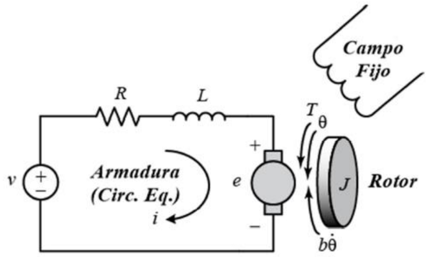
Modelo de motor DC controlado por corriente de armadura



$$v = iR + L\frac{di}{dt} + e$$

$$e = K_b\dot{\theta}$$

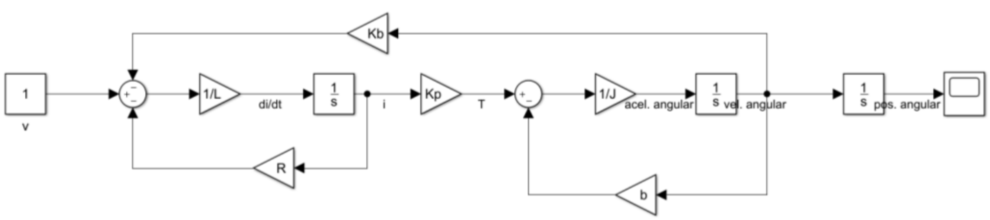
$$J\ddot{\theta} = T - b\dot{\theta}$$

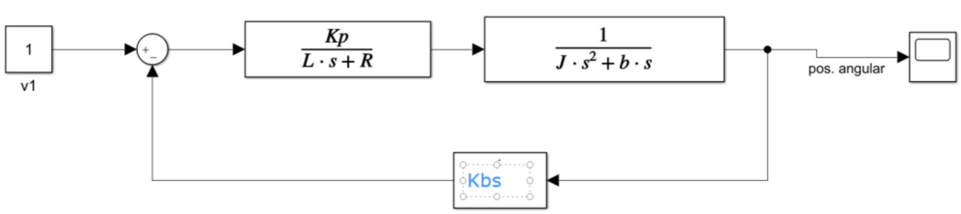
$$T = K_p i$$

DB:

$$\frac{di}{dt} = \frac{v - iR - K_b\dot{\theta}}{L}$$

$$\ddot{\theta} = \frac{K_p i - b\dot{\theta}}{J}$$





$$\frac{\theta(s)}{V(s)} = \frac{K_p}{(Ls+R)(Js^2+bs)+K_pK_bs}$$

$$\boxed{\boldsymbol{\frac{\theta(s)}{V(s)} = \frac{K_p}{JLs^3+(bL+RJ)s^2+\left(K_pK_b+Rb\right)s}}}$$

$$\boxed{\boldsymbol{\frac{\theta(s)}{V(s)} = \frac{K_p}{s\left(JLs^2+(bL+RJ)s+K_pK_b+Rb\right)}}}$$

$$\boldsymbol{\theta(s)s = W(s) \quad Transf.de\ Laplace\ de\ la\ vel.angular}$$

$$\boldsymbol{\frac{\theta(s)s}{V(s)} = \frac{K_ps}{s\left(JLs^2+(bL+RJ)s+K_pK_b+Rb\right)}}$$

$$\boxed{\boldsymbol{\frac{W(s)}{V(s)} = \frac{K_ps}{s\left(JLs^2+(bL+RJ)s+K_pK_b+Rb\right)}}}$$

$$\boxed{\boldsymbol{\frac{W(s)}{V(s)} = \frac{K_p}{JLs^2+(bL+RJ)s+K_pK_b+Rb}}}, \boldsymbol{k} =?, \boldsymbol{\omega_n} =?, \boldsymbol{\zeta} =?$$

Suponiendo que L<<R

$$\boldsymbol{\frac{W(s)}{V(s)} = \frac{K_p}{RJs+K_pK_b+Rb}, k = \frac{K_P}{K_pK_b+Rb}, \tau = \frac{RJ}{K_pK_b+Rb}}$$

VE:

$$\frac{di}{dt} = \frac{v-iR-K_b\dot{\theta}}{L}$$

$$\ddot{\theta} = \frac{K_pi-b\dot{\theta}}{J}$$

$$\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} i \\ \theta \\ \dot{\theta} \end{bmatrix}$$

$$u = v$$

$$y_1 = \theta$$

$$y_2 = \dot{\theta}$$

$$y_3 = i$$

Derivamos los estados:

$$\boldsymbol{\dot{x}_1 = \frac{u-x_1R-K_bx_3}{L}}$$

$$\dot{\boldsymbol{x}}_2 = \boldsymbol{x}_3$$

$$\dot{\boldsymbol{x}}_3 = \frac{\boldsymbol{K_p x_1 - b x_3}}{\boldsymbol{J}}$$

$$\boxed{\begin{bmatrix} \dot{\boldsymbol{x}}_1 \\ \dot{\boldsymbol{x}}_2 \\ \dot{\boldsymbol{x}}_3 \end{bmatrix} = \begin{pmatrix} -\boldsymbol{R/L} & \boldsymbol{0} & -\boldsymbol{K_b/L} \\ \boldsymbol{0} & \boldsymbol{0} & \boldsymbol{1} \\ \boldsymbol{K_p/J} & \boldsymbol{0} & -\boldsymbol{b/J} \end{pmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{pmatrix} \boldsymbol{1/L} \\ \boldsymbol{0} \\ \boldsymbol{0} \end{pmatrix} [\boldsymbol{u}]}$$

$$y_1 = x_2$$

$$y_2 = x_3$$

$$y_3 = x_1$$

$$\boxed{\begin{bmatrix} \boldsymbol{y}_1 \\ \boldsymbol{y}_2 \\ \boldsymbol{y}_3 \end{bmatrix} = \begin{pmatrix} \boldsymbol{0} & \boldsymbol{1} & \boldsymbol{0} \\ \boldsymbol{0} & \boldsymbol{0} & \boldsymbol{1} \\ \boldsymbol{1} & \boldsymbol{0} & \boldsymbol{0} \end{pmatrix} \begin{bmatrix} \boldsymbol{x}_1 \\ \boldsymbol{x}_2 \\ \boldsymbol{x}_3 \end{bmatrix}}$$