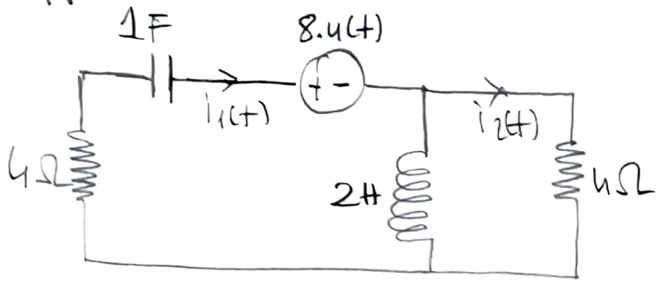
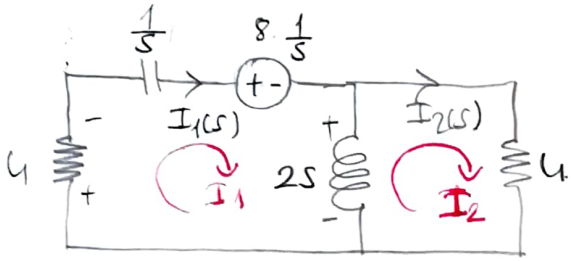
Mekatronik Müh. Otomatik Kontrol I Vize Sınavı Yanıtları

Güz 2021-2022

① Yanıt



Devrenin Laplace dönüşümünü oluşturalım.



Sol taraftaki loop üzerinde Kirchoff Gerilim Kanunu uygu..
$I_1(s) \rightarrow I_1$; $I_2(s) \rightarrow I_2$ kullanalım.

$$4I_1 + \frac{1}{s}I_1 + \frac{8}{s} + 2s(I_1 - I_2) = 0$$

$$4I_1 + \frac{1}{s}.I_1 + \frac{8}{s} + 2sI_1 - 2sI_2 = 0.$$

$$I_1\left(4 + \frac{1}{s} + 2s\right) - 2sI_2 = \frac{-8}{s}$$

$$I_1.\left(\frac{4s + 1 + 2s^2}{s}\right) - 2sI_2 = -\frac{8}{s} \quad \text{------ (1) nolu eşitlik.}$$

Sağ taraftaki loop üzerinde aynı işlemi yapalım.

$$-2s.(I_1 - I_2) + 4I_2 = 0$$

$$-2sI_1 + 2sI_2 + 4I_2 = 0 \Rightarrow 2sI_1 = (2s+4)I_2$$

$$I_1 = I_2.\left(\frac{2s+4}{2s}\right) =$$

$$I_1 = I_2\left(\frac{s+2}{s}\right) \text{----(2)}$$ Bu eşitliği (1) nolu eşitlikte yerine koyalım.

(1) in devami...

$$I_2\left(\frac{s+2}{s}\right)\left(\frac{2s^2+4s+1}{s}\right) - 2sI_2 = -\frac{8}{s}$$

$$I_2\left[\left(\frac{2s^3+4s^2+s+4s^2+8s+2}{s^2}\right) - 2s\right] = -\frac{8}{s}$$

$$I_2\left[\frac{2s^3+8s^2+9s+2-2s^3}{s^2}\right] = -\frac{8}{s}$$

$$I_2\left(\frac{8s^2+9s+2}{s}\right) = -8$$

$$I_2 = I_2(s) = \frac{-8s}{8s^2+9s+2} = \frac{-s}{s^2+\frac{9}{8}s+\frac{1}{4}}$$

$$I_1(s) = \left(\frac{s+2}{s}\right)\cdot\frac{-s}{s^2+\frac{9}{8}s+\frac{1}{4}}$$

$$I_1(s) = -\frac{s+2}{s^2+\frac{9}{8}s+\frac{1}{4}}$$

(2)

a) $\mathcal{L}\left(6\cos(2t)\cdot e^{5t}\right) = 6\cdot\mathcal{L}\left(e^{5t}\cdot\cos(2t)\right)$

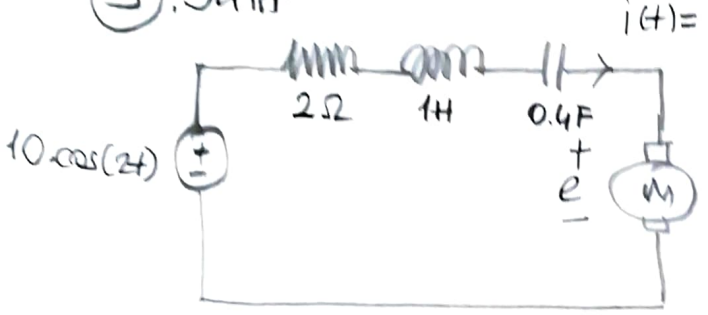
↑ zamanda ötelleme

$$= 6\cdot\left(\frac{s-5}{(s-5)^2+4}\right) = \frac{6s-30}{(s-5)^2+4}$$

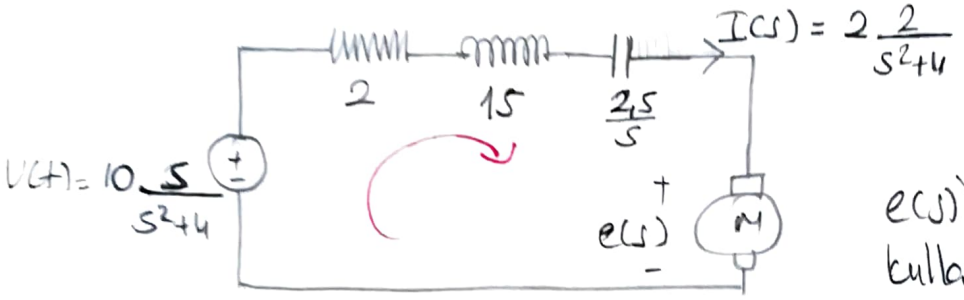
b) $\mathcal{L}^{-1}\left(\frac{s+12}{s^2+4}\right) = \mathcal{L}^{-1}\left(\frac{s}{s^2+2^2}\right) + \mathcal{L}^{-1}\left(\frac{6\cdot 2}{s^2+2^2}\right)$

$$= \cos(2t) + 6\cdot\sin(2t)$$

(3). Yanıt



Burada e(s)'i bulmak için Laplace dönüşümü uygulanmalı gerekir.



e(s)'yi bulmak için KGY kullanalım.

$$-\frac{10s}{s^2+4}+\frac{4}{s^2+4}\cdot\left[2+s+\frac{2,5}{s}\right]+e(s)=0$$

$$e(s)=\frac{10s}{s^2+4}-\frac{8}{s^2+4}-\frac{4s}{s^2+4}-\frac{10}{s.(s^2+4)}$$

$$e(s)=\frac{6s^2}{(s^2+4).s}-\frac{8s}{(s^2+4).s}-\frac{10}{(s^2+4).s}$$

$$e(s)=\frac{6s^2-8s-10}{s.(s^2+4)}$$