n-\frac{2}{3}\cdot(2)^n]u[n]$

零状态冲激响应：$h_1[n]=\delta[n]+2\delta[n-2]$，$\begin{cases}h_2[n]-h_2[n-1]-2h_2[n-2]=0\\h_2[0]=1,\ h_2[-1]=0\end{cases}$ 可得 $h_2[n]=[\frac{1}{3}\cdot(-1)^n+\frac{2}{3}\cdot 2^n]u[n]$

$\therefore h[n]=h_1[n]*h_2[n]=[(-1)^n+2^n]u[n]-\delta[n]$ （也可利用匹配系数的方法！）

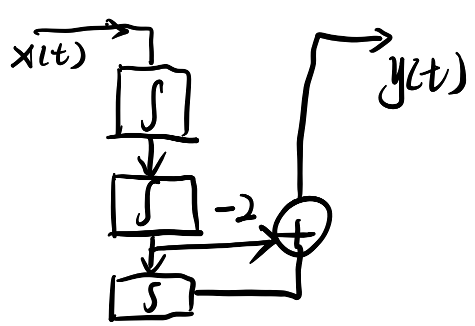
① $y_{zs}[n]=u[n]*h[n]=\frac{1-2^{n+1}}{1-2}u[n]+\{\frac{1}{2}-\frac{1}{2}(-1)^{n+1}\}u[n]-u[n]=[\frac{1}{2}\cdot(-1)^n+2^{n+1}-\frac{3}{2}]u[n]$

$\therefore y[n]=[\frac{1}{6}(-1)^n+\frac{2}{3}\cdot 2^{n+1}-\frac{3}{2}]u[n]$

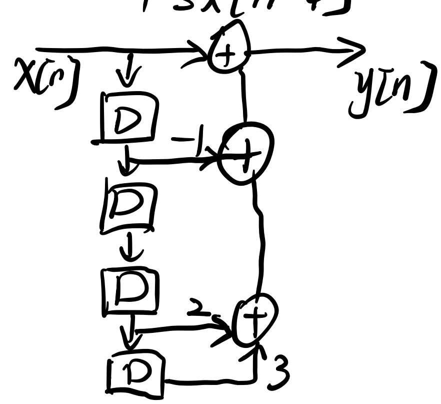
② $y_{zs}[n]=\{\frac{2^{n+1}-\frac{1}{2^{n+1}}}{2-\frac{1}{2}}+\frac{(-1)^{n+1}-\frac{1}{2^{n+1}}}{-1-\frac{1}{2}}\}u[n]-\frac{1}{2^n}u[n]=[\frac{2}{3}(-1)^n-\frac{1}{2^n}+\frac{2}{3}\cdot 2^{n+1}]u[n]$

$\therefore y[n]=[\frac{1}{3}(-1)^n-\frac{1}{2^n}+\frac{1}{3}\cdot 2^{n+1}]u[n]$

4.18 (2) $y'''(t)=x(t)-2x'(t)$

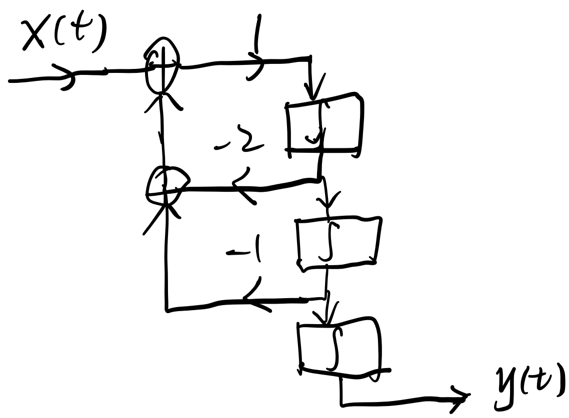


(5) $y[n]=x[n]-x[n-1]+2x[n-3]+3x[n-4]$



4.19 (1) $y''(t)+2y'(t)+y(t)=x(t)*u(t)$

$\therefore y'''(t)+2y''(t)+y'(t)=x(t)$



(4) $y[n]-\frac{1}{4}y[n-2]=\sum_{k=-\infty}^{n}x[k]+x[n-1]$ ①

$y[n-1]-\frac{1}{4}y[n-3]=\sum_{k=-\infty}^{n-1}x[k]+x[n-2]$ ②

$\Rightarrow$ ①-②: $y[n]-y[n-1]-\frac{1}{4}y[n-2]+\frac{1}{4}y[n-3]$

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