第 6 章

6.1

(1) $\dfrac{2z}{2z-1}, \quad |z|>\dfrac{1}{2}$

(2) $\dfrac{2z}{2z-1}, \quad |z|<\dfrac{1}{2}$

(3) $\dfrac{z}{z+3}, \quad |z|>3$

(4) $z, \quad |z|<\infty$

(5) $1-\dfrac{1}{8}z^{-3}, \quad |z|>0$

(6) $\dfrac{1-\left(\dfrac{1}{2z}\right)^{10}}{1-\dfrac{1}{2z}}, \quad |z|>0$

(7) $\dfrac{4z^2-7z}{(2z-1)(z-3)}, \quad |z|>3$

(8) $\dfrac{\dfrac{1}{\sqrt{2}}(z^2+z)}{z^2+1}, \quad |z|>1$

(9) $\dfrac{z^2-\dfrac{1}{\sqrt{2}}z}{z^2-\sqrt{2}z+1}, \quad |z|>1$

6.2 $\dfrac{-1.5z}{(z-0.5)(z-2)}, \quad 0.5<|z|<2$

6.3

(1) $\delta(n)$

(2) $\delta(n+3)$

(3) $\delta(n-1)$

(4) $\delta(n)+2\delta(n+1)-2\delta(n-2)$

(5) $a^n u(n)$

(6) $-a^n u(-n-1)$

6.4

(1) $2\delta(n)+\left(-\dfrac{1}{2}\right)^n u(n)$ 或 $3\delta(n)+\left(-\dfrac{1}{2}\right)^n u(n-1)$

(2) $\left[4\left(-\dfrac{1}{2}\right)^n-3\left(-\dfrac{1}{4}\right)^n\right]u(n)$

(3) $\left[2\left(\frac{1}{2}\right)^n-\left(\frac{1}{4}\right)^n\right]u(n)$

(4) $-a\delta(n)+\left(a-\frac{1}{a}\right)\left(\frac{1}{a}\right)^n u(n)$

6.5

(1) $\{1,3,7,\cdots\}$

(2) $\left\{1,\frac{3}{2},\frac{9}{4},\cdots\right\}$

(3) $\{0,1,2,\cdots\}$

6.6

(1) $x(n)=\left[8-(2n+6)\left(\frac{1}{2}\right)^n\right]u(n)$

(2) $x(n)=-\left[8-(2n+6)\left(\frac{1}{2}\right)^n\right]u(-n-1)$

(3) $x(n)=-8u(-n-1)-(2n+6)\left(\frac{1}{2}\right)^n u(n)$

6.7

(1) $\frac{1}{4}\left[(-1)^n+2n-1\right]u(n)$

(2) $n6^{n-1}u(n)$

(3) $\frac{u(-n)}{(-n)!}$

(4) $\left[\frac{\sin(n+1)\omega+\sin(n\omega)}{\sin\omega}\right]u(n)$

6.8

(1) $x(n)=\left[\left(\frac{1}{2}\right)^n-2^n\right]u(n)$

(2) $x(n)=\left[2^n-\left(\frac{1}{2}\right)^n\right]u(-n-1)$

(3) $x(n)=\left(\frac{1}{2}\right)^n u(n)+2^n u(-n-1)$

6.9

(1) $x(0)=1$，$x(\infty)$ 不存在

(2) $x(0)=1$，$x(\infty)=0$

(3) $x(0)=0$，$x(\infty)=2$

6.10 $x(n)=(-1)^{n+1}\dfrac{a^n}{n}u(n-1)$

6.11

(1) $\dfrac{z-z^{-7}}{z-1}$

(2) $\dfrac{2z}{(z-1)^2}$

(3) $\left(\dfrac{z}{z-1}\right)^2$

(4) $\ln\dfrac{z-b}{z-a}$

(5) $\dfrac{z}{a}\ln\dfrac{z}{z-a}$

(6) $\dfrac{4z^2}{4z^2+1}$

(7) $\dfrac{-z}{(z+1)^2}$

(8) $\dfrac{z^4-4z+3}{z^3(z-1)^2}$

6.12 $x(\infty)=b$

6.13

(1) $\dfrac{b}{b-a}\left[a^nu(n)+b^nu(-n-1)\right]$

(2) $a^{n-2}u(n-2)$

(3) $\dfrac{1-a^{n+2}}{1-a}u(n+1)$

6.14

(1) $1\quad(|z|\geq 0)$

(2) $\dfrac{1}{1-100z}\quad(|z|>0.01)$

(3) $\dfrac{\mathrm{e}^{-b}z\sin\omega_0}{z^2-2\mathrm{e}^{-b}z\cos\omega_0+\mathrm{e}^{-2b}}\quad(|z|>\mathrm{e}^{-b})$

6.15

(1) $\left[(0.5)^{n+1}-(2)^{n+1}\right]u(n)$

(2) $\left[2(-1)^n+4(2)^n\right]u(n)$

(3) $\left[9.26+0.66(-0.2)^n-0.2(0.1)^n\right]u(n)$

(4) $\left[0.5-0.45(0.9)^n\right]u(n)$

(5) $\left[\frac{n}{6}+\frac{5}{36}-\frac{5}{36}(-5)^n\right]u(n)$

(6) $\left[-\frac{1}{2}+\frac{1}{2}(-1)^n+2^n\right]u(n)$

6.16

(1) 稳定

(2) 不稳定

(3) 不稳定(临界稳定)

