Undamped DC motor system: complete response
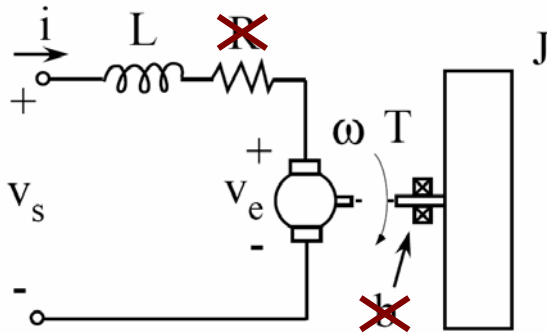

Electro-mechanical equations of motion
(time domain)

$$L\frac{di}{dt} + \cancel{Ri} + K_v\omega = v_s,$$

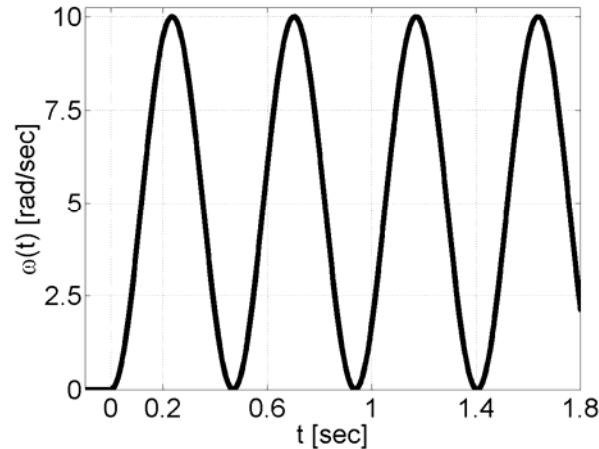$$J\frac{d\omega}{dt} + \cancel{b\omega} = K_m i$$

Step–function source

$$v_s(t) = V_0 u(t).$$

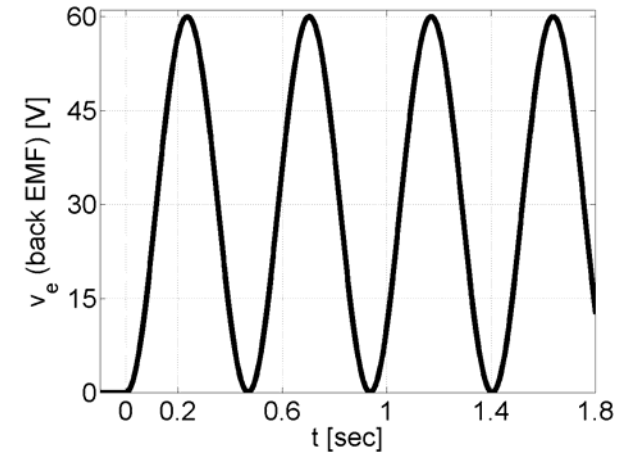$L = 0.1\text{H}, \ J = 2\text{kg} \cdot \text{m}^2,$
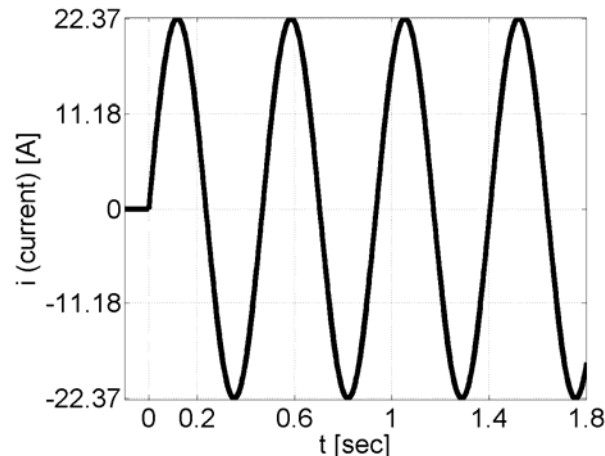$K_v = 6\text{V} \cdot \sec, \ K_m = 6\text{N} \cdot \text{m/A},$
$V_0 = 30\text{V}.$

$$\omega(t) = \frac{V_0}{K_v}\left(1 - \cos\left(\omega_n t\right)\right).$$

$$v_e(t) = K_v\omega(t).$$

$$i(t) = \frac{J}{K_m}\frac{d\omega(t)}{dt}.$$

$$v_L(t) = L\frac{di(t)}{dt} = v_s(t) - v_e(t).$$