HW 10 Answers for Selected Problems

8.45) $M\% = 100e^{-\frac{\pi\zeta}{\sqrt{1-\zeta^2}}} = 20.8\%$

$t_p = \frac{\pi}{\omega_n\sqrt{1-\zeta^2}} = 0.524$

9.29)

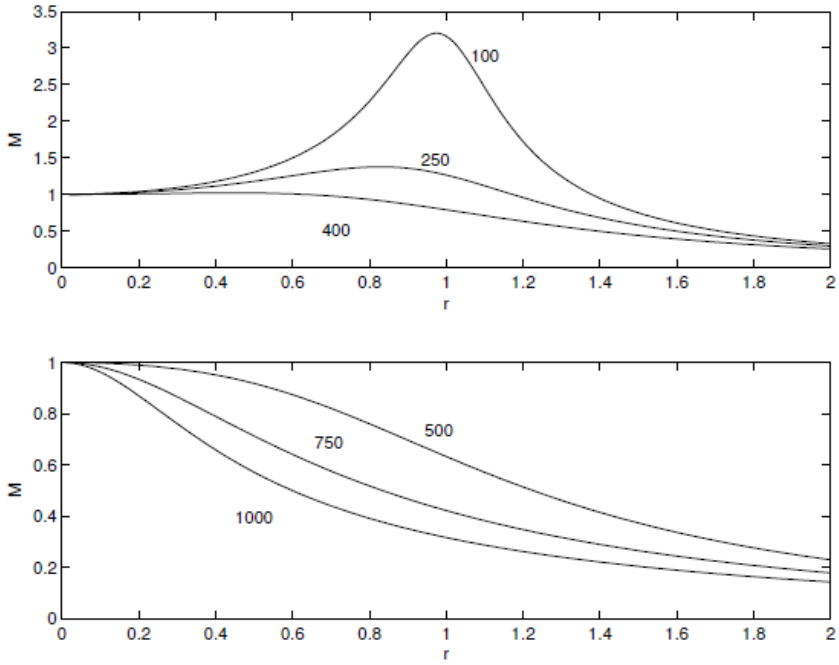

Figure : Plot for Problem 9.29

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9.40) $\frac{X(s)}{F(s)} = \frac{1}{s(359s + 718)}$

9.38) $k = 36100 \frac{\text{N}}{\text{m}}, \ c = 380 \ \frac{N \cdot s}{m}$

9.39) $\frac{X_1(s)}{Y(s)} = \frac{4096}{s^4 + 192s^2 + 4096}$

9.40) $\frac{X_1(s)}{Y(s)} = \frac{s + 0.2}{s^3 + 0.3s^2 + 1.01s + 0.2}$

1) Answers will vary

2)

3)

10.20) $\omega(t) = \frac{4}{5}t - \frac{8}{75} + \frac{8}{75}e^{-\frac{15t}{2}}$

$K_I = 0.0005; \tau = 200$

10.22) 1) $K_p = 36, K_I = 200$

2) $K_P = 36, K_I = 100$

3) $K_P = 216, K_I = 1000$

10.23)

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10.24) *Apply the final value theorem using* $\Omega_r(s) = T_d(s) = \frac{1}{s^2}$.

$$e_{ss} = \frac{4}{K_I}$$

$$For\ \zeta = 0.707, K_I = 200, e_{ss} = \frac{4}{200}$$

- $For\ \zeta = 1, K_I = 100, e_{ss} = \frac{4}{100}$
- $For\ \zeta = 1.74, K_I = 1000, e_{ss} = \frac{4}{1000}$

$$For\ the\ disturbance\ error, e_{ss} = \frac{1}{K_I}$$

- $For\ \zeta = 0.707, K_I = 200, e_{ss} = \frac{1}{200}$
- $For\ \zeta = 1, K_I = 100, e_{ss} = \frac{1}{100}$
- $For\ \zeta = 1.74, K_I = 1000, e_{ss} = \frac{1}{1000}$

10.25) 1) $K_P = 48;\ K_I = 150$

2) $K_P = 58;\ K_I = 400$

3) $K_P = 118;\ K_I = 1000$