

System Response

1. Consider the unit-step response of a unity-feedback control system whose open-loop transfer function is $G(s) = \frac{1}{s(s+1)}$

Obtain the rise time, peak time, maximum overshoot, and settling time.

2. Consider the closed-loop system given by

$$\frac{C(s)}{R(s)} = \frac{\omega_n}{s^2 + 2\zeta\omega_n s + \omega_n^2}$$

Determine the values of ζ and ω_n so that the system responds to a step input with approximately 5% overshoot and with a settling time of 2 sec.

3. Using MATLAB, obtain the unit-step response, unit-ramp response, and unit-impulse response of the following system:

$$\frac{C(s)}{R(s)} = \frac{10}{s^2 + 2s + 10}$$

4. Obtain both analytically and computationally the rise time, peak time, maximum overshoot, and settling time in the unit-step response of a closed-loop system given by

$$\frac{C(s)}{R(s)} = \frac{36}{s^2 + 2s + 36}$$

5. Fig. below shows three systems. System I is a positional servo system. System II is a positional servo system with PD control action. System III is a positional servo system with velocity feedback. Compare the unit-step, unit-impulse, and unit-ramp responses of the three systems. Which system is best with respect to the speed of response and maximum overshoot in the step response?

6. Using MATLAB, obtain the unit-step response curve for the unity-feedback control system whose open-loop transfer function is

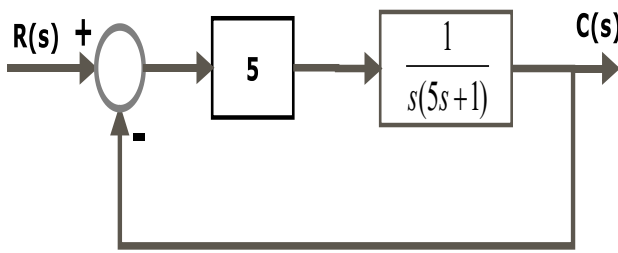
$$G(s) = \frac{10}{s(s+2)(s+4)}$$

Using MATLAB, obtain also the rise time, peak time, maximum overshoot, and settling time in the unit-step response curve

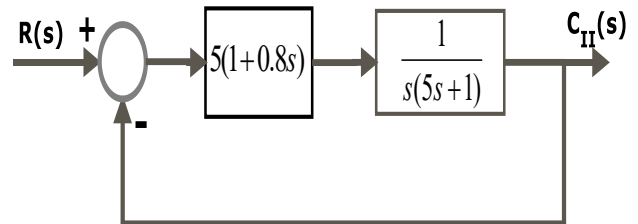
7. Consider the differential equation system given by

$$\ddot{y} + 3\dot{y} + 2y = 0, y(0) = 0.1, \dot{y}(0) = 0.05$$

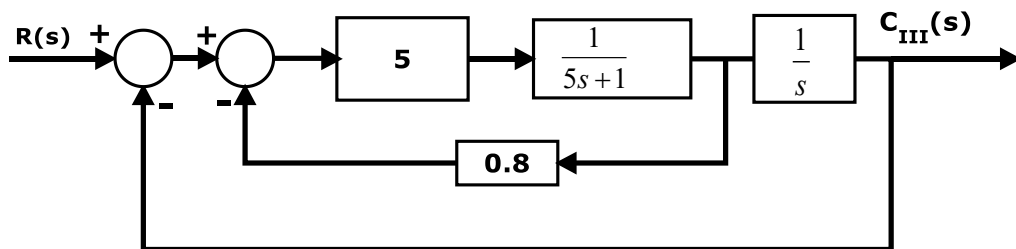
Using MATLAB, obtain the response $y(t)$, subject to the given initial condition



System I



System II



System III