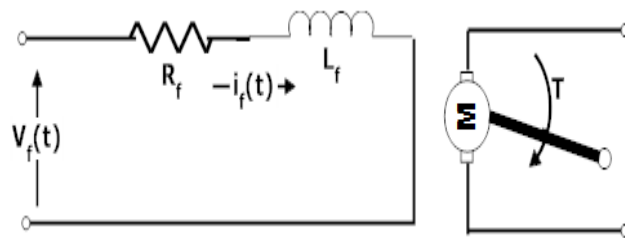


Report 001

For the field-controlled D.C. Motor shown below

- Draw the block diagram
- Find the transfer function $\frac{\theta(s)}{V_f(s)}$
- Find the response $\theta(t)$ given that the field voltage input is unit step and all the parameters settings are:
 - Field resistance $R_f \rightarrow 4$,
 - Field Inductance $L_f \rightarrow 1$

- Moment of Inertia $I \rightarrow 1$,Friction coefficient $b \rightarrow 5$
- Torque constant $K \rightarrow 10$

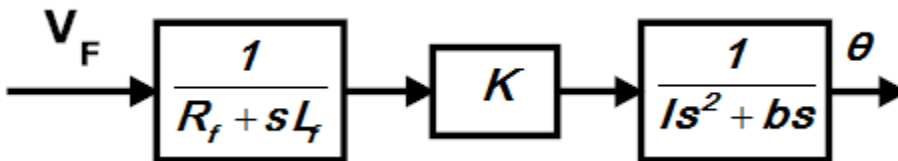


Solution

$$V_f = I_f(R_f + sL_f)$$

$$T = KI_f$$

$$T = (Is^2 + bs)\theta$$



$$\frac{\theta}{V_f} = \frac{K}{(R_f + sL_f)(Is^2 + bs)}$$

$$\frac{\theta}{V_f} = \frac{10}{(4 + s)(s^2 + 5s)}$$

$$V_f(t) = 1 \rightarrow V_f(s) = 1/s$$

$$\theta(s) = \frac{10}{s(4 + s)(s^2 + 5s)} = \frac{10}{s^2(4 + s)(s + 5)}$$

$$\theta(s) = \frac{0.5}{s^2} + \frac{\frac{10}{25} - \frac{10}{16}}{s} + \frac{\frac{10}{16}}{s + 4} - \frac{\frac{10}{25}}{s + 5}$$

$$\theta(t) = 0.5t + \frac{10}{25} - \frac{10}{16} + \frac{10}{16}e^{-4t} - \frac{10}{25}e^{-5t}$$