(4) 不稳定(临界稳定)

6.17 $-2<k<4$

6.18

(1) $H(z)=\frac{z}{z+1}$， $h(n)=(-1)^n u(n)$

(2) $y(n)=5\left[1+(-1)^n\right]u(n)$

6.19

(1) $x(n-1)=y(n)-y(n-1)+\frac{1}{2}y(n-2)$

(2) $H(z)=\frac{z}{z^2-z+0.5}$

(3) $h(n)=2\left(\sqrt{2}\right)^{-n}\sin\frac{\pi}{4}nu(n)$

6.20

(1) $H(z)=\frac{z}{3z-6}$， $h(n)=\frac{1}{3}(2^n)u(n)$

(2) $H(z)=1-5z^{-1}+8z^{-3}$， $h(n)=\delta(n)-5\delta(n-1)+8\delta(n-3)$

(3) $H(z)=\frac{z^2}{(z+0.5)(z-0.5)}$， $h(n)=0.5\left[(0.5)^n+(-0.5)^n\right]u(n)$

(4) $H(z)=\frac{z^3}{(z-1)^3}$， $h(n)=\frac{1}{2}(n+1)(n+2)u(n)$

(5) $H(z)=\frac{z^2-3}{z^2-5z+6}$， $h(n)=-\frac{1}{2}\delta(n)-\frac{1}{2}(2)^n u(n)+2(3)^n u(n)$

6.21 当$10<|z|\le\infty$时， $h(n)=(0.5^n-10^n)u(n)$，系统是因果，不稳定的

当$0.5<|z|<10$时， $h(n)=0.5^n u(n)+10^n u(-n-1)$，系统是非因果，稳定的

6.22 在$u(n)$作用下， $y(n)=\frac{a}{a-1}a^n u(n)-\frac{1}{a-1}u(n)$

在$e^{jn\omega}u(n)$作用下， $y(n)=\frac{a}{a-e^{j\omega}}a^n u(n)-\frac{e^{j\omega}}{a-e^{j\omega}}e^{jn\omega}u(n)$

以上两式右边的第一项为瞬态响应，第二项为稳态响应

6.23 $y_{zs}(n)=2u(n-1)$

6.24 (1) $a=-1.125$；(2) $y(n)=-0.25$

6.25

(1) $y_{zi}(n)=\left[(-1)^n-3(-2)^n\right]u(n)$，$y_{zs}(n)=\left[-0.5(-1)^n+2(-2)^n+0.5\right]u(n)$

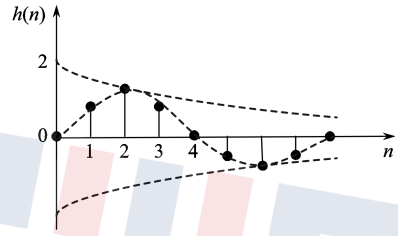
(2) $H(z)=\dfrac{2+z^{-1}}{1+3z^{-1}+2z^{-2}}$

6.26

(1) $y(n)-y(n-1)+\dfrac{1}{2}y(n-2)=x(n-1)$

(2) $H(z)=\dfrac{z}{z^2-z+\dfrac{1}{2}}$，系统稳定

(3) $h(n)=2\left(\sqrt{2}\right)^{-n}\cdot\sin\dfrac{\pi}{4}nu(n)$，$h(n)$ 如图所示



(4) $y_s(n)=20\cos\left(\pi n+\dfrac{\pi}{2}\right)$

6.27

(1) $H(z)=\dfrac{10}{3}\left(\dfrac{z}{z-\dfrac{1}{2}}\right)-\dfrac{7}{3}\left(\dfrac{z}{z-\dfrac{1}{4}}\right)$，$|z|>\dfrac{1}{2}$，$h(n)=\left[\dfrac{10}{3}\left(\dfrac{1}{2}\right)^n-\dfrac{7}{3}\left(\dfrac{1}{4}\right)^n\right]u(n)$

(2) 零点位于 $z=0$ 和 $-\dfrac{1}{3}$，极点位于 $z=\dfrac{1}{4}$ 和 $\dfrac{1}{2}$

(3) 呈低通特性，最大值为 $\dfrac{32}{9}$，最小值为 $\dfrac{16}{45}$

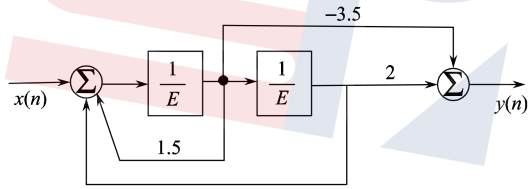
6.28

(1) $y(n+2)-1.5y(n+1)-y(n)=2x(n)-3.5x(n+1)$

(2) $y_3(n)=\left[5(2)^n-3(-0.5)^n-1\right]u(n)$

(3) 系统不稳定

(4) 模拟框图如图所示


−3.5
x(n)
1
E
1
E
2
y(n)
1.5