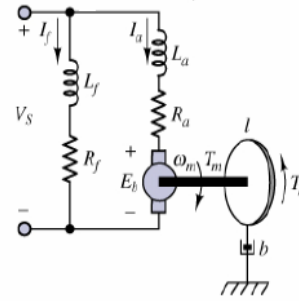


ELG2336: Lab 5

Known quantities:

A shunt-connected DC motor shown in Figure P19.36
 Motor parameters: k_a, k_T = armature and torque reluctance constant and k_f = field flux constant



Find:

Derive the differential equations describing the electrical and mechanical dynamics of the motor
 Draw a simulation block diagram of the system

Assumptions:

None

Analysis:

Electrical subsystem

$$V_S(t) = L_f \frac{dI_f(t)}{dt} + R_f I_f(t) \text{ field}$$

$$V_S(t) = L_a \frac{dI_a(t)}{dt} + R_a I_a(t) + k_a \phi \omega_m(t) = L_a \frac{dI_a(t)}{dt} + R_a I_a(t) + k_a k_f I_f(t) \omega_m(t) \text{ armature}$$

Mechanical subsystem

$$J \frac{d\omega_m(t)}{dt} = T_m(t) - T_L(t) - b \omega_m(t) = k_a \phi I_a(t) - T_L(t) - b \omega_m(t) = k_a k_f I_f(t) I_a(t) - T_L(t) - b \omega_m(t)$$

Simulation block diagram:

