$$Y(z) = H(z)\ X(z)$$

After substitution we get

$$z^{-4} = H(z)\left[1+z^{-3}\right]$$

and finally

$$H(z) = \frac{z^{-4}}{1+z^{-3}} = \frac{1}{z^4+z} = \frac{1}{z\left(z^3+1\right)}$$

4.13 End of Chapter Problems

EOCP 4.1

Find the z-transform for the following signals and indicate the ROC.

1. $x(n) = 3(.3)^n u\ (n)$
2. $x(n) = (.3)^n u\ (n) - (.3)^n u(-n-1)$
3. $x(n) = u(n) - u(n-1)$
4. $x(n) = \sin\left(n\frac{\pi}{3}\right)u(n) + (.3)^n u(-n-1)$
5. $x(n) = u(n)*(.5)^n\ u(n)$
6. $x(n) = u(n)*(.5)^n\ u(n)*(.5)^n\ u(-n-1)$
7. $x(n) = nu(n) - n\sin\left(\frac{2\pi}{3}n\right)u(n)$
8. $x(n) = (n-1)\ u(n-1) - 2\delta(n-1)$
9. $x(n) = u(-n-1)*\ u(n) + (n-1)\sin((n-1)\pi/4)\ u(n-1)$
10. $x(n) = n\ (.5)^n \sin(n)\ u(n) + u(-n-1)$

EOCP 4.2

Consider the following signals in the z-transform domain. Find $h(n)$ for each case.

1. $H(z) = 10\frac{z}{z-.5}$ ROC : $|z| < .5$
2. $H(z) = \frac{z}{(z-1)(z-.5)}$ ROC : $|z| > .5$
3. $H(z) = \frac{1}{(z-.3)(z+2)}$ ROC : $|z| < 2$

4. $H(z) = \dfrac{z^2+z+2}{(z-3)(z+2)(z-.1)}$ ROC : $.1 < |z| < 3$

5. $H(z) = \dfrac{z^2+z+2}{(z-3)(z+2)(z-.1)}$ ROC : $|z| > -2$

6. $H(z) = \dfrac{z+1}{(z-.5)(z-.5)}$ ROC : $|z| > .5$

7. $H(z) = \dfrac{z+1}{(z-.5)^2(z-.3)}$ ROC : $.3 < |z| < .5$

8. $H(z) = \dfrac{1}{(z^2+z+1)(z-.5)}$ ROC : $|z| < .5$

9. $H(z) = \dfrac{z^2+z}{(z^2+2z+2)(z-.1)(z-.3)}$ ROC : $|z| > .1$

10. $H(z) = \dfrac{(z-1)(z+1)}{z}$ ROC : $|z| > 0$

EOCP 4.3

The following signals will produce a causal $h(n)$. Find $h(n)$ using partial fraction, long division and MATLAB.

1. $H(z) = \dfrac{1}{z(z-1)}$
2. $H(z) = \dfrac{z}{z(z-1)}$
3. $H(z) = \dfrac{z^2+z+1}{z^2+5z+6}$
4. $H(z) = \dfrac{z+1}{z^2+2z+4}$
5. $H(z) = \dfrac{z^3+z^2+z+1}{z}$
6. $H(z) = \dfrac{z^2+1}{z^3+2z^2+4z}$

EOCP 4.4

Draw the block diagrams for the following systems in the z-domain.

1. $\dfrac{Y(z)}{X(z)} = \dfrac{1}{z^2(z-1)}$
2. $\dfrac{Y(z)}{X(z)} = \dfrac{z^2+z}{z^2+5z+6}$
3. $\dfrac{Y(z)}{X(z)} = \dfrac{z^2+z+1}{z^2+2z+2}$

4. $\dfrac{Y(z)}{X(z)} = \dfrac{z^2+2z+1}{z}$

5. $\dfrac{Y(z)}{X(z)} = \dfrac{z}{z^2+2z+1}$

EOCP 4.5

Find $\dfrac{Y(z)}{X(z)}$ for the block diagrams in Figures 4.14 through 4.18.

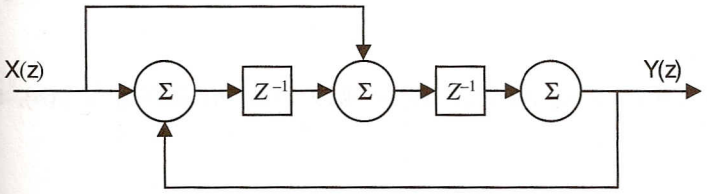

FIGURE 4.14 Block for EOCP 4.5.

