Ex10

ゆきちゃん

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- Given a unit sample response of an FIR filter si

$$h[n] = \begin{cases} \alpha^n, & 0 \le n \le 6 \\ 0, & otherwise \end{cases} \tag{0-1}$$

1. Draw the direct form implementation of this filter
2. Show that the corresponding transfer function is

$$H(z) = \frac{1 - \alpha^7 z{-}7}{1 - \alpha z^{-1}} \tag{0-2}$$

Answer:

1. 略
2. The transfer function is,

$$H(z) = \sum_{n=-\infty}^{\infty} h[n] z^{-n} \tag{0-3}$$

$$= \sum_{n=0}^{6} \alpha^n z^{-n} \tag{0-4}$$

$$= 1 + \sum_{n=1}^{6} \alpha^n z^{-n} \tag{0-5}$$

$$= 1 + \sum_{n=1}^{6} \frac{\alpha}{z} \left(\frac{\alpha}{z}\right)^{n-1} \tag{0-6}$$

$$= 1 + \frac{\frac{\alpha}{z}(1 - (\frac{\alpha}{z})^6)}{1 - \frac{\alpha}{z}} \tag{0-7}$$

$$= \frac{1 - \alpha^7 z^{-7}}{1 - \alpha z^{-1}} \tag{0-8}$$