tiators.

symmetrical or antisymmetrical about n=0.

Determine filter coefficients.

Example 6.1 Determine the frequency response of FIR filter defined by y(n) = 0.25x(n) + x(n-1) + 0.25x(n-2). Calculate the phase delay and group delay.

A non-causal LTI-FIR system have acrophase if its impulse response h(n) is non-causal LTI-FIR system have acrophase if its impulse response h(n)

The given impulse response is of length 5. Therefore for zerophase, thenswip

$$y(n) = 0.25x(n) + x(n-1) + 0.25x(n-2)$$

Taking Fourier transform on both sides

$$Y(e^{j\omega}) = 0.25X(e^{j\omega}) + e^{-j\omega}X(e^{j\omega}) + 0.25e^{-2j\omega}X(e^{j\omega})$$

$$H(e^{j\omega}) = \frac{Y(e^{j\omega})}{X(e^{j\omega})} = 0.25 + e^{-j\omega} + 0.25e^{-2j\omega}$$

$$= e^{-j\omega}(0.25e^{j\omega} + 1 + 0.25e^{-j\omega}) = e^{-j\omega}(1 + 0.5\cos\omega)$$

$$= e^{-j\omega}\overline{H}(e^{j\omega})$$
(6.41a)

Comparing Eq. (6.41a) with Eq. (6.25) we get $\theta(\omega) = -\omega$.

The phase delay
$$\tau_p = \frac{-\theta(\omega)}{\epsilon_{\omega}} = \frac{\omega}{\omega} = 1$$
.

The group delay
$$=-\frac{d\theta(\omega)}{d\omega}=\frac{-d}{d\omega}(-\omega)=1.$$