

PROBLEM:

Consider again the cascade system in Figure 1 with

$$h_1[n] = \delta[n] - \alpha\delta[n - 1] \quad \text{and} \quad h_2[n] = \alpha^n(u[n] - u[n - 6]).$$

- (a) Determine $\mathcal{H}_1(\hat{\omega})$, the frequency response of the first system.
- (b) Show that the frequency response of the second system is

$$\mathcal{H}_2(\hat{\omega}) = \frac{1 - \alpha^6 e^{-j\hat{\omega}6}}{1 - \alpha e^{-j\hat{\omega}}}.$$

- (c) It is possible to show that $h[n] = h_1[n] * h_2[n] = \delta[n] - \alpha^6\delta[n - 6]$. From $h[n]$ determine $\mathcal{H}(\hat{\omega})$ the frequency response of the overall system (from $x[n]$ to $y[n]$).
- (d) Show that your result in part (c) is the product of the results in parts (a) and (b); i.e., $\mathcal{H}_1(\hat{\omega})\mathcal{H}_2(\hat{\omega}) = \mathcal{H}(\hat{\omega})$.