

Example 10-6: As an example of using (??), we can find the difference equation that generates an impulse response such as

$$h[n] = 2(0.9)^n u[n] + 5(0.9)^{n-1} u[n-1] \quad (10.5)$$

Using the linearity and delay properties of the z -transform, as well as the z -transform pair in (??), the system function for the system having the given impulse response is

$$H(z) = 2 \left(\frac{1}{1 - 0.9z^{-1}} \right) + 5z^{-1} \left(\frac{1}{1 - 0.9z^{-1}} \right) = \frac{2 + 5z^{-1}}{1 - 0.9z^{-1}} \quad (10.6)$$

Note that this is identical in form to $H(z)$ in (??) which we obtained previously in Section ?? by taking the z -transform of a difference equation (??). In other words, the one-to-one correspondence between the system function and difference equation given in (??) and (??) can be used to write the following difference equation that generates $h[n]$ in (10.5):

$$y[n] = 0.9y[n-1] + 2x[n] + 5x[n-1] \quad (10.7)$$

