Lab 8  
EE 324: Signals and Systems II

In this lab section we will explore the relations between discrete-time systems and continuous-time systems.

1 Prelab assignment

1. Get familiar with the zero-order hold (ZOH) block in simulink [https://www.mathworks.com/help/simulink/slref/zeroorderhold.html?s_tid=gn_loc_drop]
2. Learn how to generate discrete time Sine wave in simulink [https://www.mathworks.com/help/dsp/ref/sinewave.html]
3. Discretizing the following system using $s = \frac{1}{T}(z - 1)$ with sample period $T = 1, 0.1, 0.01$

\[ H(s) = \frac{900}{s^2 + 2s + 900} \]  \quad (1)

4. Discretizing $H(s)$ using $s = \frac{\frac{2}{T}z - 1}{z + 1}$ with sample period $T = 1, 0.1, 0.01$
5. Discretizing $H(s)$ using ZOH method with sample period $T = 1, 0.1, 0.01$

2 Lab assignment

1. Verify your results in Prelab 5 using matlab function d2c.
2. Realize the discrete-time systems obtained in Prelab 3-5 in simulink.
3. Compare the responses of these three systems for all the sample period $T = 1, 0.1, 0.01$. You can choose the input to be a discrete-time Sine wave or Band-Limited White Noise or any other signal you like. Describe your observations.
4. Build a discrete-time system through a cascade connection of a zero-order hold and $H(s)$, as shown in the figure below.
5. Compare the responses of the systems in Lab 4 and Prelab 5 for all the sample period $T = 1, 0.1, 0.01$. Describe your observations.