UNIVERSITY OF GAZIANTEP
ELECTRICAL AND ELECTRONIC ENGINEERING DEPARTMENT

EEE322 EXPERIMENT 07

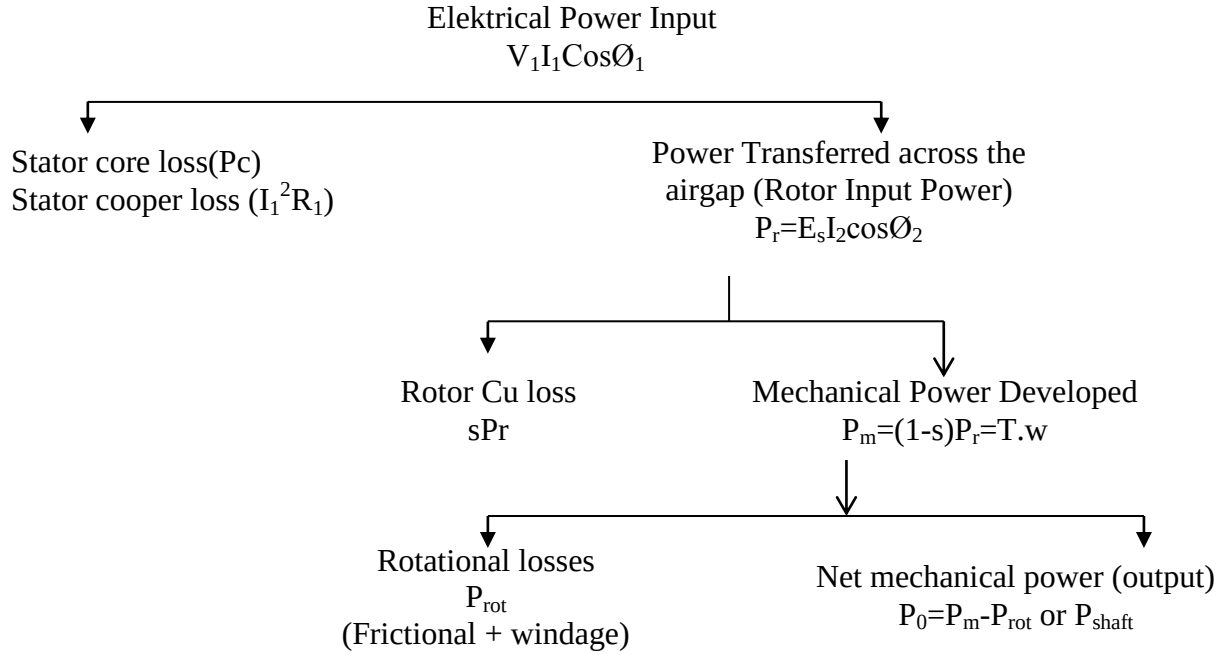
LOAD TEST ON AN INDUCTION MOTOR

A.Object of the experiment

The object of this experiment is to carry out load test on a squirrel-cage/wound rotor induction motor. The parameters of the approximate equivalent circuit of the machine have been determined from previous experiment. The equivalent circuit is used to calculate several points on the torque/speed curves of the m/c. These theoretical points are compared with those obtained in practice in the load tests.

B.Theory

Power flow in an induction machine per phase may be schematically illustrated as follows:



a) Efficiency

$$\eta = \frac{OutputPower}{Inputpower} \qquad (1)$$

If the friction, windage and stator core and copper losses are negligible, then

$$\eta = \frac{\mathrm{Pr}(1-s)}{\mathrm{Pr}} \Rightarrow (1-s) \qquad (2)$$

b) Torque

The Electromechanical Torque Developed (using approximate Equivalent circuit as shown in fiuure 1) is:

$$Te = \frac{3Pm}{w} \qquad (3)$$

$$S = \frac{n_s - n}{n_s} \qquad n=n_S(1-s) \quad \text{or} \quad w=w_S(1-s) \qquad (4)$$

$$T_e = \frac{3P_r(1-s)}{w_s(1-s)} = \frac{3P_r}{w_s} \qquad (5)$$

$$Te = \frac{3I'_2\, r'_s / S}{w_s} = \frac{3V_1^{\,2} r'_2 / S}{w_s[(r_1 + r'_2/S)^2 + (x_1 + x'_2)^2]} \qquad (6)$$

