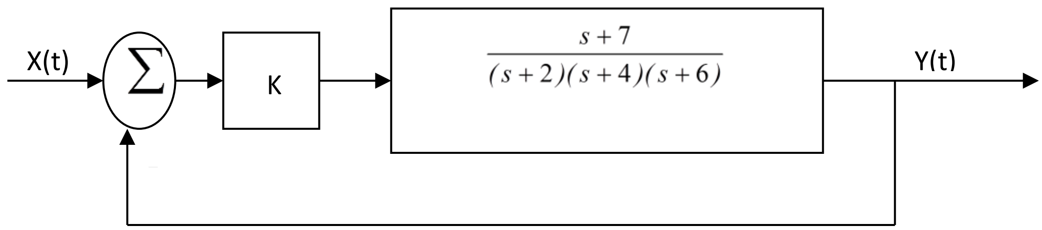
AMERICAN UNIVERSITY OF BEIRUT
ELECTRICAL AND COMPUTER ENGINEERING DEPARTMENT
EECE 340
Homework V – Routh Hurwitz Stability Criterion

Problem 1

Consider the unit feedback system shown below



a. Determine the error signal E(s).
b. Determine the range of K for the system to be stable

Problem 2

The open loop transfer function of a unity feedback control is given by:

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

Check for system stability by determining the number of poles in each half of the complex plane.

Problem 3

The open-loop transfer function of a unity-feedback control system is given by:

$$\mathrm{G(s)} = \frac{\mathrm{K}}{(\mathrm{S}+1)(\mathrm{S}+2)(\mathrm{S}+4)}$$

Determine the range of K for which this system is stable.

Problem 4

The transfer function of an LTI system is given by

$$\frac{Y(s)}{X(s)} = \frac{s+1}{s^6 + 2s^5 + 3s^4 + 6s^3 + 2s^2 + 4s + 1}$$

Where x(t) is the input and y(t) is the output. Determine the stability of the system by determining the number of poles of the system in each half of the complex plane.

Problem 5

The transfer function of a linear time-invariant system, whose input is x(t) and output y(t), is given by

$$\frac{Y(s)}{X(s)} = \frac{3s+10}{2s^4 + s^3 + 3s^2 + 5s + 10}$$

Check the stability of the system by determining the number of poles of the system in each half of the complex-plane.

Problem 6

The transfer function of a linear time-invariant system, whose input is x(t) and output y(t), is given by

$$\frac{Y(s)}{X(s)} = \frac{3s+10}{s^4 + s^3 - s - 1}$$

Check the stability of the system by determining the number of poles of the system in each half of the complex-plane.

Problem 7

The forward transfer function of a unity feedback control system is given by:

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

Check the stability of the system by determining the number of poles in each half of the complex plane.

Problem 8

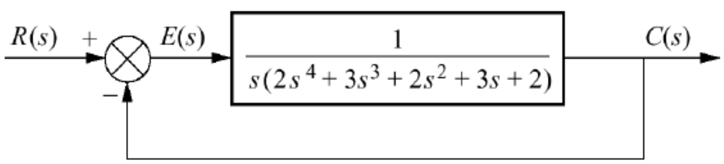
The closed-loop transfer function of a unity feedback control system, whose input is Y(s) and output is R(s), is given by

$$\frac{Y(s)}{R(s)} = \frac{10}{s^5 + 7s^4 + 6s^3 + 42s^2 + 8s + 56}$$

Check the stability of the above system by determining the number of poles in each half of the complex plane.

Problem 9

The block Diagram of a unity feedback control system is shown below



Find the number of poles in the left-half-plane, the right-half-plane, and on the jω-axis.