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Lecture 13: Consider Transfer Function $G(s) = \frac{50}{s^2 + 6s + 25}$ $\left(\frac{\text{output (s)}}{\text{input (s)}} \right)$

Compared with the standard form: $\frac{\omega_n^2}{s^2 + 2\zeta\omega_n s + \omega_n^2}$

$$\Rightarrow \begin{cases} \cdot\ \omega_n^2 = 50 \Rightarrow \omega_n = \sqrt{50} \approx 7.071 \\ \cdot\ 2\zeta\omega_n = 6 \Rightarrow \zeta = \frac{3}{\omega_n} = \frac{3}{\sqrt{50}} \approx 0.424 \end{cases}$$

System properties:

- Settling time (t_s): $t_s = \frac{4}{\sigma} = \frac{4}{\zeta\omega_n} = \frac{4}{3} \simeq 1.33\ (s)$
- Peak time (t_p): $t_p = \frac{\pi}{\omega_d} = \frac{\pi}{\omega_n\sqrt{1-\zeta^2}} \approx 0.445\ (s)$
- Maximum overshoot: $M_p = \exp\left[-\zeta\pi / \sqrt{1-\zeta^2} \right] \simeq 0.249 \simeq 24.9\%$

Plot the step response of $\frac{50}{s^2+6s+25}$ in Matlab