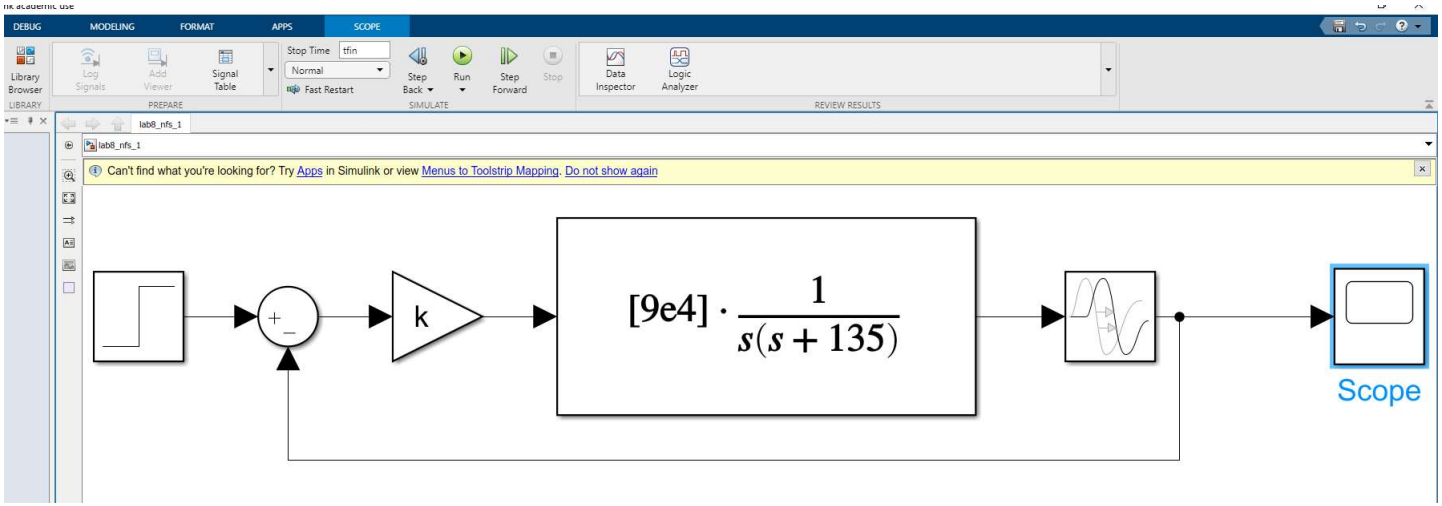
CL transient from the OL FR

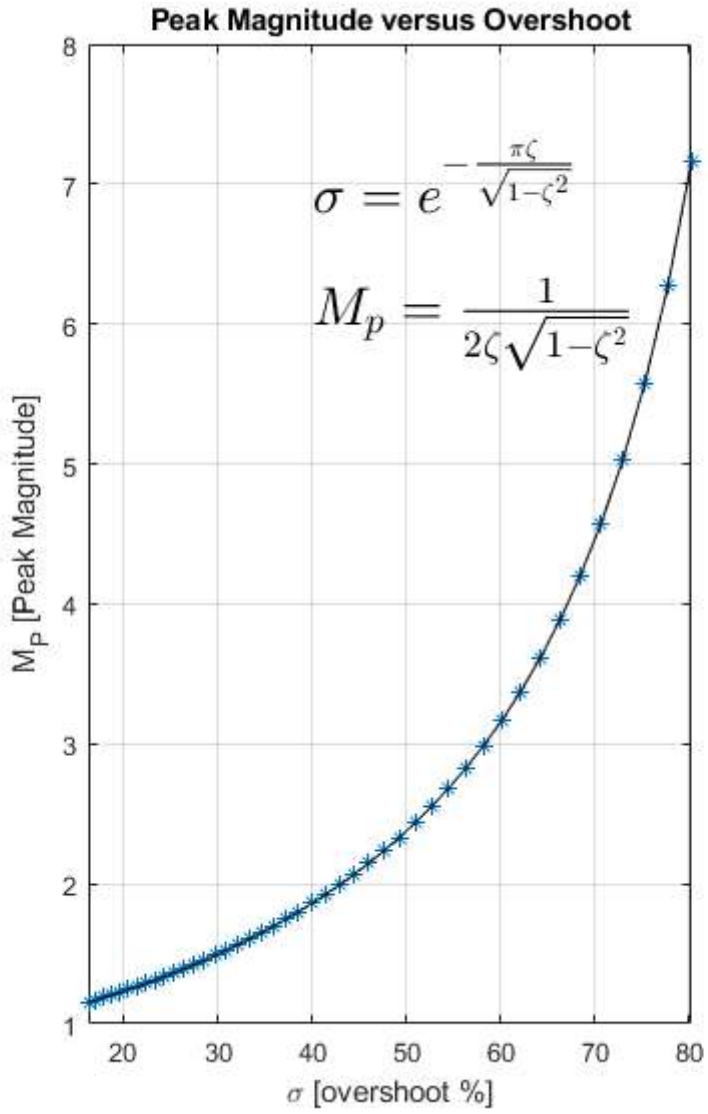
CL [Closed Loop], OL [Open Loop], FR [Frequency Response]

