

ECE 141 Homework 3

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Problem 3.53

(a)

Characterist equation

$$1 + KG(s) = 0$$

$$s(s^3 + 2s + 3s + 4) + 4(s + 2) = 0$$

$$s^4 + 2s^3 + 3s^2 + 8s + 8 = 0$$

Therefore we have

$$\begin{array}{rcll} s^4: & 1 & 3 & 8 \\ s^3: & 2 & 8 & \\ s^2: & -2 & 8 & \\ s^1: & 24 & & \\ s^0: & 8 & & \end{array}$$

Unstable because change of two sign changes, equal two roots, so Unstable

(b)

$$1 + KG(s) = 0$$

$$s^2(s + 1) + 2(s + 4) = 0$$

$$s^3 + s^2 + 2s + 8 = 0$$

Therefore we have

$$\begin{array}{rcl} s^3: & 1 & 2 \\ s^2: & 1 & 8 \\ s^1: & -6 & \\ s^0: & 8 & \end{array}$$

Unstable because change of two sign changes, equal two roots, so Unstable

Problem 3.54

(a)

$$\begin{array}{rcll} s^4: & 1 & 32 & 100 \\ s^3: & 8 & 80 & \\ s^2: & 22 & 100 & \\ s^1: & 43.6 & & \\ s^0: & 100 & & \end{array}$$

No sign change, so no roots

(b)

$$\begin{array}{rclcl} s^4: & 1 & 7 & 8 & \\ s^3: & 2 & -2 & & \\ s^2: & 8 & 8 & & \\ s^1: & 43.6 & & & \\ s^0: & 100 & & & \end{array}$$