Induction Generator Expt 2: Study of the self-excitation characteristics of an induction generator

Procedure:

Do this experiment on the same machine for which you obtained the equivalent circuit parameters in Expt. 1. This experiment actually consists of three parts. In the first part, the self-excitation is studied at different capacitance values and in the second part the speed versus voltage characteristic is studied at a certain value of capacitance. These two parts are performed at no load. In the third part, the load-test is performed.

1. Connect a three-phase capacitor bank (of capacity higher than the calculated minimum value) across the stator terminals of the induction machine. Connect a zero-centered MC ammeter across two of the rotor terminals to indicate the slip. Start the d.c. machine as a motor with armature resistance. As the machine picks up speed, initially a very small voltage appears in the induction machine terminals. Then, at a certain speed, self-excitation takes place and the stator voltage will shoot up. Note down the speed and the voltage. Repeat this procedure at various values of capacitance.

2. In the second part, take a capacitance of value above the minimum value required for operation at 50 Hz. Obtain self-excitation, and then increase the speed in steps. Note the voltage and speed.

3. Add a three phase loading rheostat through a switch, to the stator of the induction machine. First obtain self-excitation and then increase the speed so that the terminal voltage reaches the rated value. Close the loading switch and increase the load in steps. Keep the speed constant with the help of the d.c. machine. Note all the meter readings. It is desirable to increase the loading in small steps, because the voltage will collapse if the load is increased beyond a threshold value. Plot voltage versus current, efficiency versus loading, power output versus loading, and slip versus loading.

4. Now keep the load constant and vary the speed, simulating a wind turbine supplying a heating load. Note all meter readings again. Plot the terminal voltage versus speed.

Measure the slip by counting the oscillations of the rotor ammeter in case of wound-rotor machine. For a squirrel-cage machine, connect a line-frequency stroboscope to the stator terminals (not to the power line), and count the revolutions of the chalk-mark on the rotor.
Report:

1. For each capacitance value, first predict the speed of self-excitation from the data of Expt.1, and then confirm the prediction with the experiment. State why the rotor ammeter was stationary throughout the experiment.

2. Explain why the slip increased with increased loading though the speed is constant. Report the qualitative conclusions regarding the characteristics of a self-excited induction generator.