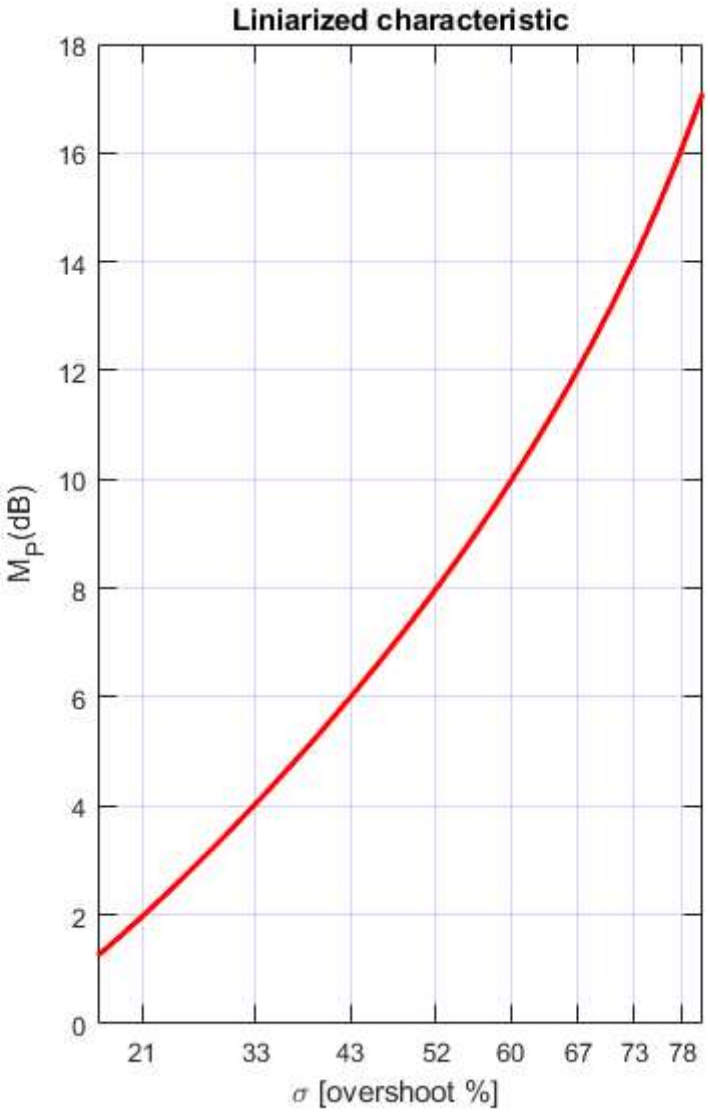
Theoretical aspects

For a NFS with time delay (τ_m) as in the picture below

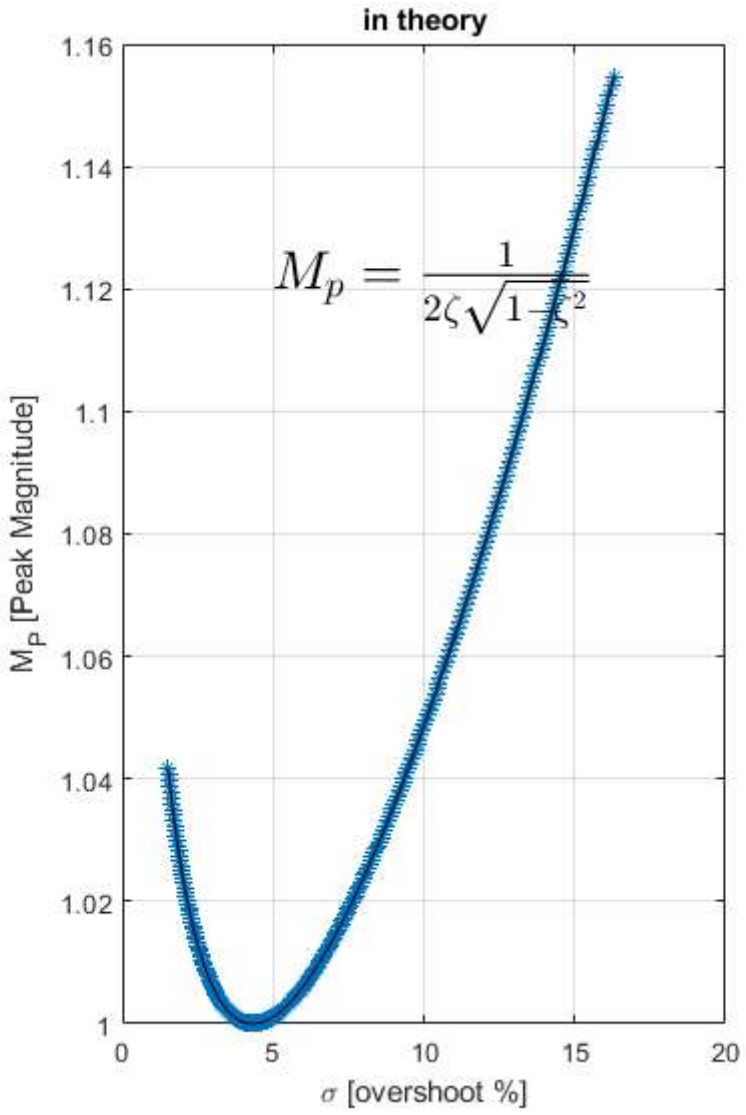


