Controller design using root locus

Exercise 1

A simple unity feedback system has a timedelay of 0.3 sec-

$$G(s) = \frac{Ke^{-0.3s}}{s+1}$$

Approximate the time delay function using a Pade approximation

Draw the root locus

Find the limit for K giving stability

Exercise 2

In a unity feedback system

$G(s) = \frac{K(s^2+2s+4)}{s(s+4)(s+6)(s^2+1.4s+1)}$

Plot the root locus for the system.

Find the K values that gives stability.

Exercise 3

A system G(s) has the transfer function $G(s) = \frac{10}{s(s+1)}$

Design a lead compensator using root locus so the closed loop system has a damping ratio ξ=0.5 and $\omega_n = 3$.

corresponding to

$$s^2 + 2\xi\omega_n s + \omega_n^2 = s^2 + 3s + 9$$

Test your result by a step response