Indian Institute of Technology Kanpur
Department of Electrical Engineering
EE 250 Control Systems Analysis
Tutorial Session 3

10 February 2021

Question 1.

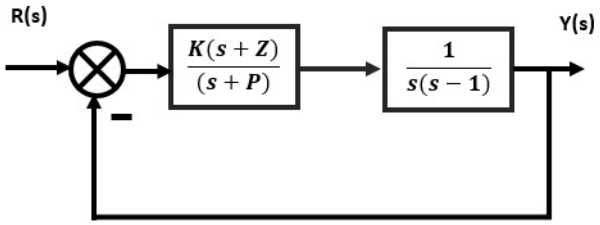
Determine the stability of the system with the characteristic equation given as $D(s) = s^4 - 1$ using Routh array. Validate your result.

Question 2.

Determine the stability of the system with the characteristic equation as $D(s) = s^5+2s^4+24s^3+48s^2-25s-50$ using Routh Array. Validate your result by finding the five roots of the system with the help of Auxiliary equation.

Question 3.

For the figure given below, find K, Z and P for which the close loop system is stable:



Question 4.

The open loop transfer function of a unity feedback system is given by $G(s) = \frac{K}{s(s\tau+1)}$ (K > 0, $\tau > 0$). By what factor must K be reduced so that the peak overshoot in the unit step response of the system is reduced from 75% to 25%.

Question 5.

A servo mechanism controls the angular position, θ, of a load with moment of inertia, J=$2.5kg - m^2$. The damping torque coefficient referred to the load shaft is $40N - m/rads/sec$. The motor develops a torque at the load at the rate of 1000N-m/rad of the error.

(a) Determine the frequency of the transient oscillation, the peak overshoot, the peak time and the steady state error due to an unit step input of 1 rad.

(b) Determine the steady state error when the command signal is 1 revolution/min.

(c) Determine the steady state error when a steady torque of 10 N-m is applied at the load shaft.