In this exercise you will explore a typical response of first and second order systems. All other systems can be usually approximated with first or second order systems so it is important to be well acquainted with these typical responses.

1. Consider the first order system:

\[ G(s) = \frac{p}{s + p} \]

where \( p \) is a parameter. On the same figure, plot the step response of the system for \( p = 1, 2, 10 \). How does \( p \) affect the response?

2. Now consider a second order system:

\[ G(s) = \frac{K}{s^2 + ps + K} \]

where \( K \) and \( p \) are the parameters of the system.

(a) For \( K = 1 \), plot the step response of the system for \( p = 0, 1, 2, 5 \). Plot all the responses on the same figure! Comment on the effect of \( p \) on the response. On one figure, sketch the location of the poles of the system in the complex plane for each value of \( p \) (you can use the function \texttt{pzmap} to find the location of the poles).

(b) On one figure, plot the step response of the system for \( K = 1, 2, 10 \) and \( p = 0.8K \). How does the response change in this case? Sketch the location of the poles of the system in the complex plane for each value of \( K \) on one figure.

3. Now consider a second order system with a zero:

\[ G(s) = \frac{(\gamma s + 1)}{s^2 + 1.2s + 1} \]

On the same figure, plot the step response of the system for \( \gamma = 0, 0.1, 1, 10 \). Note that \( \gamma = 0 \) corresponds to the case when the system has no zeros. Identify the location of the zero for each value of \( \gamma \). On one figure, sketch the location of the poles and the zero for each value of \( \gamma \). How does a zero affect the response of a second order system?

4. Consider the third order system:

\[ G(s) = \frac{1}{(s^2 + s + 1)(\gamma s + 1)} \]

On the same figure, plot the step response of the system for \( \gamma = 0, 0.05, 0.1, 1, 10 \). Note that \( \gamma = 0 \) corresponds to the case when the system has no additional pole. Identify the location of the pole for each value of \( \gamma \) and sketch the location of all the poles on the complex plane (again, do this on one figure). How does a third pole affect the response of a second order system?