UTS Engineering
48550 Electrical Energy Technology

Laboratory 2

3-PHASE INDUCTION MOTOR PARAMETERS

EACH STUDENT ATTENDING THIS LAB SHOULD READ CAREFULLY THE
SAFETY PRECAUTIONS BELOW, SIGN THIS COVER SHEET AND RETURN IT TO
YOUR LAB TUTOR

- STUDENTS ARE WARNED OF POSSIBLE ELECTRIC SHOCK RISK AND
  FIRE RISK IN THE LAB AREA.
- NO FOOD OR DRINK IS ALLOWED IN THE LAB.
- AS THE BENCH POWER SUPPLIES HAVE 150 V AC AVAILABLE, THE
  TESTS COVERED IN THIS LAB CAN BE LETHAL IF A MISTAKE IS
  MADE.
- FIND OUT THE LOCATION OF YOUR NEAREST EMERGENCY STOP
  BUTTON BEFORE STARTING.
- DO NOT TURN ON THE SUPPLY UNTIL YOU HAVE DRAWN THE
  CIRCUIT DIAGRAM AND YOUR CONNECTIONS HAVE BEEN CHECKED
  BY YOUR TUTOR.
- DO NOT DISCONNECT ANY LEADS WHILE THE SUPPLY IS ON.
- ALWAYS SET THE VARIABLE VOLTAGE TO ZERO BEFORE TURNING
  ON THE SUPPLY.
- RETURN THE VOLTAGE TO ZERO BEFORE SWITCHING OFF, UNLESS
  THERE IS AN EMERGENCY.
- REMEMBER TO DIAL 6 FOR EMERGENCY.
- REMEMBER TO DIAL 0000 FOR AMBULANCE.

I have read these precautions and shall carry them out.

Signed: (Please sign)
LAB 2 -- 3-PHASE INDUCTION MOTOR PARAMETERS

Aim
2. Measurement of variation of magnitude and frequency of rotor open circuit voltage with speed.

Apparatus
1. Lyb-o-tec bench with DC and three-phase AC power supplies.
2. 3-phase, 4-pole stator, 3-phase, 4-pole wound rotor with slipring and AC brushgear for induction machine.
3. 4-pole DC machine set as prime mover.
4. V/A/Watt meter
5. Metering equipment of the test bench.

Preliminary Work
Assuming a turns ratio of 0.635:1 between the rotor and stator for the machines on benches other than brown and grey, where the ratio is 0.768:1, plot the expected results for the experimental work on the rotor open circuit voltage in Item 4 below.

Experiment
Assemble the AC machine by connecting the stator windings in star and short-circuiting the slipring brushes.

Connect the combination V/A/Watt meter to measure directly (on a single phase basis) the input quantities to be used in determining the parameters of the T equivalent circuit.

1. No load test  (Assume a rated line voltage of 120 V for test purposes)
   • Use the meter connected as above to set the supply voltage to 69.3 V (equivalent to 120 V between phases) and check that the motor runs at 1400 to 1450 rev/min.
   • Measure the input voltage, current, power and speed with no load on the motor shaft.

2. Locked rotor test  (Assume a rated full load current of 2.0 A for test purposes)
   • Connect an additional AC ammeter in one branch of the star to measure rotor current.
   • Block the rotor mechanically by using a screw driver and, with the combination V/A/Watt meter set to monitor current, raise the voltage slowly to the rated stator current of 2.0 A.
   • Measure the input voltage, current, power and rotor current.

3. Resistance test
   • Measure the DC resistance of the AC stator and rotor windings using the volt/ammeter method.
4. **Rotor open circuit voltage and frequency test**
   - Assemble the DC machine as the prime mover. Connect it as a shunt motor (with 4 shunt field coils in series with each other and in parallel with the armature) to the DC supply from the bench. Stable speed variation can be readily obtained by varying the DC supply voltage.
   - Mount the DC machine above the AC machine and couple the shafts with the hose piece coupling.
   - Remove the short circuit connections from the sliprings and connect the oscilloscope between any two sliprings.

**Method**

- Excite the stator with a constant voltage of 20 V (phase to neutral) and measure the amplitude and frequency of the rotor voltage with the rotor stationary.
- Start the DC motor and observe the effect on magnitude and frequency up to 1500 rev/min.
- Take readings of magnitude and frequency from oscilloscope at about 300 rev/min intervals up to 1500 and plot results on the same axes as your calculated predictions in the pre-work.
- Reverse the phase sequence of the stator supply and observe the effects on rotor voltage.
- Repeat the above test by reversing the phase sequence of the stator supply.
- Repeat the above test using a different value of AC stator voltage. Test of reversing the phase sequence is optional.

**Report**

1. Report your results with the necessary diagrams and graphs as for the previous lab tests.
2. Using the results of your No-load and Locked rotor tests, calculate the parameters for the T equivalent circuit model for use in predicting the motor performance in Lab 3.
3. Discuss the results in Item 4 above and offer quantitative theoretical explanations of any differences between the calculated and measured results.
4. Attach the signed results sheets.

**NOTE:** Keep a separate record of the equivalent circuit parameters for use when carrying out Laboratory 3.