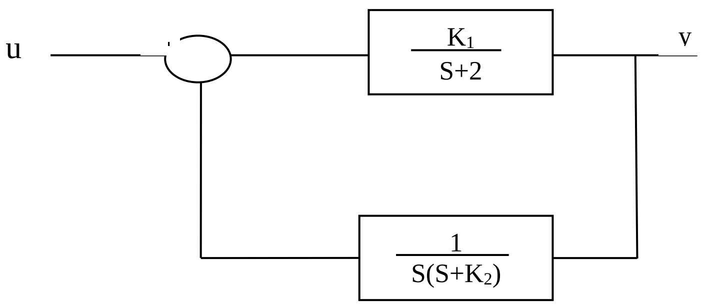
Cairo University
Faculty of Engineering
Computer Dept. - 3rd Year

ELC 3252
CONTROL ENGINEERING
3rd Year - 2022

SHEET 3

Error Analysis and Routh Stability

1. For the system shown in figure, find the conditions on K_1 and K_2 to make the system stable. Plot the region of stability for K_1 and K_2.



2. A unity feedback system has a forward transfer function of:

$$G(s) = \frac{12\,(s+4)}{s\,(s+1)\,(s+3)\,(s^2+2s+10)}$$

a) Determine the static error coefficients for this system.
b) Determine the steady state error and the steady state output for a reference input r (t) =16+2t and for r (t) =5t^2.
c) Is the closed loop system stable?

3. A unity feedback control system has the forward transfer function:

$$G(s) = \frac{k_v}{s\,(4s+1)\,(s+1)}$$

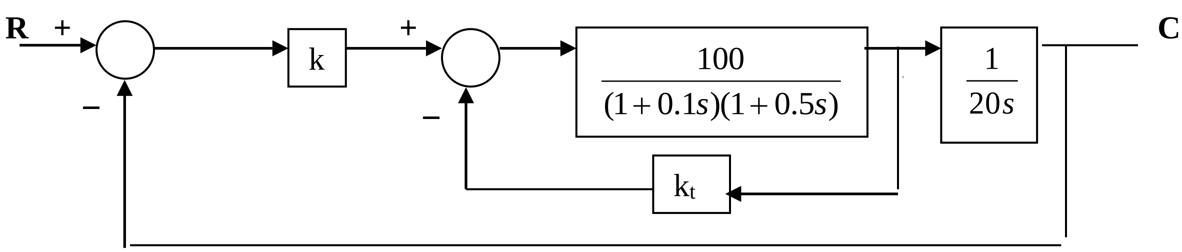
a) The steady state value of the error is desired to be less than or equal to 0.1 for a reference input r (t) = 1+t. Determine the minimum value of k_v that satisfies this requirement.
b) Check the stability of the system for the value k_v of obtained in part (a) and comment on your result. Not

4. The block diagram of a control system is shown the following figure. Find the step, ramp and parabolic error constants. The error signal is defined to be e (t). Find the steady state errors of the system in terms of k and k_t, when the following inputs are applied:

a) r (t) =6+8t

b) r(t) =2t+7 t^2

What constraint must be made on the values of k and k_t so that the answers are valid? Determine the minimum steady state error that can be achieved with a unit ramp input.



5. The block diagram of a feedback control system is shown in the figure. The error signal is defined to be e (t).

a) Find the steady state error of the system in terms of k and k_t when the input is a unit ramp function. Give the constraints on the values of k and k_t so that the answer is valid.