Modelo de motor DC controlado por corriente de armadura

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

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

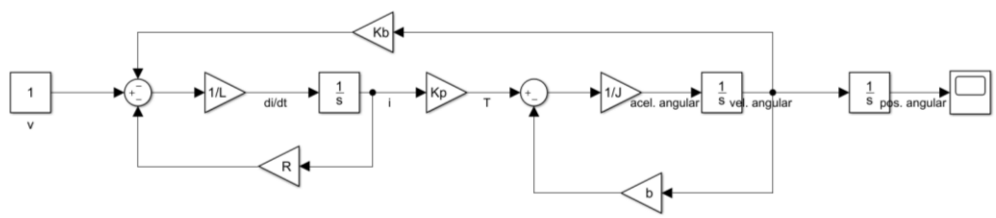
$$J\ddot{\theta} = T - b\dot{\theta}$$

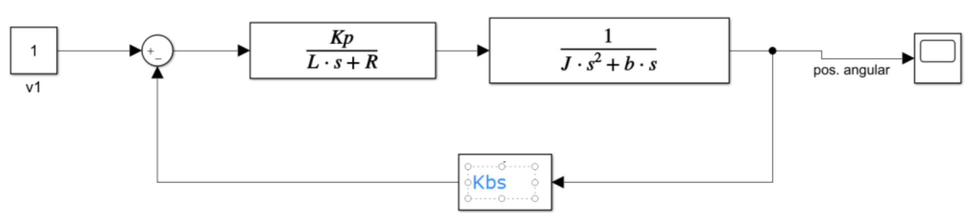
$$T = K_p i$$

DB:

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

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





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

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

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

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

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

Suponiendo que L<<R

$$\frac{\boldsymbol{W(s)}}{\boldsymbol{V(s)}} = \frac{\boldsymbol{K_p}}{\boldsymbol{RJs + K_pK_b + Rb}}$$

VE:

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

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

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

$$u = v$$

$$y_1 = \theta$$

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

$$y_3 = i$$

Derivamos los estados:

$$\dot{\boldsymbol{x}}_{\boldsymbol{1}} = \frac{\boldsymbol{u - x_1R - K_bx_3}}{\boldsymbol{L}}$$

$$\dot{\boldsymbol{x}}_{\boldsymbol{2}} = \boldsymbol{x_3}$$

$$\dot{\boldsymbol{x}}_{\boldsymbol{3}} = \frac{\boldsymbol{K_px_1 - bx_3}}{\boldsymbol{J}}$$

$$\boxed{\begin{bmatrix} \dot{\boldsymbol{x}}_{\boldsymbol{1}} \\ \dot{\boldsymbol{x}}_{\boldsymbol{2}} \\ \dot{\boldsymbol{x}}_{\boldsymbol{3}} \end{bmatrix} = \begin{pmatrix} \boldsymbol{-R/L} & \boldsymbol{0} & \boldsymbol{-K_b/L} \\ \boldsymbol{0} & \boldsymbol{0} & \boldsymbol{1} \\ \boldsymbol{K_p/J} & \boldsymbol{0} & \boldsymbol{-b/J} \end{pmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{pmatrix} \boldsymbol{1/L} \\ \boldsymbol{0} \\ \boldsymbol{0} \end{pmatrix} [\boldsymbol{u}]}$$

$$y_1 = x_2$$

$$y_2 = x_3$$

$$y_3 = x_1$$

$$\boxed{\begin{bmatrix} \boldsymbol{y_1} \\ \boldsymbol{y_2} \\ \boldsymbol{y_3} \end{bmatrix} = \begin{pmatrix} \boldsymbol{0} & \boldsymbol{1} & \boldsymbol{0} \\ \boldsymbol{0} & \boldsymbol{0} & \boldsymbol{1} \\ \boldsymbol{1} & \boldsymbol{0} & \boldsymbol{0} \end{pmatrix} \begin{bmatrix} \boldsymbol{x_1} \\ \boldsymbol{x_2} \\ \boldsymbol{x_3} \end{bmatrix}}$$