3.6 (4)

求下列差分方程所描述的LTI离散系统的 y_{zi}, y_{zs} 和 y

(4) $y(k)+3y(k-1)+2y(k-2)=f(k)$

$f(k)=\varepsilon(k)$, $y(-1)=1$ $y(-2)=0$

解: ① 零输入

$$y_{zi}(k)+3y_{zi}(k-1)+2y_{zi}(k-2)=0$$

$$\Rightarrow \lambda^2+3\lambda+2=0$$

$$\Rightarrow \lambda_1=-1 \quad \lambda_2=-2$$

$\Rightarrow$ 齐次解为: $y_{zi}(k)=C_1(-1)^k+C_2(-2)^k$

代入初始值:

$$y_{zi}(-1)=-C_1-\frac{1}{2}C_2=1$$

$$y_{zi}(-2)=C_1+\frac{1}{4}C_2=0$$

$$\Rightarrow C_1=1 \quad C_2=-4$$

则 $y_{zi}(k)=(-1)^k-4(-2)^k,\ k\geq 0$

② 零状态

$$y_{zs}(k)+3y_{zs}(k-1)+2y_{zs}(k-2)=1 \quad k\geq 0$$

$$y_{zs}(-1)=y_{zs}(-2)=0$$

$\Rightarrow y_{zs}(0)+3y_{zs}(-1)+2y_{zs}(-2)=1 \quad \Rightarrow y_{zs}(0)=1$

$y_{zs}(1)+3y_{zs}(0)+2y_{zs}(1)=1 \quad \Rightarrow y_{zs}(1)=-2$

$y_{zs}(k)=C_3(-1)^k+C_4(-2)^k+\frac{1}{6}$

代入初始值

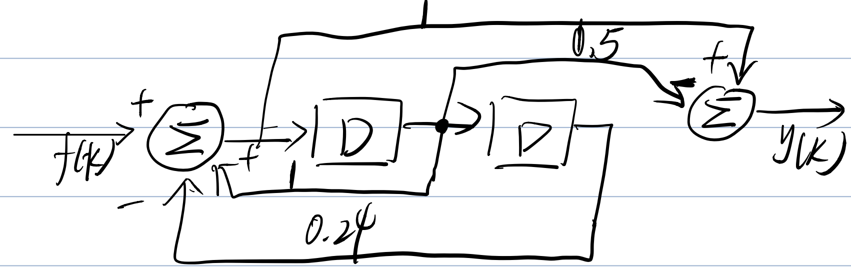
$$y_{zs}(k)=-\frac{1}{2}(-1)^k+\frac{4}{3}(-2)^k+\frac{1}{6}$$

③ 全响应

$$y(k)=y_{zs}(k)+y_{zi}(k)=\frac{1}{2}(-1)^k-\frac{8}{3}(-2)^k+\frac{1}{6},\ k\geq 0$$

3.10 (b)

求题3.10图所示各系统的单位序列响应



解：设左侧加法器输出为 $x(k)$

则 左侧加法器

$$x(k) = f(k) + x(k-1) - 0.24x(k-2)$$

右侧加法器

$$y(k) = x(k) - 0.5x(k-1)$$

设 $h_1(k) - h_1(k-1) + 0.24h(k-2) = \delta(k)$

$\because h_1(-1) = h_1(-2) = 0 \Rightarrow h_1(0) = h_1(1) = 1$

$\Rightarrow$ 方程齐次解为

$$h_1(k) = C_1 \cdot \left(\frac{2}{5}\right)^k + C_2 \left(\frac{3}{5}\right)^k,\ k \geq 0$$

代入初始条件 $\Rightarrow C_1 = -2 \quad C_2 = 3$

$$\Rightarrow h_1(k) = \left[-2\left(\frac{2}{5}\right)^k + 3\left(\frac{3}{5}\right)^k\right]\varepsilon(k)$$

则系统的单位序列响应为

$$h(k) = h_1(k) - \frac{1}{2}h_1(k-1)$$

$$= \frac{1}{2}\left[\left(\frac{2}{5}\right)^k + \left(\frac{3}{5}\right)^k\right]\varepsilon(k),\ k \geq 0$$