



گزارش اول تمرین MATLAB

18 آبان

درس پردازش سیگنال های دیجیتال – دکتر شیخ زاده

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سوال 1)

Q1 - Impulse response

$$a) \quad y(n) - 0.18y(n-1) = 0.5x(n)$$

$$Y(z)(1 - 0.18z^{-1}) = 0.5X(z)$$

$$\frac{Y(z)}{X(z)} = \frac{0.5}{1 - 0.18z^{-1}} \Rightarrow h(n) = (0.18)^n \cdot 0.5x(n) \quad \checkmark$$

$$b) \quad Y(z)(1 - 0.2z^{-1} - 0.15z^{-2}) = X(z)(z^{-1} + 1.7z^{-2})$$

$$H(z) = \frac{z^{-1} + 1.7z^{-2}}{1 - 0.2z^{-1} - 0.15z^{-2}} = \frac{0.9z^{-1} - 0.1}{0.3(z^{-1} - 2)(z^{-1} + 1.0)} = \frac{-0.3}{3} + \frac{A}{z^{-1} - 2} + \frac{B}{z^{-1} + 1.0}$$

$$= \frac{-0.3}{3} + \frac{A}{z^{-1} - 2} + \frac{B}{z^{-1} + 1.0} \Rightarrow \frac{0.9z^{-1} - 0.1}{3} = \frac{(z^{-1} - 2)B}{3} + \frac{(z^{-1} + 1.0)A}{3}$$

$$\Rightarrow A = -11, B = \frac{-1.7}{3} \Rightarrow H(z) = \frac{-0.3}{3} + \frac{11/2}{1 - \frac{1}{2}z^{-1}} + \frac{1.7}{3 \cdot (1 + \frac{1}{2}z^{-1})}$$

$$\Rightarrow h(n) = \frac{-0.3}{3} \delta(n) + \frac{11}{3} \left(\frac{1}{2}\right)^n u(n) + \frac{1.7}{3} \left(-\frac{1}{2}\right)^n u(n) \quad \checkmark$$

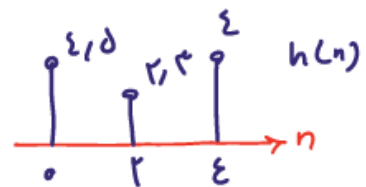
$$c) Y(z) = X(z) \left(\frac{1}{z} + r_1 r_2 z^{-r} + z z^{-z} \right)$$

$$\Rightarrow H(z) = \frac{1}{z} + r_1 r_2 z^{-r} + z z^{-z}$$

$$\Rightarrow h(n) = \frac{1}{z} \delta(n) + r_1 r_2 \delta(n-r) + z \delta(n-z) \quad \checkmark$$

2. a, b are infinite. It continues until $n=\infty$ and has value there.
Thus, it is IIR.

- c is finite. Its impulse response is
Thus, it is FIR.



3. $y(n) - \frac{1}{r} y(n-1) - \frac{1}{z} y(n-2) = x(n-1) + \frac{1}{r} x(n-2)$
 $y(n), n \geq 0, y(-1) = 0, x(n) = \left(\frac{1}{r}\right)^n u(n)$

$$y(n) = x(n) * h(n)$$

\uparrow
 $\left(\frac{1}{r}\right)^n u(n)$