Home Assignments
Digital Signal Processing
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11. FIR filters

$$
\begin{aligned}
H(\omega) &= \sum_{n=-\infty}^{\infty} h_n e^{-i\omega n} && (1)\\
&= h_{-1}e^{i\omega} + h_0 e^0 + h_1 e^{-i\omega} && (2)\\
&= h_0 + h_1\left(e^{i\omega} + e^{-i\omega}\right) \qquad \text{with } h_{-1} = h_1 && (3)\\
&= h_0 + 2h_1\cos(\omega) && (4)\\
& && (5)
\end{aligned}
$$

a) $\{h_{-1}, h_0, h_1\} = \{\frac{1}{3}, \frac{1}{3}, \frac{1}{3}\}$

$$H(\omega) = \frac{1}{3} + \frac{2}{3}\cos(\omega)$$

b) $\{h_{-1}, h_0, h_1\} = \{\frac{1}{4}, \frac{1}{2}, \frac{1}{4}\}$

$$H(\omega) = \frac{1}{2} + \frac{1}{2}\cos(\omega)$$

c) $\{h_{-1}, h_0, h_1\} = \{-\frac{1}{4}, \frac{1}{2}, -\frac{1}{4}\}$

$$H(\omega) = \frac{1}{2} - \frac{1}{2}\cos(\omega)$$

Since all filters are symmetric around the orgin, the angles are zero.

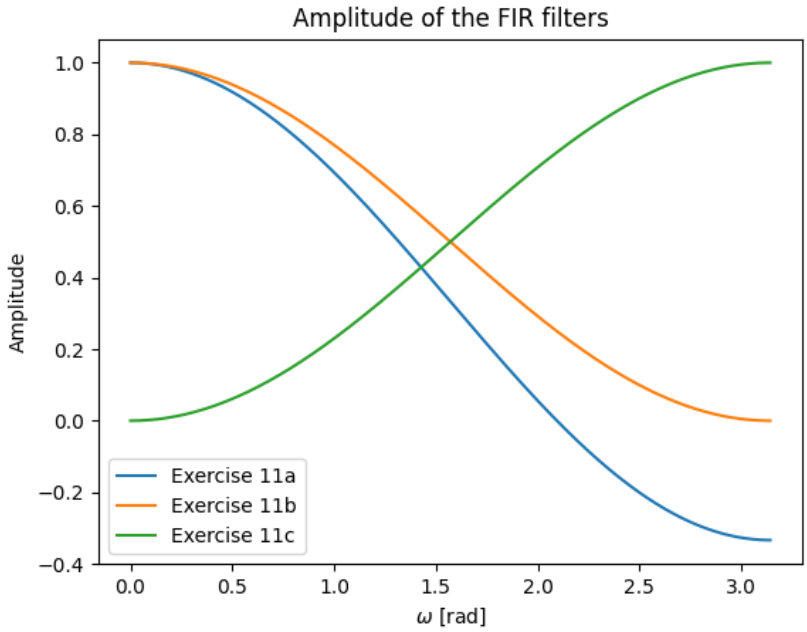

Figure 1: Amplitudes for the given FIR filters.