EE 340L

EXPERIMENT No. 6

TORQUE-SPEED CHARACTERISTICS OF DC MOTORS

Use a variable DC supply to determine the armature resistance, series winding resistance, field winding resistance, maximum and minimum values of the field rheostat. Note that the rated current of the field winding and rheostat is 0.5A, while that of the series and armature windings is 3A.

I. Shunt-Excited DC Motor

1. Connect the DC machine as a shunt-excited motor to an AC generator (to be used as a load) as shown in figure 7(a).

2. Apply 0.5 DC amps to the AC generator field winding. The rotor switch should be in “Sync- Run”.

3. Start the motor with no load (AC generator terminals open) by increasing slowly the armature DC supply until the rated value is reached (115V). Adjust the field rheostat until it reaches a speed of 1800 RPM. Adjust the generator field current so that its terminal voltage reads 208V (line-to neutral). Record the DC motor armature current, field current, and speed.

4. Add load to the shaft by connecting a resistive load to the AC generator. Start from a high resistance of 600 Ohms per phase, then down to 300 Ohms, 200 Ohms, 150 Ohms, and 120 Ohms, and 100 Ohms. Record the DC motor source current and speed for each load.

5. Shunt off the main power supply.

II. Series-Excited DC Motors

1. Connect the machine as a series-excited motor (see figure 7(b)). Make sure that there is a mechanical load (AC generator with excited field current and with a load resistance of 600 Ohms per phase) before starting the machine.

2. Start the motor by slowly increasing the variable DC supply voltage from 0 V to 115 V. Read the speed and DC motor source current.

3. Increase the load as indicated in the section above. For each step, record the DC motor current and speed.

4. Shut down the main supply.
III. Compound-Excited DC motors

1. Test the motor to make sure that it is cumulative- rather than differential- compound excited

   (a) Short circuit the series winding as shown in Figure 7(c).
   (b) Start the motor under no load, and bring the speed to 1800 rpm.
   (c) Remove the short circuit and note the change in speed. If the speed is lower, then the machine is connected correctly. If not, place the short back and change the polarity of the series winding, then remove the short, and note the decrease in speed.

2. Increase the electric resistive load as indicated in the section above. For each step, record the DC source current and motor speed.

3. Shut down the main supply.

QUESTIONS:

1. For each reading in Parts I, II and III above, calculate the following:

   (a) Motor input power,
   (b) Motor copper loss,
   (c) Motor converted power,
   (e) Motor torque.

2. Plot the torque-speed curve of each of the three motors.

3. Plot the torque versus armature current for each of the three motors.