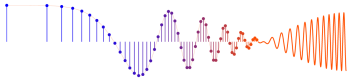
EXERCISE 7.3: Derive the z-transform operator for the first-difference system by working the input $x[n] = z^n$ through the system. Write $y[n]$ as $y[n] = H(z)\{x[n]\}$.

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

SOLUTION



First-Difference is: $y[n] = x[n] - x[n-1]$

Let $x[n] = z^n$

Then $x[n-1] = z^{n-1} = z^n z^{-1}$

$$\Rightarrow y[n] = z^n - z^n z^{-1}$$

$$= (1 - z^{-1}) z^n$$

This is $x[n]$

$$= (1 - z^{-1}) x[n]$$

$$\therefore H(z) = 1 - z^{-1}$$