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CONTROL LAB 4

PRELAB (On Paper)

Unity feedback system which has a $G(s) = \frac{K(s+2)}{s^2-4s+13}$ transfer function.

i) Draw root locus.

ii) Determine the points where the root loci cross the imaginary axis and find the gain on these points.

iii) Determine the angle of departure from the complex-conjugate open-loop poles.

iv) Determine the points where the root loci cross the real axis.

1)

Movement equation of the system in the following figure can be writed as $m\ddot{x}(t) + b\dot{x}(t) + kx(t) = f(t)$. Assume that M=1 kg, b=10 Ns/m, and k=20 N/m.

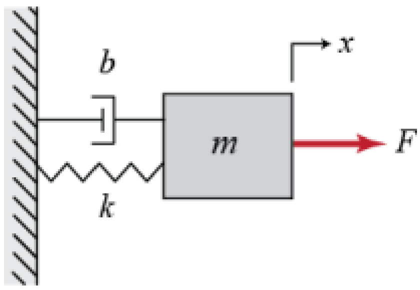

Fig. System

i) If system output x(t) is controlled by proportional controller, find Kp ranges which make to underdamped ,critically damped , overdamped, undamped system's response. Is there a Kp range that makes the system stable ? If it is, state this range. / On Paper/
ii) Draw step response of system for Kp ranges. / On Simulink/

2)

A) Given open-loop transfer function $G(s) = \frac{1}{s+1}$, draw root locus control system on MATLAB.

i) Check the root locus by adding a pole s= -2 point.

ii) Check the root locus by adding a pole s= -4 point.

B) Given open-loop transfer function $G(s) = \frac{1}{s(s+1)(s+4)}$, draw root locus control system on MATLAB

i) Check the root locus by adding a zero s= -5 point.

ii) Check the root locus by adding a zero s= -2 point.

iii) Check the root locus by adding a zero s= -0.5 point.

C) It is desired that given open-loop transfer function $G(s) = \frac{(s+2)}{s^2-4s+13}$ to stabilize without exceeding 52% overshoot. Find the required gain by root locus method and obtain the unit step response on MATLAB.