

ECE 141, Spring 2022  
Homework 3

**3.53** Suppose that unity feedback is to be applied around the listed open-loop systems. Use Routh's stability criterion to determine whether the resulting closed-loop systems will be stable.

(a)  $KG(s) = \frac{4(s+2)}{s(s^3+2s^2+3s+4)}$

(b)  $KG(s) = \frac{2(s+4)}{s^2(s+1)}$

**3.54** Use Routh's stability criterion to determine how many roots with positive real parts the following equations have:

(a)  $s^4 + 8s^3 + 32s^2 + 80s + 100 = 0$

(c)  $s^4 + 2s^3 + 7s^2 - 2s + 8 = 0$

**3.57** Consider the closed-loop magnetic levitation system shown in Fig. 3.66. Determine the conditions on the system parameters ( $a$ ,  $K$ ,  $z$ ,  $p$ ,  $K_0$ ) to guarantee closed-loop system stability.

**Figure 3.66**

Magnetic levitation system for Problem 3.57

