

KING FAHD UNIVERSITY OF PETROLEUM & MINERALS

Electrical Engineering Department

EE 306 Electric Energy Engineering - Experiment#6

Torque Speed Characteristics of DC Shunt and Compound Motors

Objectives:

1. To study the variation of speed of shunt motor when load is changed.
2. To study speed vs. load characteristics of a compound motor.

Apparatus:

1 DC motor- generator set
1 Tachometer
1 DC Voltmeter
2 DC Ammeters
1 Power supply
1 Resistance

Theory:

For DC shunt and long shunt compound motors, current and flux are related by:

$$V_t = E_a + I_a R_a \quad (1)$$

$$E_a = K_a \omega_m \Phi \quad (2)$$

Which gives

$$\omega_m = \frac{V_t - I_a R_a}{K_a \Phi} \quad (3)$$

Using the equation

$$I_a = T_{dev} / (K_a \Phi) \quad (4)$$

We can write

$$\omega_m = \frac{1}{K_a \Phi} V_t - \frac{R_a}{(K_a \Phi)^2} T_{dev} \quad (5)$$

Equation (5) shows the relation between torque, speed, terminal voltage and flux of the motor.

Procedure:

1. Record the rated voltage, current and speed of the motor and the generator. The generator is used to load the motor.
2. Connect the circuit as shown in fig.1

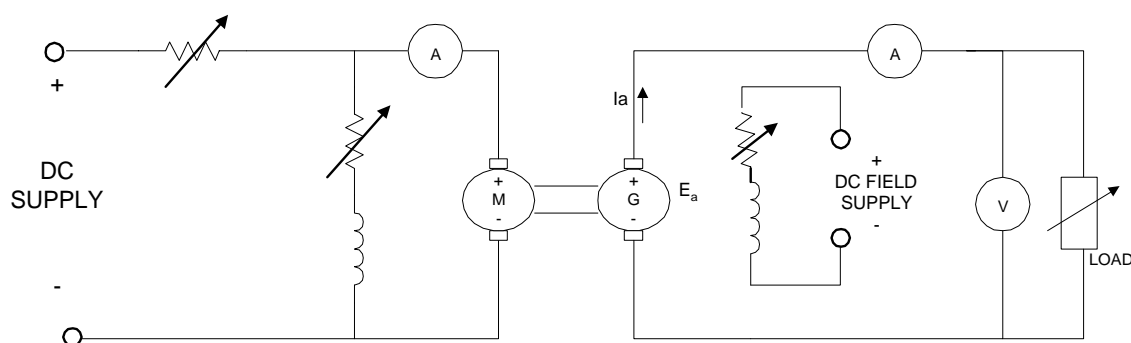


Fig.1: The Shunt Motor Generator Connection

3. Adjust the generator field resistance to maximum and motor field to minimum.
4. Start the motor and bring the speed to slightly more than rated.
5. Apply the generator field and buildup the voltage to its rated value.
6. Load the generator from no load to approximately 120 % full load by switching in the load rack. Adjust the generator terminal voltage to the rated value every time by varying the field rheostat and/or the field supply voltage.
7. Record the motor speed n (rpm) and the motor armature current I_a for every load value of load.
8. Make connection as given in fig.2 for the compound motor.

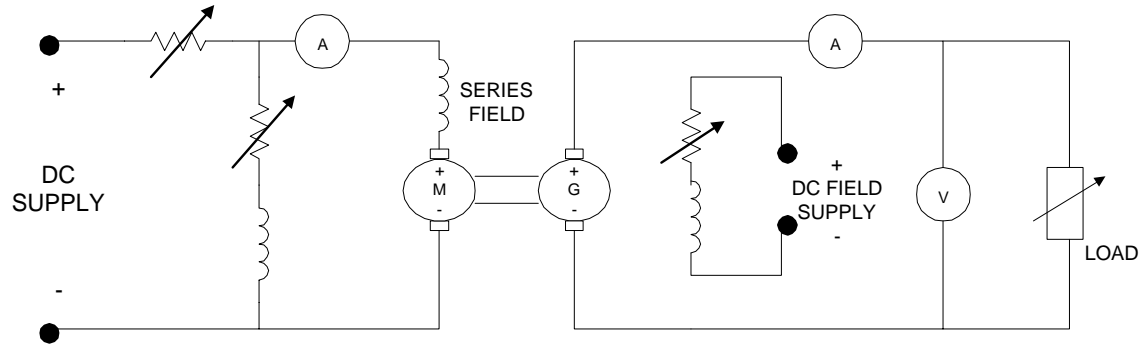


Fig.2: The Compound Motor Generator Connection

9. Repeat steps 3 thru 7 for the compound motor.

Report:

1. Plot the speed vs. motor armature current for the DC shunt motor.
2. Repeat 1 for the compound motor.
3. Calculate the speed regulation from no load to full load of the DC shunt motor.
4. Repeat 3 for the compound motor.

Compare the torque-speed characteristics of the two motors and note your observation.