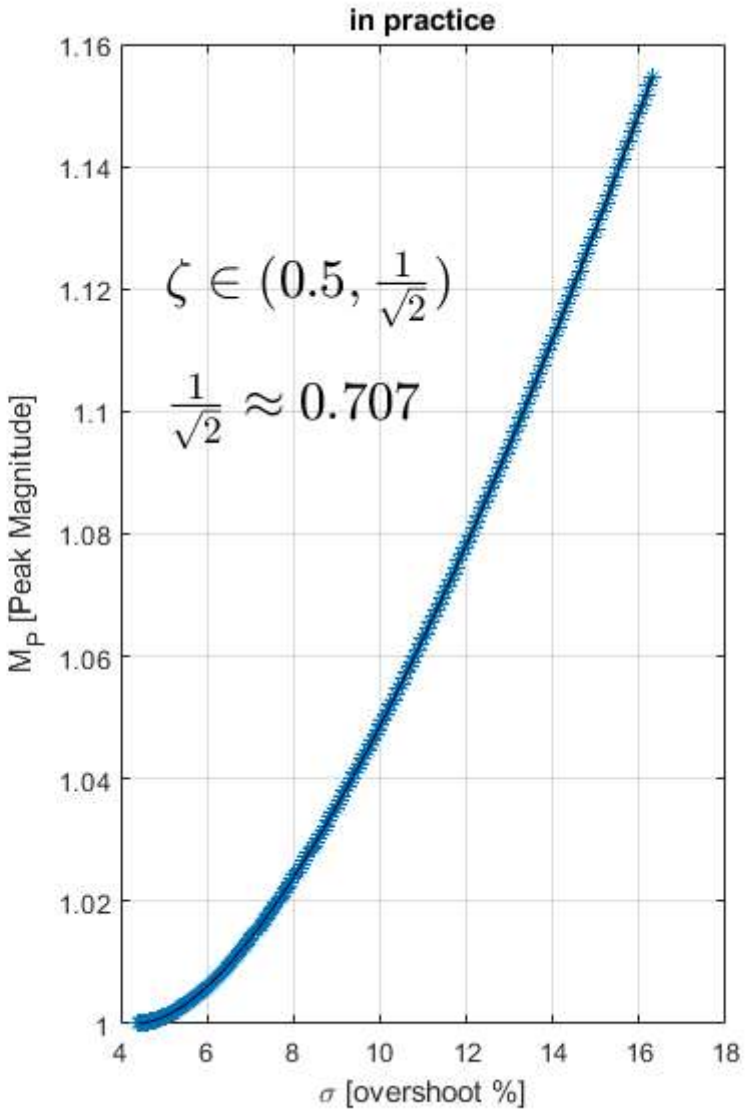
The relation between the OL Nyquist Diagram and the CL step response transients can be illustrated in the next TWO figures:





