

Exercises Week 11

DSP

1. A digital filter has the following properties:

- it is a high-pass filter of order 1
- the pole is situated at a distance 0.9 from the origin
- continuous signals are completely blocked by the filter

Requirements:

- a. Draw the pole-zero diagram and find the system function $H(z)$
 - b. Compute the amplitude response and the phase response of the filter
 - c. Normalize the filter such that $|H(\pi)| = 1$
 - d. Find the output signal $y[n]$ if the input signal is $x[n] = 2 \cos(\frac{\pi}{6}n + \frac{\pi}{4})$, $n \in \mathbb{Z}$
2. Design two filters of order 2 of the following types, and write their difference equation:
- a low-pass filter
 - a band-pass filter with central frequency around the frequency $\omega = \frac{3\pi}{4}$