

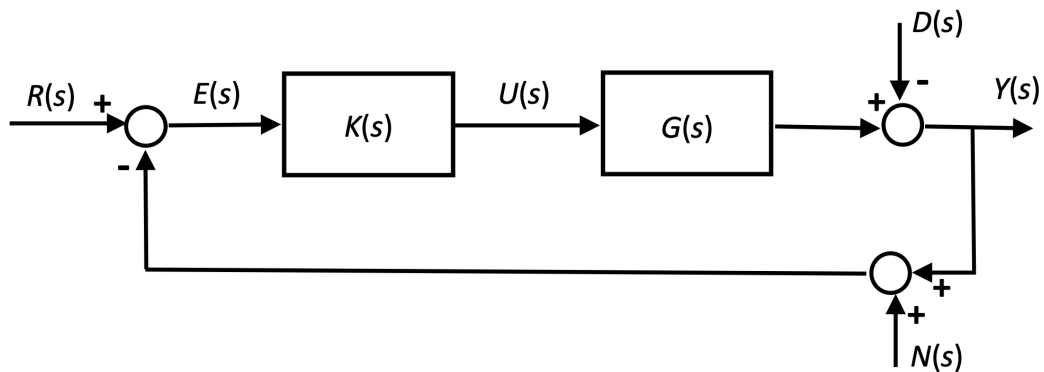
Automatic Control Systems – October 15th, 2024

Student: _____ ID: _____

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

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

- 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

$$G(s) = \frac{7}{s^2 + 9s + 14},$$

- design $K(s)$ in order to satisfy the following requirements:
 - $e_{\infty} = 0$ w.r.t. a step disturbance signal $d(t)$;
 - $y(t)$ with overshoot to a step reference signal $r(t)$ less than 20%;
 - settling time $t_{s5\%} \leq 1$ sec.
- for the designed controller, evaluate the effect of multifrequency noise $n(t)$ in the range $[50 \text{ } +\infty]$ rad/s on the system output $y(t)$.

Time available: 2 hours