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Assignment

a) Overshoot = $= \exp\left(\frac{-\pi\zeta}{\sqrt{1-\zeta^2}}\right)$

$= 5 \times 0.163033 = 0.815165$

b) Decay Ratio $= (\text{overshoot})^2 = 0.6644$

c) Max Value of $f(t)$

$$C(t) = \left[1 - \frac{e^{\zeta\omega_n t}}{\sqrt{1-\zeta^2}} \sin(\omega t + \phi)\right]$$

$\phi = \cos^{-1}(\zeta)$ $\quad 2\omega_n \varepsilon = 1$

$\varepsilon = 1/2$

$\omega_n = 1$

$\omega_d = \omega_n \sqrt{1-\zeta^2}$

$= \omega_n \sqrt{1 - \frac{1}{4}}$

$\frac{\omega_n \sqrt{3}}{2}$

$\phi = \cos^{-1}\left(\frac{1}{2}\right) = \pi/3$

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for max value we have to put t_p in t

$$t_p = \frac{\pi}{\omega_d} = \frac{2\pi}{\sqrt{3}}$$

f(t) = putting all values we get = 5.8157

d) ultimate values of $\lim_{t\to\infty} y(t)$

$$\lim_{t\to\infty} c(t) = 5$$

e) Rise time $= \frac{\pi - \phi}{\omega_d} = \frac{4\pi}{3\sqrt{3}} = 2.418$

f) period of oscillation $= \frac{2\pi}{\omega_d} = \frac{2\pi}{\sqrt{3}} \times 2$

$= 7.257$

- 20180IC3087
- Manan Madan