TD 3 Stability Analysis of Sampled Data Control Systems

Exercise N° 1

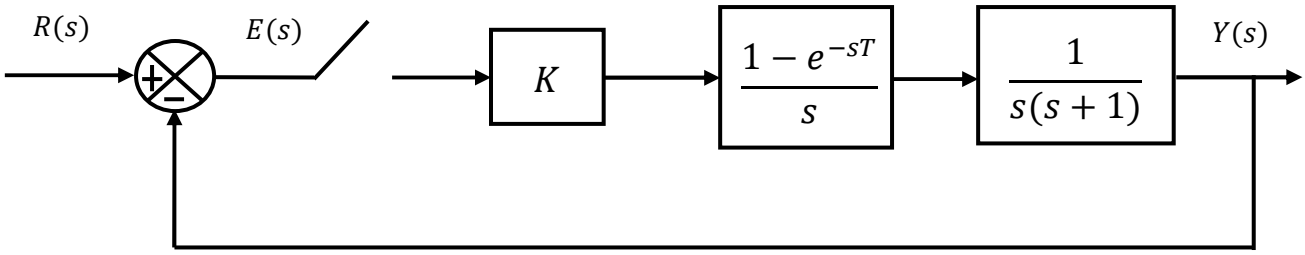
Given the following z transfer functions:

(a) $G(z) = \frac{4(z-2)}{(z-2)(z-0.1)}$, **(b)** $G(z) = \frac{4(z-0.2)}{(z-0.2)(z-0.1)}$, **(c)** $G(z) = \frac{5(z-0.3)}{(z-0.2)(z-0.1)}$, **(d)** $G(z) = \frac{8(z-0.2)}{(z-1)(z-0.1)}$

- Indicate the type of stability (asymptotic, marginal or in the sense of BIBO) of each transfer function.

Exercise N° 2

Consider the discrete (sampled data) feedback control system represented by the following block diagram:



1. Using the definition of stability in z-plane, study and analyze the stability of the above system for the case of *K* = 1 regarding the following two systems :
    a. Open loop control system.
    b. Closed loop (feedback) control system.
2. Now taking $K \neq 1$, using the **Jury** criterion, evaluate the stability of the closed loop control system as a function of the parameter *K*.

Exercise N° 3

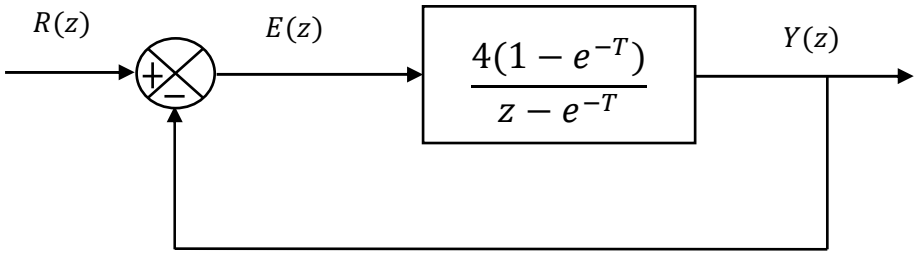
Given the discrete control system described by the following feedback z- transfer function:

$$F(z) = \frac{K}{z^2 + z + K}$$

- For the different values of the parameter *K*, study the stability of the system using **Jury** criterion.

Exercise N° 4

Consider the following discrete control system:



Study the accuracy of the feedback control system for the cases:

- $R(z)$: is a position step input.
- $R(z)$: is a velocity step input.
- $R(z)$: is an acceleration step input.

We give : T=0.2 (sec).