Automatic Control Systems – July 3rd, 2024

Student:_____ **ID:**_____

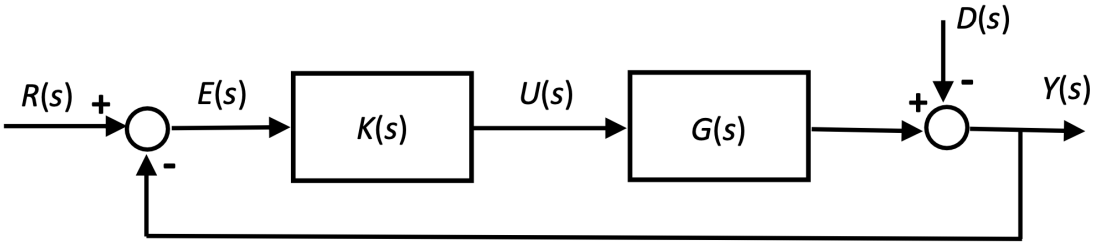
1. Given the LTI system defined by the transfer function $G(s)$,

$$G(s) = \frac{(s+15)}{(s^2+3s+25)},$$

   a. calculate the analytic expression of the forced response to a step input of unitary amplitude (i.e., step response);

   b. draw the qualitative step response.

2. For the closed loop system shown in figure,



where

$$G(s) = \frac{0.8}{(s^2+4.4s+1.6)},$$

   a. design $K(s)$ in order to satisfy the following requirements:

      i. $e_\infty \leq 0.1$ w.r.t. a step reference input $r(t) = 2 \cdot 1(t)$;

      ii. $y(t)$ with overshoot to a step reference input $r(t)$ less than 15%;

      iii. settling time $t_{s5\%} \leq 0.6$ sec.

   b. draw the qualitative response $y(t)$ of the devised closed loop system to the following inputs:

      $r(t) = 1(t)$;

      $d(t) = d_0 1(t - t_0)$ with $d_0 = 0.2$ and $t_0 = 2$ sec.

Time available: 2 hours