National Taiwan University

Department of Engineering Science and Ocean Engineering

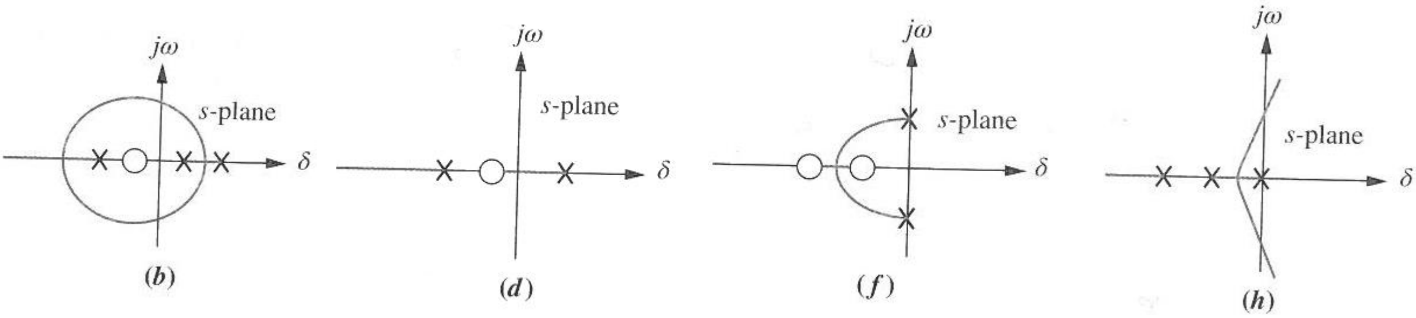
2019 Winter Semester

Homework 5

Chap 8 A Graph Tool – Root Locus

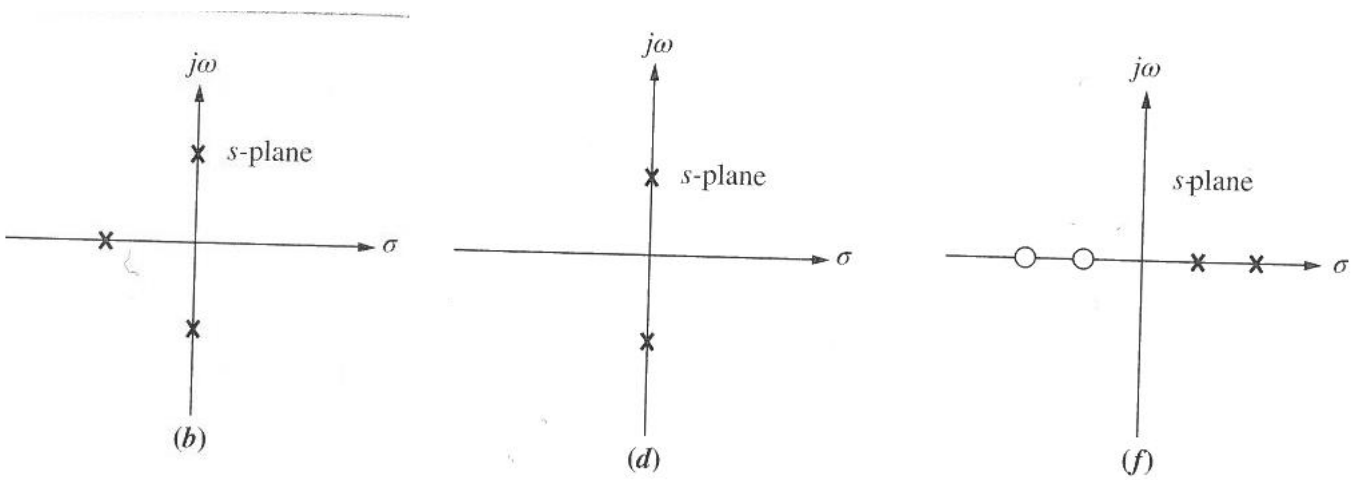
1. **Chap 8 Prob. 1 (b)(d)(f)(h)**

1. For each of the root loci shown in Figure P8.1, tell whether or not the sketch can be a root locus. If the sketch cannot be a root locus, explain why. Give *all* reasons. [Section: 8.4]



2. **Chap 8 Prob. 2 (b)(d)(f)**

2. Sketch the general shape of the root locus for each of the open-loop pole-zero plots shown in Figure P8.2. [Section: 8.4]



3. Chap 8 Prob. 10

10. Sketch the root locus and find the range of K for stability for the unity-feedback system shown in Figure P8.3 for the following conditions: [Section: 8.5]

a. $G(s) = \dfrac{K(s^2+1)}{(s-1)(s+2)(s+3)}$

b. $G(s) = \dfrac{K(s^2-2s+2)}{s(s+1)(s+2)}$

4. Chap 8 Prob. 14

14. Let the unity-feedback system of Figure P8.3 be defined with

$$G(s) = \frac{K(s+3)}{s(s+1)(s+4)(s+6)}$$

Then do the following: [Section: 8.5]

a. Draw the root locus.

b. Obtain the asymptotes.

c. Obtain the value of gain that will make the system marginally stable.

d. Obtain the value of gain for which the closed-loop transfer function will have two identical real roots.

5. Chap 8 Prob. 20(a)-(g)

20. Assume for the unity-feedback system shown in Figure P8.3, that

$$G(s) = \frac{K(s^2-2s+2)}{(s+1)(s+3)(s+4)(s+5)}$$

Then do the following: [Section: 8.7]

a. Make a sketch of the root locus.

b. Calculate the asymptotes.

c. Find the range of K for which the system is closed-loop stable.

d. Caculate the breakaway points.

e. Obtain the value of K that results in a step response with 20% overshoot.

f. Obtain the locations of all closed-loop poles when the system has 20% over shoot.

g. Discuss the validity of a second-order approximation for the given overshoot specification.

Submission place and deadline:
先進流體傳動控制實驗室 AFPCL R139 / 12:00 pm, December 17, 2019