Experiment #9: Single Phase Induction Motor

The single phase induction motor (IM) is the most commonly used motor in major home appliances. It is very rugged, cheap to make, and hardly ever breaks down! It is however, much noisier than its big brother the three phase induction motor. This is, as we learned previously, due to the two (opposing) rotating fields, one of which is against the direction of rotation. As discussed in the lecture, a practical single phase induction motor usually has starting means. There are many such starting methods, the most common being the use of an auxiliary winding to simulate a “second” phase. With this there is need to shift the phase by 90° (or less). A capacitor is used in series with this winding to achieve this phase shift. This allows the motor to start, and at a certain speed a centrifugal switch operates to perform one of the following actions: 1) disconnect the auxiliary winding all together, 2) switch to a different (running) value of capacitance in series with the auxiliary winding, or 3) some other action specific to the motor being used.

Experiment Outline:

1. Confirm that the IM is mechanically connected to the DC dynamometer (DCD). Make sure to connect the arm of the dynamometer as explained in class so that the dynamometer can read both positive and negative torque.
2. Excite the IM with AC power (windings in parallel) and gradually increase the voltage till the motor just rotates. Note the direction of rotation.
3. Increase the voltage gradually till the motor goes up to almost full speed. Regardless whether the centrifugal switch operates or not, arrange to open the auxiliary winding in a safe manner (discuss your plan with the instructor first). Does the motor continue to rotate?
4. Power down (#1). (Note, this is power down #1, there are others below).
5. Now arrange to “reverse” the direction of rotation. Repeat the steps above.
6. Power down (#2).
7. Connect the DCD armature to a resistive bank.
8. Start the IM by applying AC power. Note and record the direction of rotation. Make sure the field of the DCD is at a low excitation, and the armature has a relatively high resistance (low load) connected.
9. Increase the speed of the IM till full AC voltage is applied.
10. Gradually increase the load using the DCD. This is achieved by reducing the resistance on the armature as well as increasing the field. Measure and record the power, voltage and current of the IM as the load is increased. Also record the torque. Stop increasing the load when you reach the peak torque. (How will you do that? again, discuss your plan with the instructor). Power down (#3).