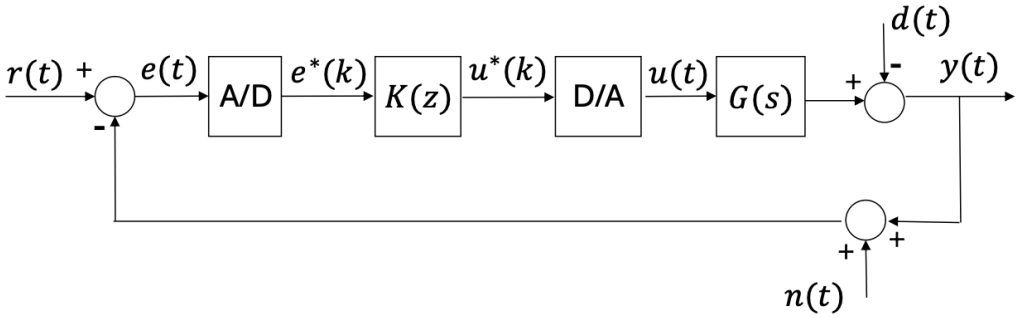
Industrial Automation – November 19th, 2024

Student:_____ **ID:**_____

1. For the closed-loop control system shown in figure,



where

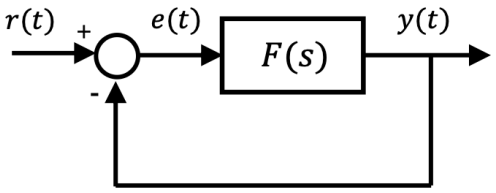
$$G(s) = \frac{20}{s^2 + 22s + 40},$$

a. design a digital control $K(z)$ by emulation of a continuous control design (i.e. by computing the discrete equivalent using Tustin's method) with a sampling time $T = 0.08$ sec, in order to satisfy the following requirements:

i. $e_\infty = 0.1$ w.r.t. a ramp reference signal $r(t) = \frac{1}{2}t \cdot 1(t)$;
ii. $y(t)$ with overshoot to a step reference signal $r(t)$ less than 15%;
iii. settling time $t_{s5\%} \leq 1$ sec.

b. discuss the action to be implemented for reducing the effect of high-frequency noise n (i.e., $n(t) = 0.1\sin(\omega t)$, with $\omega \in [70, 90]$ rad/s).

2. For the closed-loop control system show in figure,



where the open loop function is defined by

$$F(s) = \frac{\rho\left(s + \frac{3}{2}\right)}{s(s^2 + 2s + 10)},$$

draw the root locus and discuss the stability of the closed-loop control system for $\boldsymbol{\rho}>0$.

Time available: 2 hours