Control System: Homework 06 for Units 5A, 5B: Root Locus

Assigned: November 5, 2021

Due: November 18, 2021 (23:59)

1. (U5B: Root Locus)

3. For the characteristic equation

$$1 + \frac{K}{s^2(s+1)(s+5)} = 0,$$

(a) Draw the real-axis segments of the corresponding root locus.

(b) Sketch the asymptotes of the locus for $K \to \infty$.

(c) Sketch the locus.

(d) Verify your sketch with a Matlab plot.

2. (U5B: Root Locus)

4. *Real poles and zeros.* Sketch the root locus with respect to K for the equation $1+KL(s) = 0$ and the listed choices for $L(s)$. Be sure to give the asymptotes and the arrival and departure angles at any complex zero or pole. After completing each hand sketch, verify your results using Matlab. Turn in your hand sketches and the Matlab results on the same scales.

(a) $L(s) = \dfrac{2}{s(s+1)(s+5)(s+10)}$

(b) $L(s) = \dfrac{(s+2)}{s(s+1)(s+5)(s+10)}$

3. (U5B: Timing Property and Root Locus)

13. For the system in Fig. 5.53,

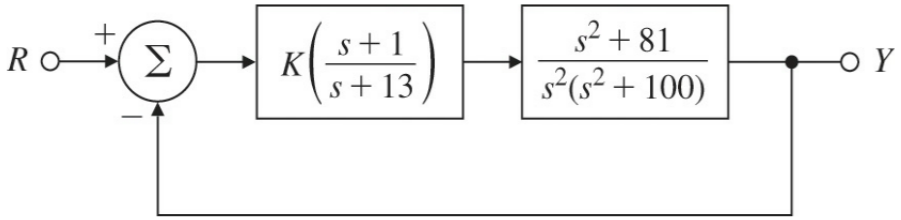

Fig. 5.53 Feedback system for Problem 5.13

(a) Find the locus of closed-loop roots with respect to K.

(b) Is there a value of K that will cause all roots to have a damping ratio greater than 0.5?

(c) Find the values of K that yield closed-loop poles with the damping ratio $\zeta = 0.707$.

(d) Use Matlab to plot the response of the resulting design to a reference step.