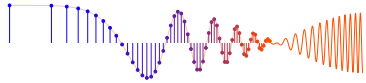

EXERCISE 7.6: Use z-transforms to combine the following cascaded systems

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

into a single difference equation for $y[n]$ in terms of $x[n]$.

McClellan, Schafer and Yoder, *Signal Processing First,* ISBN 0-13-065562-7.
Prentice Hall, Upper Saddle River, NJ 07458.

SOLUTION

$$w[n] = x[n] - x[n-1]$$

DELAY PROPERTY

$$W(z) = X(z) - z^{-1}X(z)$$

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

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

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

$$= (1 - z^{-1} + z^{-2})(1 - z^{-1})X(z)$$

MULTIPLY POLYNOMIALS

$$= (1 - 2z^{-1} + 2z^{-2} - z^{-3})X(z)$$

$$Y(z) = X(z) - 2z^{-1}X(z) + 2z^{-2}X(z) - z^{-3}X(z)$$

$$y[n] = x[n] - 2x[n-1] + 2x[n-2] - x[n-3]$$