

Electromechanical actuator

$$L = N^2 \frac{\mu_0 A}{x} = \frac{k}{x}$$

Steady-state equilibrium equations:

$$V = RI$$

$$\frac{k}{2} \frac{I^2}{x^2} = F_a + K(\xi - x)$$

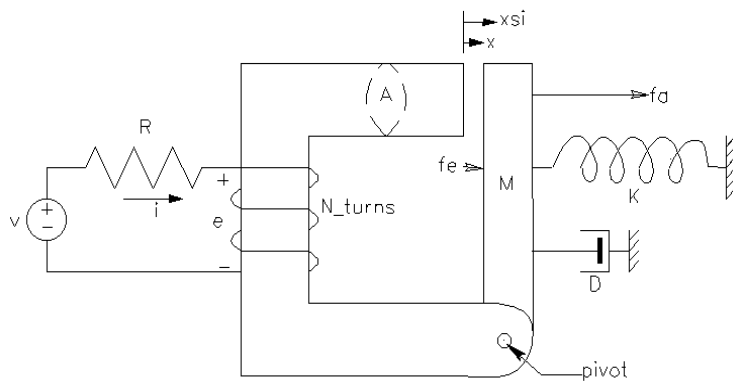
Dynamic equations:

$$v = Ri + e$$

$$f_a = M \frac{d^2 x}{dt^2} + K(x - \xi) + D \frac{dx}{dt} - f_e$$

$$e = \frac{d\lambda}{dt} = L \frac{di}{dt} + i \frac{dL}{dx} \frac{dx}{dt} = \frac{k}{x} \frac{di}{dt} - k \frac{i}{x^2} \frac{dx}{dt}$$

$$f_e = \frac{1}{2} i^2 \frac{dL}{dx} = -\frac{k}{2} \frac{i^2}{x^2}$$



equilibrium position

$$x = \xi$$

when $i=0$ & $f_a=0$