No-load and Blocked rotor tests of a Three-Phase Induction Machine

1 Aim of the Experiment

The aim of this experiment is to determine the equivalent circuit of a three phase induction machine. This is typically done by performing the no-load and blocked rotor tests.

2 Background

The no-load test is used to determine the magnetizing branch values — the core loss and the magnetizing inductance. The blocked rotor test is used to determine the winding resistance and inductances. An induction machine on no-load runs close to synchronous speed and hence the rotor circuit carries very little current. In this laboratory, however, the induction machine can be *run* at synchronous speed using a dc machine and hence the rotor circuit is really open.

3 Procedure

3.1 No-load test

Make the appropriate circuit connections and get them checked before energizing any portion. This is to be done in two stages – connect the series circuits first (no voltage measurement circuits first, and then the voltage measurement circuits. The circuit has to be checked at each of these stages.

Observe the frequency of the supply and find out the synchronous speed.

Make sure that both AC and DC machine rotate in same direction *independently*.

Close DC supply switch and run the DC machine at the synchronous speed by varying the appropriate rheostat.

Close AC supply switch and note down the required measurements at various voltages – at least 10 readings by varying the input ac voltage from 0 to 1.1 times the rated value. Remember that LabView has to be set up to take one set of readings at every button press.

Now de-energize the dc machine completely, switch off the dc supply. Perform the no-load test again and observe the readings at rated voltage input.

3.2 Blocked Rotor Test

The blocked rotor test is done by holding the rotor at standstill position by using the holding mechanism.

Once the connections have been checked, apply suitable voltage at the stator side such that rated current flows.

4 Calculations

Use the no-load and blocked-rotor test data to compute the equivalent circuit of the induction machine. Estimate the mechanical losses in the setup using the two versions of no-load test that you have done (you may need this in the next experiment).

Further, plot the magnetizing inductance as a function of applied voltage during the no-load test.

Plot also the slip-torque characteristic of the machine.

All computations and readings recorded in the computer through LabView must be shown to the TAs for evaluation.

5 Report

In an A4 sheet, write down your name and roll no at the top right corner. Record your readings during no-load and blocked rotor test. Further, draw the equivalent circuit of the induction machine and mark the values of various elements determined. Also, a plot of the magnetizing inductance with applied voltage is to be drawn by hand with reasonable accuracy. Neatness of the report is important.

Load Test

on

Three-Phase Induction Machine

1 Aim of the Experiment

The aim of this experiment is to obtain the performance characteristics of an induction machine by conducting load test on three phase induction machine.

2 Background

The load test is conducted on a three-phase induction machine to study the actual behaviour of the machine under load. When the motor is loaded, the speed drops down, current increases and power factor improves.

3 Procedure

The procedure to do the experiment is briefly as follows.

The Induction machine is to be run as a motor. The DC machine that is coupled to it is to be operated as a generator that can be loaded electrically, thereby loading the induction motor.

Energize the dc generator after the induction machine has been brought to rated input voltage. Try to maintain the ac input voltage to the machine constant during the test.

Add the load from position 0 to 5 in steps. Remember that LabView has to be set up to take one set of readings at every button press.

Note down readings that would enable you to estimate the mechanical output from the induction machine (*how can you estimate the torque developed?*), and assess the performance from the ac supply side of the induction machine.

4 Calculations

The test readings under load test can be used to determine the performance of the machine. Since the applied voltage would have been constant throughout the loading, the efficiency, slip, torque, output power and power factor can be calculated at each load.

Further, plot the efficiency, power factor, current, torque and output power as a function of slip.

All computations and readings recorded in the computer through LabView must be shown to the TAs for evaluation.

5 Report

In an A4 sheet, write down your name and roll no at the top right corner. Record your readings during load test. Draw all plots by hand with reasonable accuracy. Neatness of the report is important.

6 Points to Ponder

1. Why does the power factor change with loading in the manner that you see?
2. How do the performance characteristics observed compare with what you can estimate from the equivalent circuit?
3. What would be the disadvantage(s) of operating an induction machine under no-load conditions?
4. How would the speed-torque characteristic change if the rotor resistance were to be lower? What would be the effect on speed regulation?
5. If an induction machine is running under loaded conditions, and supply voltage were to dip, what would happen to current drawn? (use this induction machine's equivalent circuit to estimate). Assume that the load requires constant torque.