

ECE 331 Laboratory – Winter 2003
6. DC Generator Test

Objective:

To investigate the characteristics of a dc machine.



Fig. 6.1: 5 Hp DC Machine coupled to an Induction Machine

Procedure:

1. Nameplate Data

Take the nameplate data of the dc machine and get familiar with their meaning.

2. Resistance Test

Measure the resistances of field and armature windings by using the multimeter and micro-ohm meter.

3. Insulation Test

Using the mega-ohm meter measure the insulation resistance of the field winding.

4. Open Circuit Test (No-load)

Connect the dc machine in a separately excited configuration as shown in Fig. 6.2. The field is supplied from a variable dc power source. Measure the field current (I_f) and the armature voltage (V_a). Turn on the induction motor before you turn on the field voltage. Measure speed, field current and armature voltage, for field currents from 0 to max value and then from the max value down to 0.

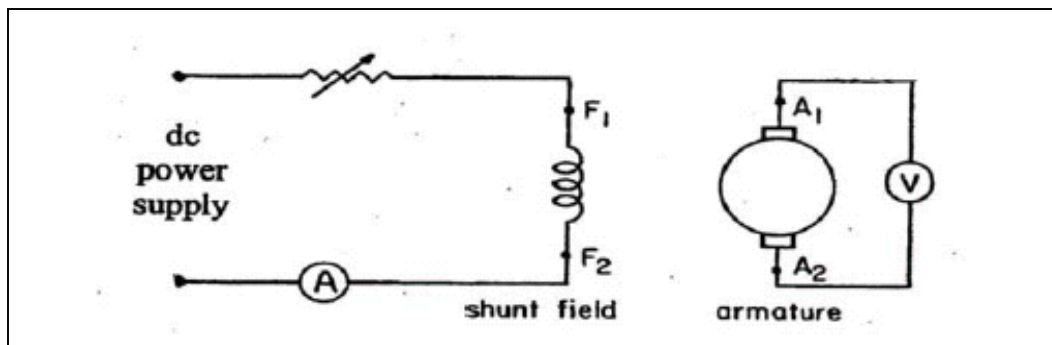


Fig. 6.2 Separately Excited dc machine for open circuit

5. Separately Excited Test

Connect the generator armature to the water rheostat load as shown in Fig. 6.3. Turn on the induction motor. Turn on the field supply and adjust the voltage until the field current reaches the value to give the rated armature voltage. Keeping the field current constant, increase the water rheostat in several steps until the armature current reaches 120% of its rated value. Measure speed, armature voltage, and armature current for these points.

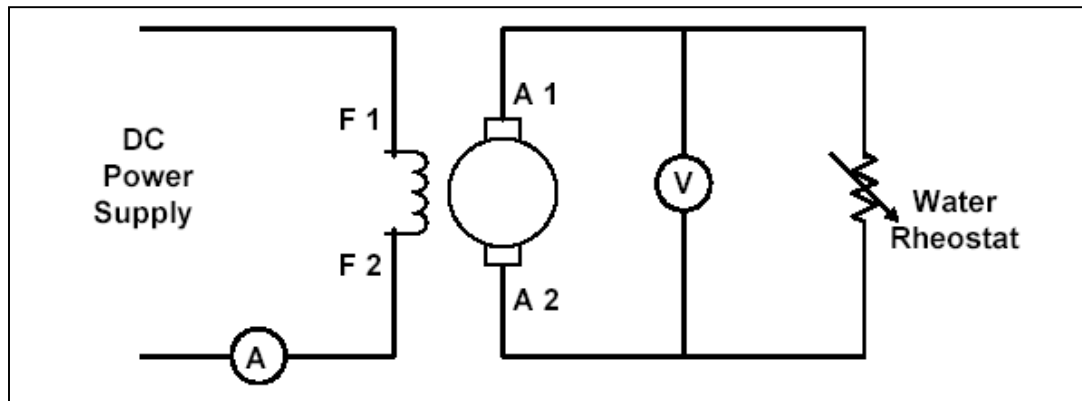


Fig. 6.3 Separately Excited dc machine for load test

6. Shunt Excited Test

Connect the generator as shown in Fig. 6.4. Adjust the external field resistance to a minimum. Turn on the induction motor. Increase the armature current by using the water rheostat in several steps and measure speed, armature voltage, armature current, and field current.

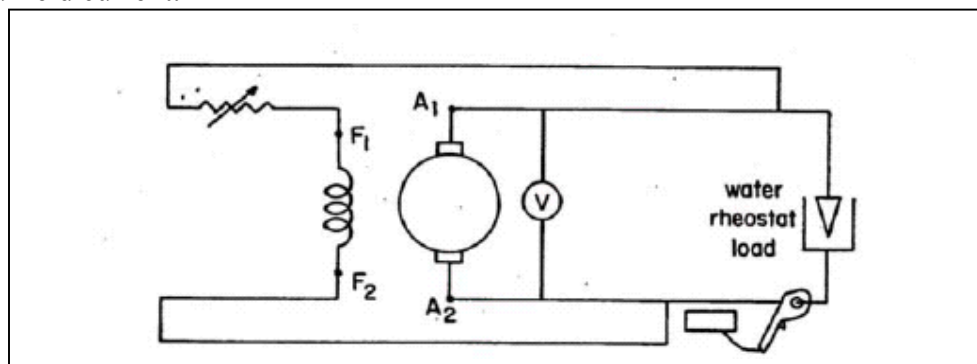


Fig. 6.4 Shunt Excited dc machine

7. Adjustable Speed Test

The induction motor is now connected to an inverter that makes an adjustable speed possible by developing adjustable frequency and voltage.

Reconnect the generator for the open circuit test as shown in Fig. 6.2. Turn on the field supply and adjust the voltage level that the rated field current is flowing. Turn on the inverter and increase the speed in several steps recording field current, speed, armature voltage.

Questions and Conclusion:

1. Graph armature voltage as a function of field current for the open circuit test.
2. Graph armature voltage as function of armature current for the separately excited test.
Determine the effective resistance between the armature terminals.
3. Graph armature voltage as a function of armature current for the shunt excited test.
Compare the graph with the results from the separately excited test.
4. Graph armature voltage as a function of speed for the adjustable Speed Test.
5. Comment on the form of each graph.
6. Give a Thevenin equivalent circuit for the generator armature circuit.
7. For the generator operation: what is the relation between armature voltage and load?
8. In the motor operation: what problem occurs during startup?
9. Name and draw four excitation schemes.