

PROBLEM:

The frequency response of a linear time-invariant filter is given by the formula

$$\mathcal{H}(\hat{\omega}) = (1 + e^{-j\hat{\omega}})(1 - e^{j\pi/3}e^{-j\hat{\omega}})(1 - e^{-j\pi/3}e^{-j\hat{\omega}})$$

- Write the difference equation for the FIR filter that gives the relation between the input $x[n]$ and the output $y[n]$. Give numerical values for the filter coefficients.
- What is the output of this FIR filter if the input is $x[n] = \delta[n]$?
- Evaluate the frequency response $\mathcal{H}(\hat{\omega})$ at the frequencies $\hat{\omega} = \pi$ and $\hat{\omega} = \pi/3$.
- If the input is of the form $x[n] = Ae^{j\phi}e^{j\hat{\omega}n}$, for what values of $-\pi \leq \hat{\omega} \leq \pi$ will $y[n] = 0$ for all n ?