

Lecture Module - Electrical Systems

ME3050 - Dynamic Modeling and Controls

Mechanical Engineering

Tennessee Technological University

Topic 4 - Mechatronics Applications

Electrical Systems

- What is Mechatronics?
- Example: DC Motor
- Governing Equations
- Model Derivation
- Response Equation

What is Mechatronics?

Example: DC Motor

Governing Equations

Model Derivation

Response Equation

What is Mechatronics?

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Example: DC Motor

Governing Equations

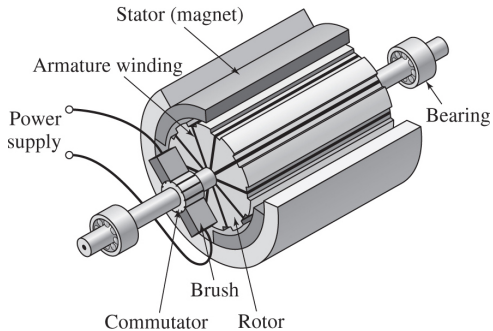
Model Derivation

Response Equation

What is Mechatronics?

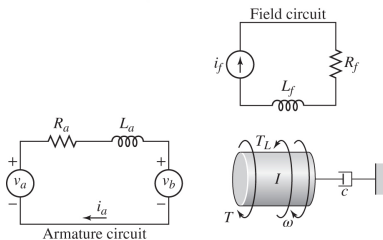
Example: DC Motor

Armature Controlled Brushed DC Motor



Example: DC Motor

Armature Controlled Brushed DC Motor



v_a : armature voltage (input)

R_a : armature resistance

Torque on armature

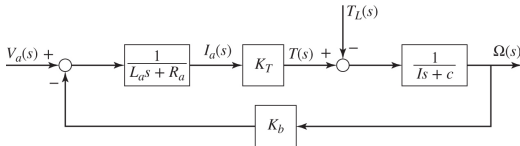
$$T = (nBLi_a)r = (nBLr)i_a = K_T i_a \quad (6.5.3)$$

Back EMF (electromotive force)
voltage

$$v_b = nBLv = (nBLr)\omega = K_b \omega \quad (6.5.4)$$

Example: DC Motor

Armature Controlled Brushed DC Motor



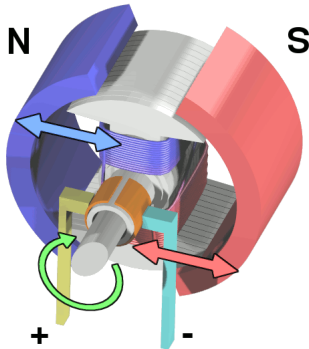
Kirchoff's Voltage Law

$$v_a - R_a i_a - L_a \frac{di_a}{dt} - K_b \omega = 0 \quad (6.5.5)$$

Newtons's Second Law

$$J \frac{d\omega}{dt} = T - c\omega - T_L = K_T i_a - c\omega - T_L \quad (6.5.4)$$

Example: DC Motor



Animation on Web

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