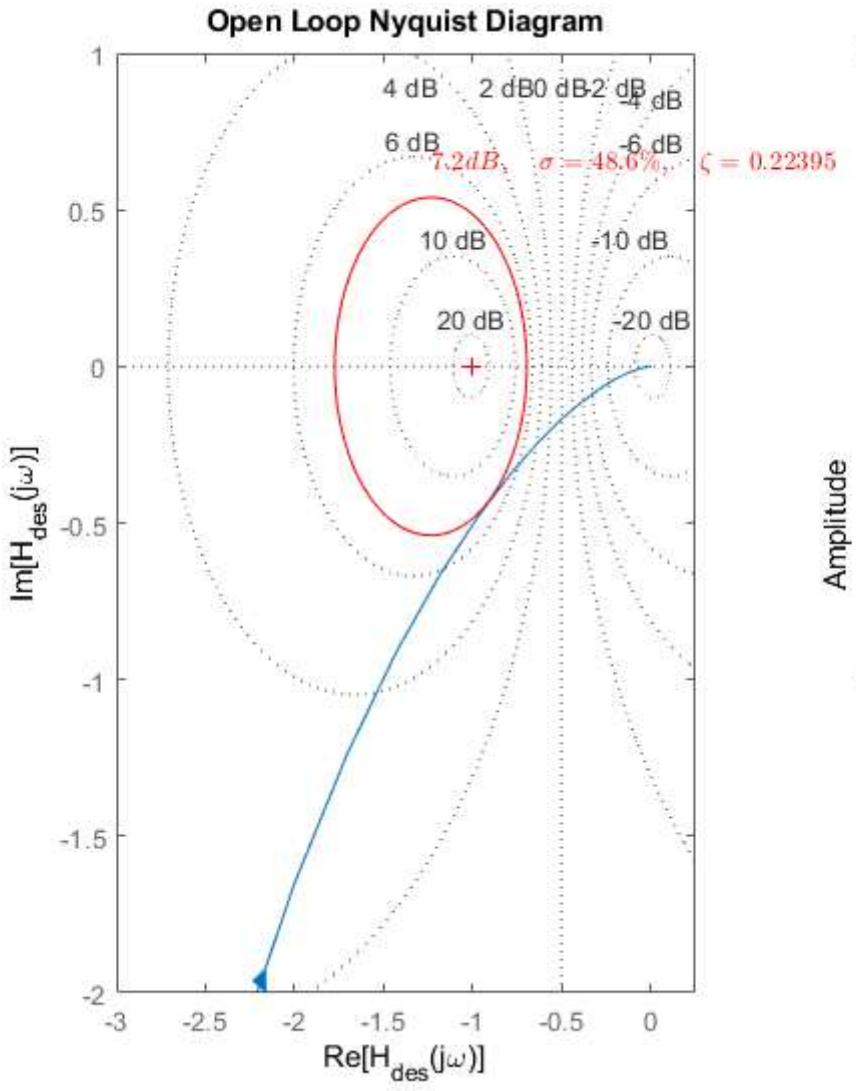
In practice, the overshoot is no higher than 20%; the plot above will be reduced to this practical range:

