

Automatic Control Systems – July 18, 2023

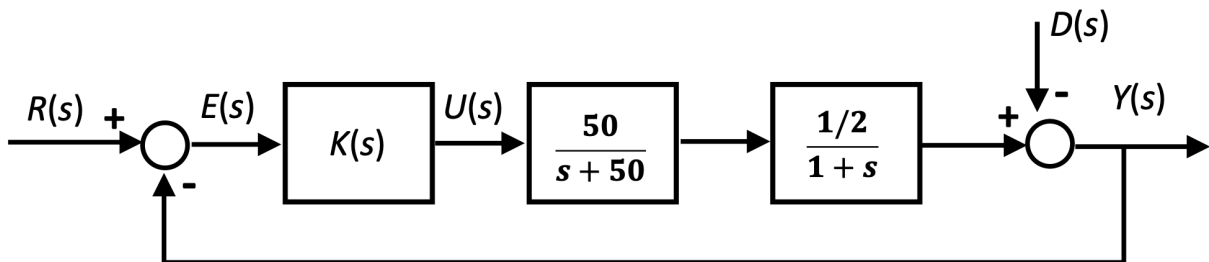
Student: _____ ID: _____

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

$$G(s) = \frac{s + 20}{s^2 + 2s + 8}$$

- 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 the reference r and the disturbance d are step signals,

- devise $K(s)$ in order to satisfy the following requirements:
 - rejection of the step disturbance $d(t)$ (i.e., $e_\infty = 0$);
 - no overshoot;
 - settling time $t_{s5\%} \leq 0.5$ s;
- calculate the gain stability margin of the devised control system.

Time available: 2 hours