Motor Model

Figure 4.6, p. 221 (Dorf & Bishop)

Motor Model

Km

Controller

Response

K

Back EMF Gain

Kb

Armature

Conductance

1/R

Va

Ia

Tm

w

Motor

Dynamics

1

J.s+B

Motor

Response

Step

Vb

Kb

BEMF Gain

Va

1/R

Armature

Conductance

Km

Motor

Constant

Vb

Load

J, b

Speed

ω(t)

Constant field current

i_f

E

R_o

I_o

Steel bar

Conveyor

Rolls

Step 1

Motor

Response

Motor

Dynamics
Motor Step Response

Motor Parameters
- \( R = 2 \)
- \( K_m = 1 \)
- \( J = 1 \)
- \( B = 1 \)
- \( K_b = 1 \)

Feedback Control Model

Motor Model
- \( \frac{K_m}{R \cdot J} s + \frac{R \cdot B + K_m \cdot K_b}{R \cdot J} \)

Motor Response
- \( J \cdot s + B \)

Motor Constant
- \( K_m \)

Controller Response
- \( \frac{1}{R} \)
- \( \frac{K_m (R \cdot J)}{s + (R \cdot B + K_m \cdot K_b)/(R \cdot J)} \)

Controller Response
FB Control Step Response

Disturbances (Noise)
Superposition

\[ T_N(s) = \frac{Y(s)}{N(s)} \]

\[ T_U(s) = \frac{Y(s)}{U(s)} \]

Disturbances (Noise)
2nd Order Truck Suspension

\[ \frac{1}{1000s^2 + 2500s + 5000} \]

Step Response

First Order  Second Order