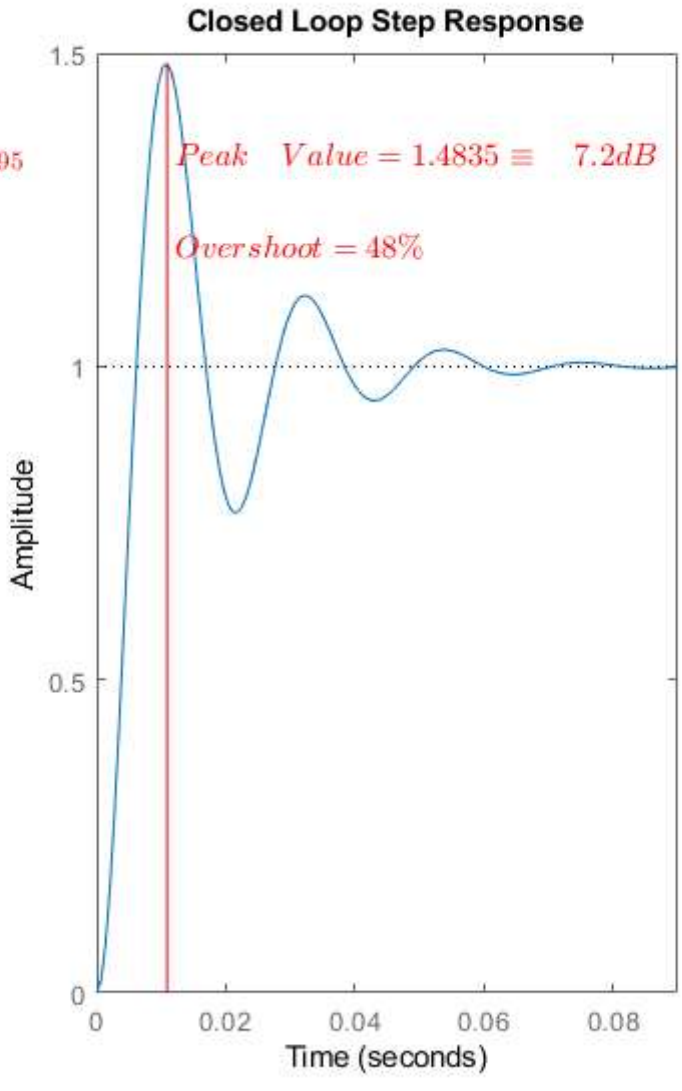




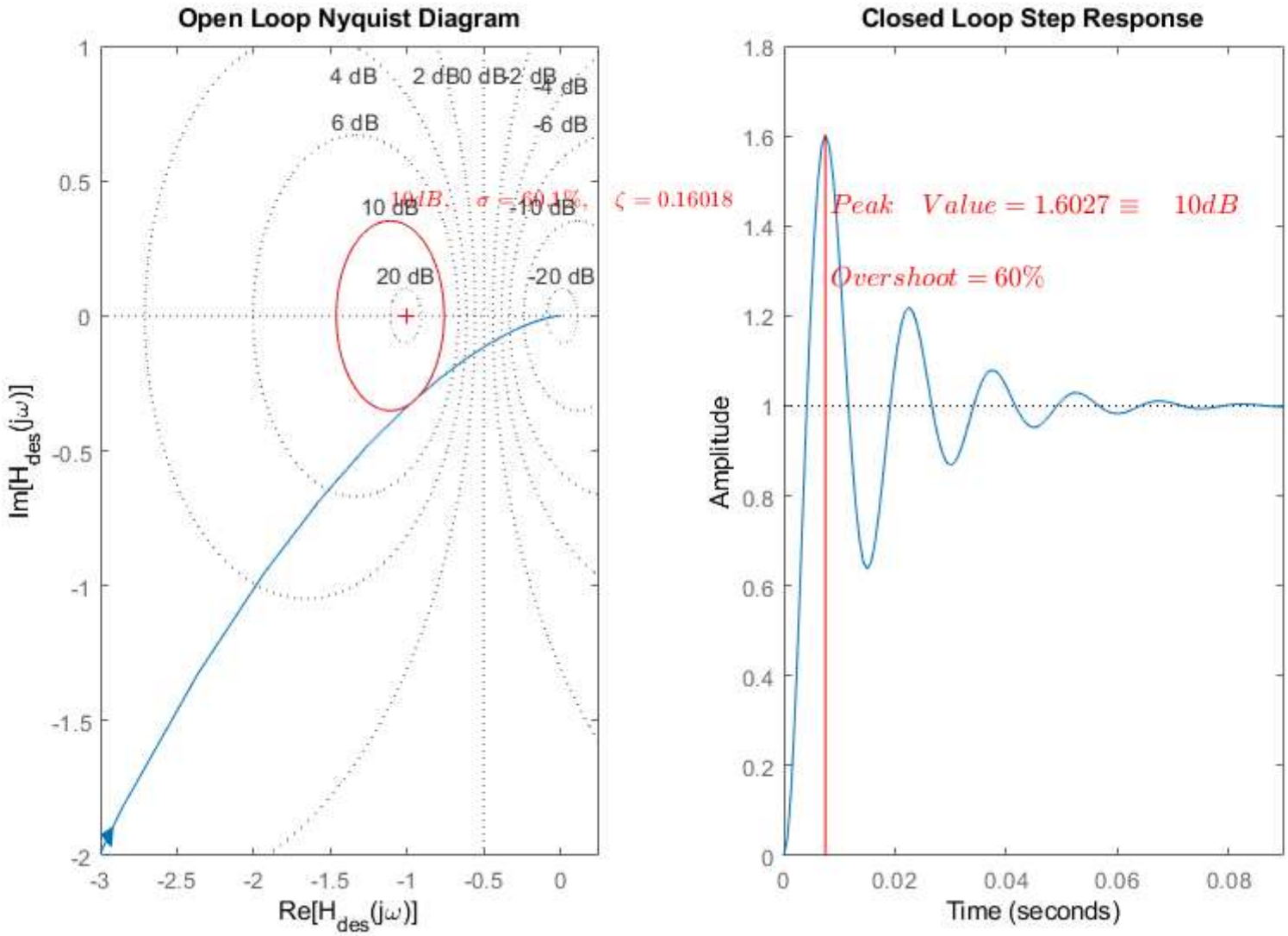
Examples

Example 1: for k=1 and no time delay ($\tau_m = 0$)

