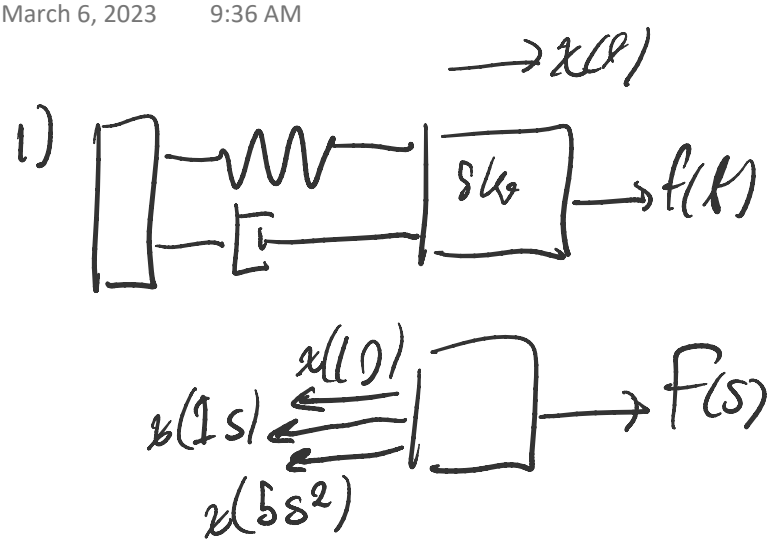
Quiz 6

March 6, 2023 9:36 AM



$$X(5s^2+s+10) = F(s)$$

$$\frac{F}{X} = \frac{1}{5s^2+s+10}$$

Unit step input

$$C(s) = \frac{1}{s(5s^2+s+10)} \qquad \frac{k\omega_n^2}{s^2+2\xi\omega_n+\omega_n^2}$$

$$= \frac{1}{5s(s^2+\frac{1}{5}s+2)}$$

$$\omega_n = \sqrt{2} \qquad 2\xi\sqrt{2} = \frac{1}{5}$$

$$\xi = \frac{1}{10\sqrt{2}}$$

$$k\omega_n^2 = 1$$

$$k = 1/2$$

$$\therefore OS = e^{-(\xi\pi/\sqrt{1-\xi^2})} \times 100$$

$$\%OS = e^{-(\xi\pi/\sqrt{1-\xi^2})} \times 100\%$$
$$= 79.99\%$$

$$T_s = \frac{4}{\frac{\sqrt{2}}{10\sqrt{2}}} = 40\,s$$

$$T_p = \frac{\pi}{\sqrt{g}\sqrt{1-\frac{1}{10\sqrt{2}}}} = 2.304\,s$$

from graph:
@ $\xi = 1/(10\sqrt{2})$, $T_r \approx 1.104$

$$C_{final} = 2$$