ECE 320 & ECE 329

ENERGY SYSTEMS I

BACKGROUND STUDY IN ENERGY SYSTEMS

SESSION no. 21

University of Idaho

$$T_e = K_a \Phi_d I_A$$

torque — constant — magnetic flux — armature current

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$$K_a = \frac{k C N}{2\pi a}$$

GEOMETRY ↓ (k)

Series ↓ (C)

← turns (N)

↑ Parallel paths (a)

$$E_A = K_a \Phi_d \omega$$

GENERATED VOLTAGE

ANGULAR VELOCITY

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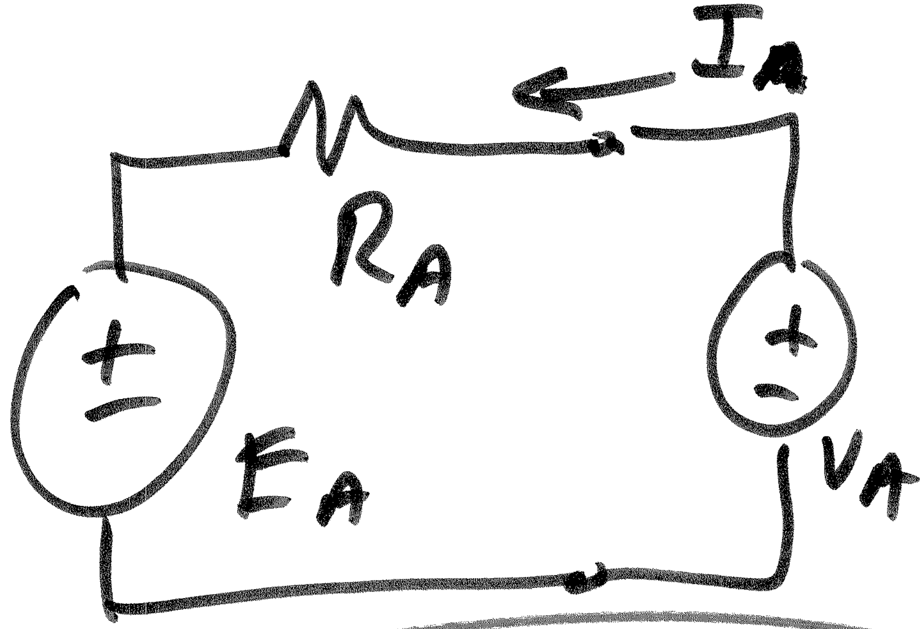


$$V_A = E_A + I_A R_A$$

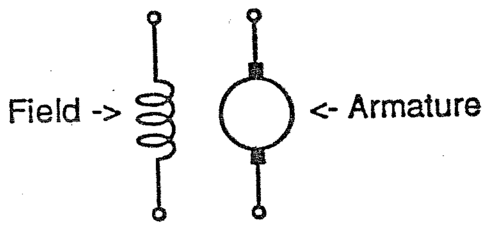
Terminal V — GENERATED VOLTAGE — ARMATURE CURRENT — ARMATURE RESISTANCE

POWER

$$P = T_e \omega = E_A I_A$$

DC Machine Fundamentals

Wiring Diagram Symbols



Field Winding Connections

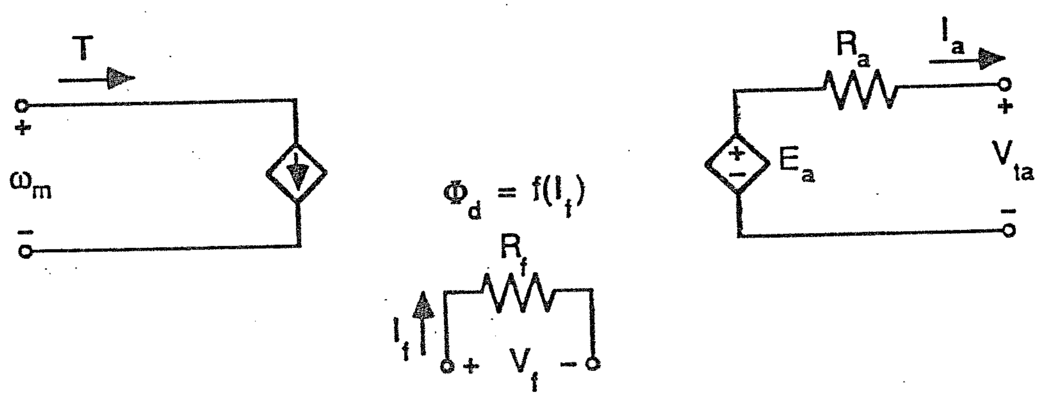
Separately excited

Shunt

Series

Compound

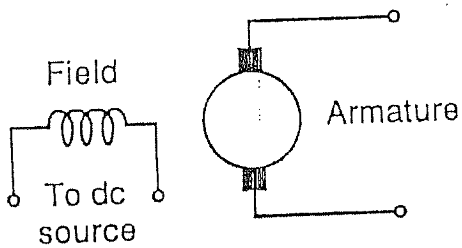
Equivalent Circuit Model (Generator Polarities)



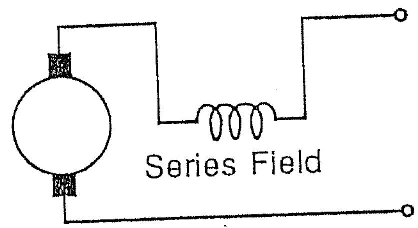
Relationships

Torque Equation	Field Equation	Voltage Equation
$T = K_a \Phi_d I_a$	$\Phi_d = f(I_f)$	$E_a = K_a \Phi_d \omega_m$
$\omega_m = \frac{2\pi n}{60}$	$V_f = I_f R_f$	$V_{ta} = E_a - I_a R_a$
	$K_a = \frac{P C_a}{2\pi m}$	

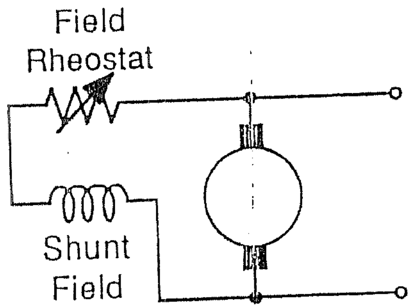
DC Machine Field Connections



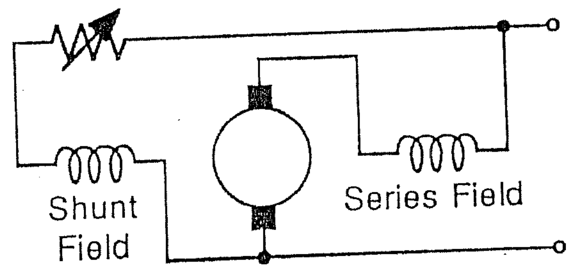
Separate Excitation



Series Field Connection



Shunt Field Connection



Compound Connection

ECE 320

Energy Systems I

Lesson 21

DC Motors

Next: examples; apply the basic equations! A model that predicts machine operation with a fairly few number of parameters.