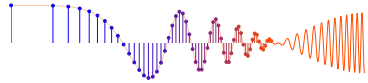

Example 7-10: Nulling Signals with Zeros

For example, when $H(z) = 1 - 2z^{-1} + 2z^{-2} - z^{-3}$, the roots are

$$\begin{aligned} z_1 &= 1 \\ z_2 &= \tfrac{1}{2} + j\tfrac{1}{2}\sqrt{3} \;=\; 1e^{j\pi/3} \\ z_3 &= \tfrac{1}{2} - j\tfrac{1}{2}\sqrt{3} \;=\; 1e^{-j\pi/3} \end{aligned}$$

As shown in Fig. 7-5, these zeros are all on the unit circle, so complex sinusoids with frequencies 0, $\pi/3$, and $-\pi/3$ will be set to zero by the system. That is, the output resulting from each of the following three signals will be zero:

$$\begin{aligned} x_1[n] &= (z_1)^n \;=\; 1 \\ x_2[n] &= (z_2)^n \;=\; e^{j\pi n/3} \\ x_3[n] &= (z_3)^n \;=\; e^{-j\pi n/3} \end{aligned}$$