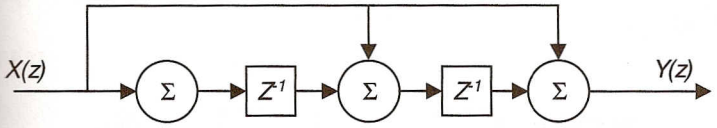

FIGURE 4.15 Block for EOCP 4.5.

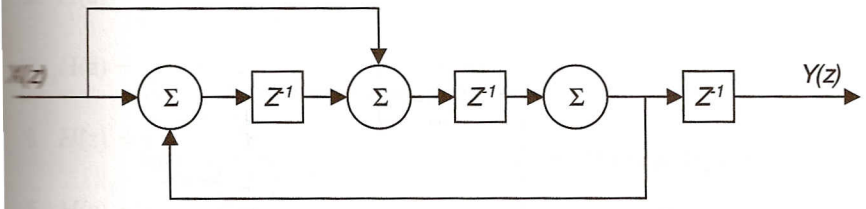

FIGURE 4.16 Block for EOCP 4.5.

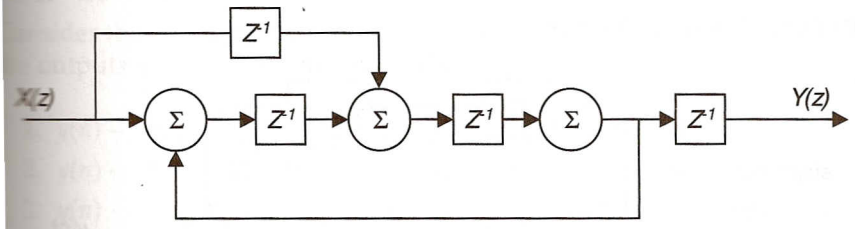

FIGURE 4.17 Block for EOCP 4.5.

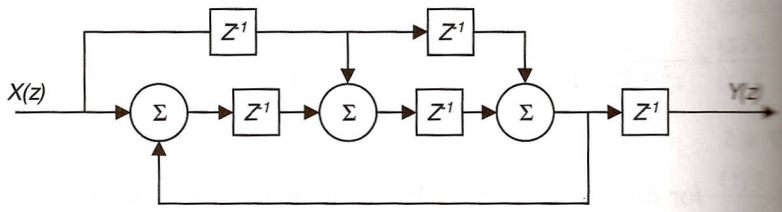

FIGURE 4.18 Block for EOCP 4.5.

EOCP 4.6

For each block diagram in Figures 4.19 through 4.23 find $y(n)$, the step response.

EOCP 4.7

Consider the following transfer functions. Find the difference equation representing these systems and indicate if any of them is stable. Use MATLAB to find $h(n)$.

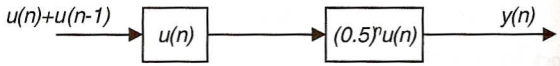

FIGURE 4.19 Block for EOCP 4.6.

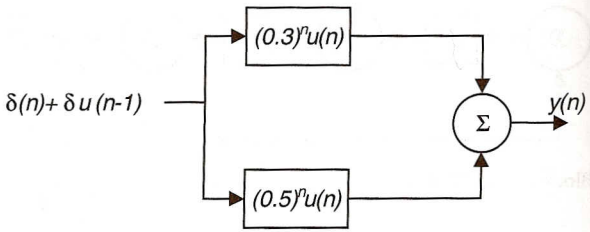

FIGURE 4.20 Block for EOCP 4.6.

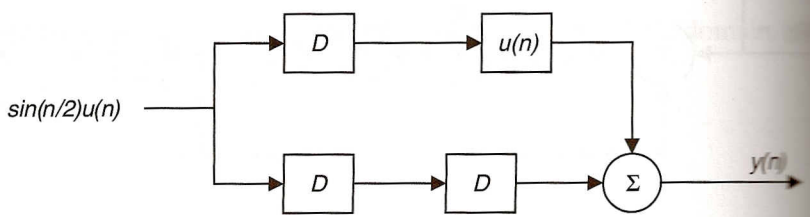

FIGURE 4.21 Block for EOCP 4.6.