# EE110B Lab 4

Consider a discrete-time LTI system governed by the following (causal) difference equation:

$$y[n] = 1.8\cos(\pi/4)y[n-1] - 0.81y[n-2] + x[n] - 2\cos(3\pi/4)x[n-1] + x[n-2] \qquad (1)$$

1) Determine an expression of the frequency response $H(f)$ of this system.
2) Plot the amplitude and phase responses, i.e., $|H(f)|$ and $\angle H(f)$, versus $-0.5 < f < 0.5$. Discuss the features of the responses (such as the positions of peaks and valleys).
3) a) Assume $y[-1] = y[-2] = 0$ and $x[n] = \cos(\frac{3\pi}{4}n)u[n]$. Apply the recursive formula (1) to compute and plot $y[n]$ for $n \geq 0$. Discuss your results.

   b) Now assume $x[n] = \cos(\frac{3\pi}{4}n)$ (without the step function $u[n]$). Compute and plot the output of the system, $y[n]$ for $n \geq 0$, using the following:

$$y[n] = |H(3/8)|\cos\left(\frac{3\pi}{4}n + \angle H(3/8)\right). \qquad (2)$$

   Compare this with the above result. Are they close for large $n$? Do you know why?
4) a) Assume $y[-1] = y[-2] = 0$ and $x[n] = \cos(\frac{\pi}{4}n)u[n]$. Apply the recursive formula (1) to compute and plot $y[n]$ for $n \geq 0$. Discuss your results.

   b) Now assume $x[n] = \cos(\frac{\pi}{4}n)$ (without the step function $u[n]$). Compute and plot the output of the system, $y[n]$ for $n \geq 0$, using the following:

$$y[n] = |H(1/8)|\cos\left(\frac{\pi}{4}n + \angle H(1/8)\right). \qquad (3)$$

   Compare this with the above result. Are they close for large $n$? Do you know why?