Aerospace Engineering Department, IIT Bombay
AE 308 & AE 775 – Control Theory
Tutorial 5

Q1

Sketch the root-locus plot of a system with its open loop transfer function as follows

$$G(s) = \frac{K}{s(s+1)(s^2+4s+13)}$$

Find the angles of departure and the points at which the root locus intersects the imaginary axis.

Q2

Sketch the root-locus plot of a system with its open loop transfer function as follows

$$G(s) = \frac{K(s+2)(s+3)}{s(s+1)}$$

Q3

Draw the Bode plot of a system with its open loop transfer function as follows

$$G(s) = \frac{Ks^2}{(s+5)(s+50)}$$

Q4

Draw the Bode plot of a system with its open loop transfer function as follows

$$G(s) = \frac{K(s+10)}{s^2(s+5)}$$

Q5

Sketch the Polar plot of a system with its open loop transfer function as follows

$$G(s) = \frac{K}{s^2(1+sT_1)(1+sT_2)(1+sT_3)}$$

Q6

Sketch the Nyquist plot of a system with its open loop transfer function as follows

$$G(s) = \frac{K}{s(s+3)(s+5)}$$

Find the point at which the plot intersects the negative real axis and find the gain margin. Also, find the range of K for the stability of the closed loop system.

Q7

Find the gain and phase margins of the system whose open loop transfer function is given by

$$G(s) = \frac{6}{(s+2)(s^2+2s+2)}$$

Q8

Consider the following open loop transfer function

$$G(s) = \frac{1}{(s+1)(s+2)(s+10)}$$

Design a PI controller such that the steady-state error due to a step input for the compensated system is zero while maintaining the same transient response.