

Sistem Persamaan Diferensial

$x' = -2x + y$

$y' = -4x + 3y + 10 \cos t$

$y = x' + 2x$

$x'' = -2x' + y'$

$= -2x' - 4x + 3y + 10 \cos t$

$= -2x' - 4x + 3(x' + 2x) + 10 \cos t$

$= -2x' - 4x + 3x' + 6x + 10 \cos t$

$$x'' - x' - 2x = 10 \cos t$$

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$$x'' - x' - 2x = 10 \cos t$$

$$x'' - x' - 2x = 10 \cos t$$

$$x'' - x' - 2x = 0 \Rightarrow \lambda^2 - \lambda - 2 = 0 \Rightarrow \lambda_1 = -1, \quad \lambda_2 = 2$$

$$x_h = c_1 e^{-t} + c_2 e^{2t}$$

$$x_p'' = -K \cos t - M \sin t$$

$$x_p' = -K \sin t + M \cos t$$

$$x_p = K \cos t + M \sin t$$

$$x'' - x' - 2x = 10 \cos t$$

$$-K \cos t - M \sin t = -K \cos t - M \sin t$$

$$-(-K \sin t + M \cos t) = -M \cos t + K \sin t$$

$$-2(K \cos t + M \sin t) = -2K \cos t - 2M \sin t$$

$$= (-3K - M) \cos t + (K - 3M) \sin t +$$

$$(-3K - M) \cos t + (K - 3M) \sin t = 10 \cos t$$

$$(-3K - M) = 10 \quad (K - 3M) = 0$$

$$-3K - M = 10$$

$$3K - 9M = 0$$

$$-10M = 10$$

$$M = -1, \quad K = -3$$



$$x_p = K \cos t + M \sin t$$

$$x_p = -3 \cos t - \sin t$$

$$x(t) = x_h + x_p$$

$$x(t) = c_1 e^{-t} + c_2 e^{2t} - 3 \cos t - \sin t$$

$$y = x' + 2x$$

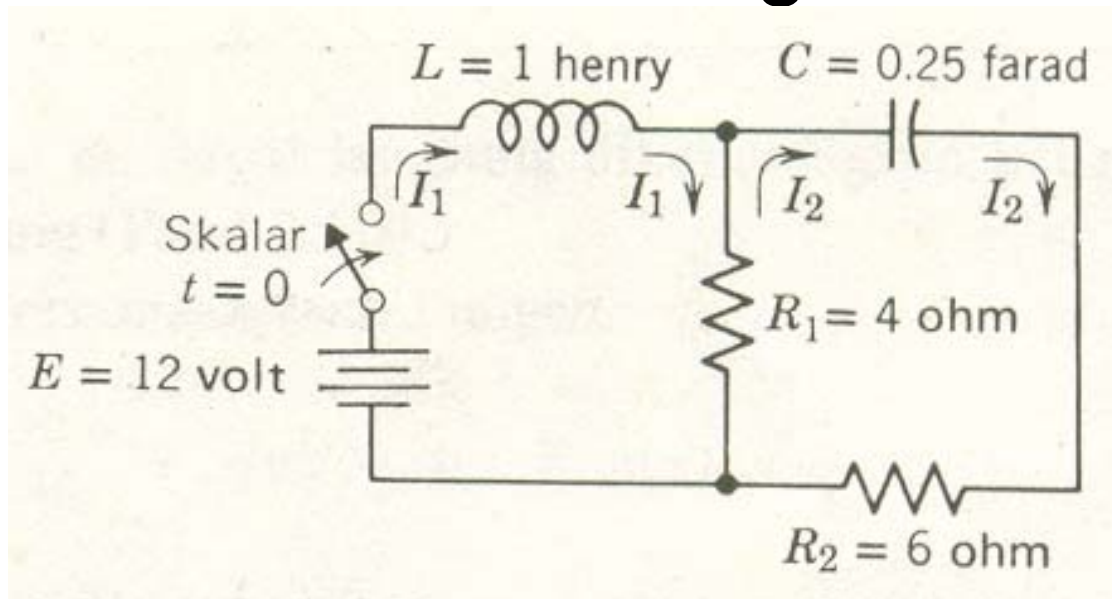
$$x'(t) = -c_1 e^{-t} + 2c_2 e^{2t} + 3 \sin t - \cos t$$

$$-c_1 e^{-t} + 2c_2 e^{2t} - \cos t + 3 \sin t$$

$$\underline{2c_1 e^{-t} + 2c_2 e^{2t} - 6 \cos t - 2 \sin t} +$$

$$y(t) = c_1 e^{-t} + 4c_2 e^{2t} - 7 \cos t + \sin t$$

Model Rangkaian



Cari I_1 dan I_2

Langkah 1. Membentuk Model Matematis

Loop sebelah kiri

$$I_1' + 4(I_1 - I_2) = 12$$

$$I_1' + 4I_1 - 4I_2 = 12$$

$$I_1' = -4I_1 + 4I_2 + 12$$

Loop sebelah kanan

$$6I_2 + 4(I_2 - I_1) + 4 \int I_2 dt = 0$$

$$6I_2' + 4I_2 - 4I_1 + 4I_2 = 0$$

$$-4I_1' + 10I_2' + 4I_2 = 0$$

$$I_2' = 0,4I_1' - 0,4I_2$$

Langkah 2. Menyelesaikan Sistem Persamaan Diferensial

$$I_1' = -4I_1 + 4I_2 + 12$$

$$I_2' = 0,4I_1' - 0,4I_2$$

$$I_2 = \frac{1}{4}I_1' + I_1 - 3$$

$$I_1'' = -4I_1' + 4I_2'$$

$$= -4I_1' + 4(0,4I_1' - 0,4I_2)$$

$$= -4I_1' + 1,6I_1' - 1,6I_2$$

$$= -4I_1' + 1,6I_1' - 1,6\left(\frac{1}{4}I_1' + I_1 - 3\right)$$

$$= -4I_1' + 1,6I_1' - 0,4I_1' - 1,6I_1 + 4,8$$

$$I_1'' + 2,8I_1' + 1,6I_1 = 4,8$$

PD Tak Homogen

Persamaan diferensial tak homogen

$$I_1'' + 2,8I_1' + 1,6I_1 = 4,8$$

Penyelesaian umum :

$$I_1 = c_1 e^{-2t} + c_2 e^{-0,8t} + 3$$

Mencari
 I_2

$$I_2 = \frac{1}{4} I_1' + I_1 - 3$$

$$I_1' = -2c_1 e^{-2t} + -0,8c_2 e^{-0,8t}$$

$$I_2 = \frac{1}{4} (-2c_1 e^{-2t} + -0,8c_2 e^{-0,8t}) + (c_1 e^{-2t} + c_2 e^{-0,8t} + 3) - 3$$

$$I_2 = \frac{1}{2} c_1 e^{-2t} + \frac{4}{5} c_2 e^{-0,8t}$$

Langkah 3. Penyelesaian khusus dari syarat awal

Syarat awal $I_1(0) = 0$, $I_2(0) = 0$

$$I_1(0) = c_1 + c_2 + 3 = 0$$

$$I_2(0) = \frac{1}{2}c_1 + \frac{4}{5}c_2 = 0$$

Mencari
 c_1 dan c_2

$$c_1 + c_2 = -3$$

$$\frac{1}{2}c_1 + \frac{4}{5}c_2 = 0$$

$$c_1 = -8, \quad c_2 = 5$$

$$I_1 = -8e^{-2t} + 5e^{-0,8t} + 3$$

$$I_2 = -4e^{-2t} + 4e^{-0,8t}$$