

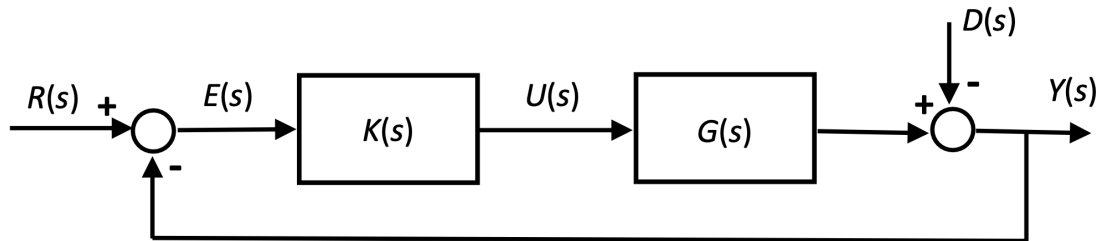
Automatic Control Systems – June 11th, 2024

Student: _____ ID: _____

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

$$G(s) = \frac{2(5s + 1)}{(s^2 + 8s + 12)},$$

- calculate the analytic expression of the forced response to a step input of unitary amplitude (i.e., step response);
 - draw the qualitative step response.
2. For the closed loop system shown in figure,



where

$$G(s) = \frac{10}{s(s + 10)},$$

- design $K(s)$ in order to satisfy the following requirements:
 - $e_{\infty} = 0$ w.r.t. a step disturbance $d(t) = d_0 1(t - t_0)$;
 - $y(t)$ without overshoot to a step reference input $r(t)$;
 - settling time $t_{s5\%} \leq 0.3$ sec.
- 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 $t_0 = 1$ sec.

Time available: 2 hours