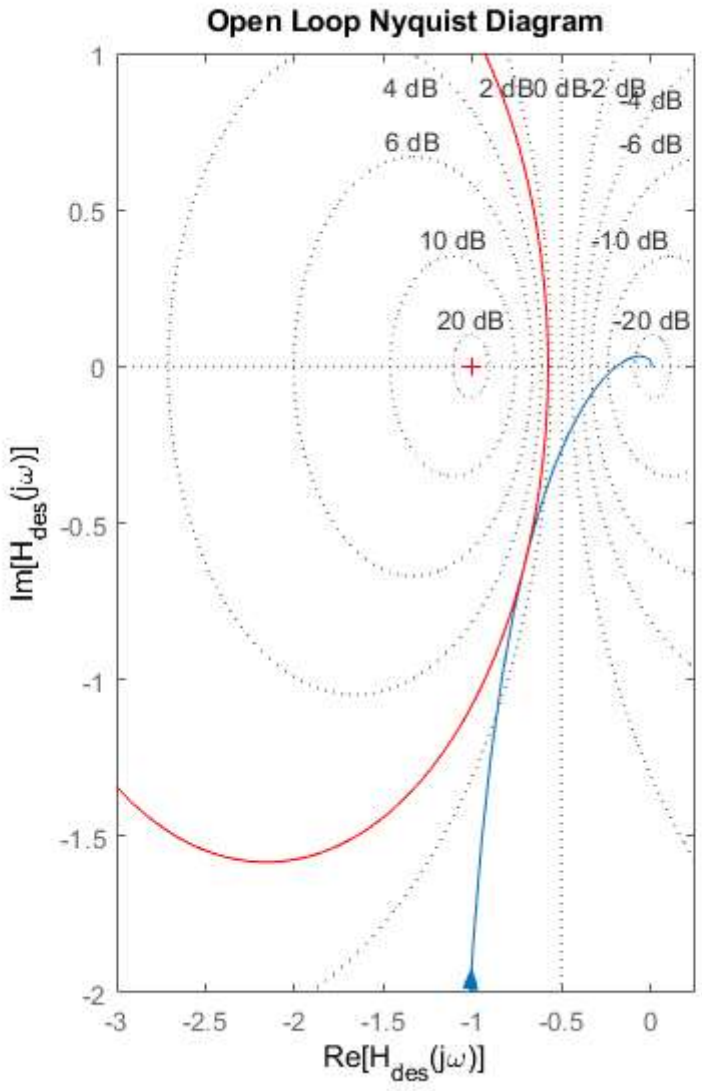


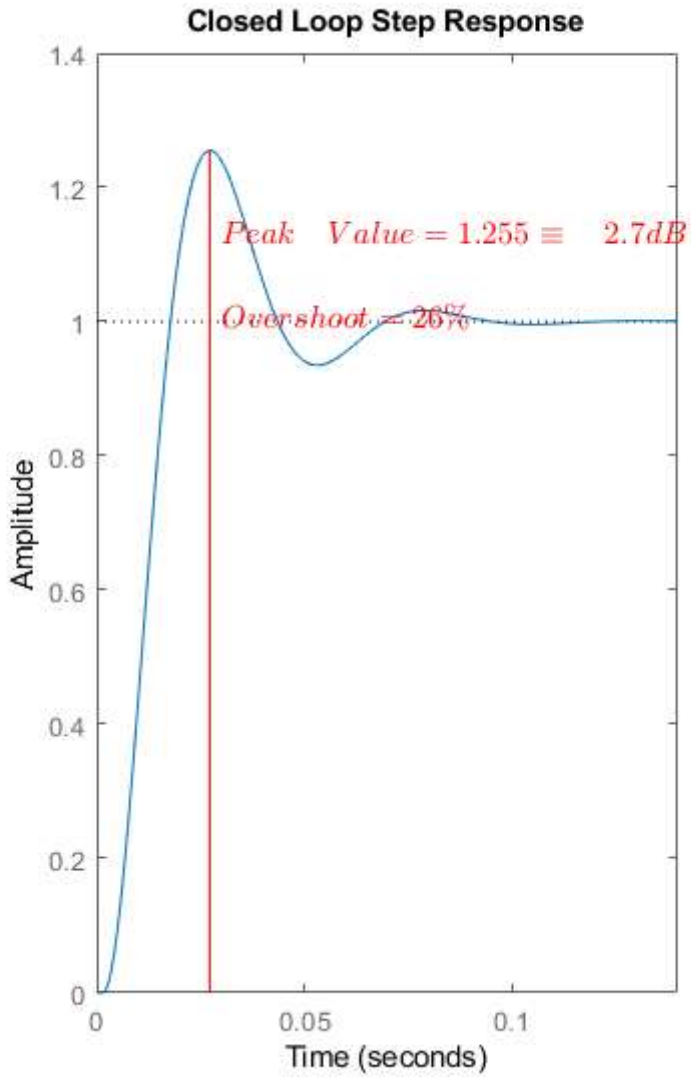


Example 2: for k=2 and $\tau_m = 0$



Example 3: for k=0.2 and $\tau_m = 0.015$





Problems

1. Develop a matlab function that plot on ND circle of constant magnitude;consider as input parameter magnitude (Mp-Peak Value); the circle has radius $r = \frac{M_p}{M_p^2 - 1}$ and is centered at $\left(-\frac{M_p^2}{M_p^2 - 1}, 0\right)$

2. Write a matlab function that converts the Peak Value (Mp) to overshoot and damping ratio; example of calling the function: [sigma, zeta]=compute_from_Mp(Mp)