

- 4.13 The signal flow diagram of a discrete-time system is shown in Figure 4.18. Obtain the two-step difference equation relating the output,  $y(n]$ , and

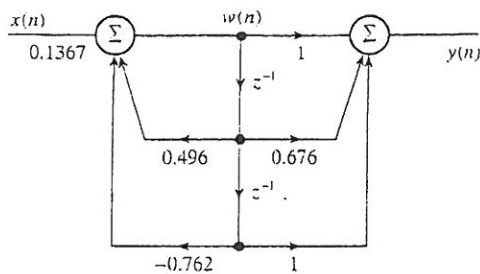


Figure 4.18 The signal flow diagram of the discrete-time system for Problem 4.13.

input,  $x(n]$ . Derive the transfer function,  $H(z)$ , from the difference equation.

$$w[n] = 0.1367x[n] + 0.496w[n-1] - 0.762w[n-2]$$

$$W(z) = 0.1367X(z) + 0.496z^{-1}W(z) - 0.762z^{-2}W(z)$$

$$\frac{W(z)}{X(z)} = \frac{0.1367}{1 - 0.496z^{-1} + 0.762z^{-2}}$$

$$y[n] = w[n] + 0.676w[n-1] + w[n-2]$$

$$Y(z) = W(z) + 0.676z^{-1}W(z) + z^{-2}W(z)$$

$$\frac{Y(z)}{W(z)} = \frac{1 + 0.676z^{-1} + z^{-2}}{1}$$

$$H(z) = \frac{\cancel{W(z)}}{X(z)} \cdot \frac{Y(z)}{\cancel{W(z)}} = \left( \frac{0.1367}{1 - 0.496z^{-1} + 0.762z^{-2}} \right) \left( \frac{1 + 0.676z^{-1} + z^{-2}}{1} \right)$$

$$= \frac{0.1367 + 0.0924z^{-1} + 0.1367z^{-2}}{1 - 0.496z^{-1} + 0.762z^{-2}}$$