Maximum torque occurs if we differentiate equation (4) w.r.t s

C- Procedure :

READ THE NOTES CAREFULLY

(1) Connect the circuit as shown in Figure (2) as induction motor with squirrel cage rotor. Apply around 200 volts line to line to the stator winding of the induction motor and allow it to run up to no-load speed. While the single phase variac is at the lowest level, close, switch S2 and increase the load in steps up to a maximum value at which the stator current of the I/M exceeds the rated value by 10%. Record at each step the values of rotational speed, stator current, the reading of each wattmeter and the readings of the dynamometer.

(2) Repeat the procedure described in (1) for the stator voltages of 250 V and 330 Volts (line to line)

D- Resulls and conclusions :

(1) Plot on one graph the torque/speed characteristics of the m/s at four values of suitor voltage used. Use the equivalent circuit (found in exp. FFF 322 L/8) to calculate the theoretical torque developed at two values of speed obtained in the lab during the load tests (one close to synchronous speed and one as far away from it as possible) at rated voltage and plot these on the same graph.

(2) Calculate the output efficiency of the m/s at each point of the load tests. Compute output power from torque and speed land hence plot curves of efficiency against slip on load at rated voltage and reduced voltage.

(3) Check that at any given value of speed the torque developed is proportional to square of stator voltage.

(4) Comment on the results and on the shape off all curves and discuss any discrepancies between calculated and measured quantities.

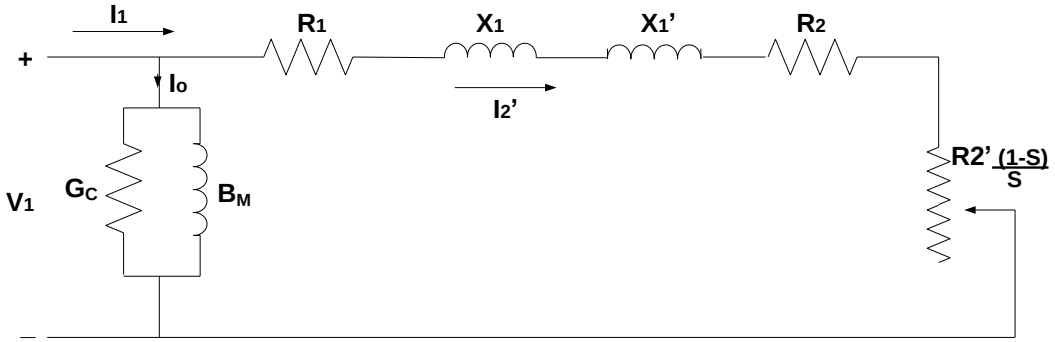


Fig.1 Approximate per phase equivalent circuit for an induction motor

NOTE:

The brake assembly is arranged between the single/three-phase ac m/c and the universal d.c. m/c. It consists of a adequately dimensioned eddy current brake combined with hydrolic oil disk brake for short time duty.

The brake, which is cradle-mounted in 2pedestel bearings, permits the complete torque characteristics on the starting to the breakdown torque of every type of rotor which can be made with the sets to be plotted.

The eddy-current brake can continuously brake the motor at their rated load, but it can only be used for a short time approximately 3 minutes for measuring the starting and overload torques because of the heat developed in such cases.

Rating of eddy- current brake: 4 kW continuous duty at 1500rpm or 5.5kW continuous duly at 3000 rpm.

Excitation:(0-220) V d.c./4.5 A max.

Combined brake rating is 12k\V max. For short time duty of 3 minutes. The brake assembly is fitted with coupling halves on both shaft extensions. The single/three phase a.c. machine can be uncoupled by removing the rotor. Between the brake and universal d.c. machine, there is a clutch which can be disengaged when at standstill. The brake assembly is fitted with a dial-type dynamometer for measuring purposes. Load power can be calculated by using :

$$P = \frac{F * n}{10^4} kW$$

where F:Indication of the dynmometer in Nm.

n:Speed in r.p.m

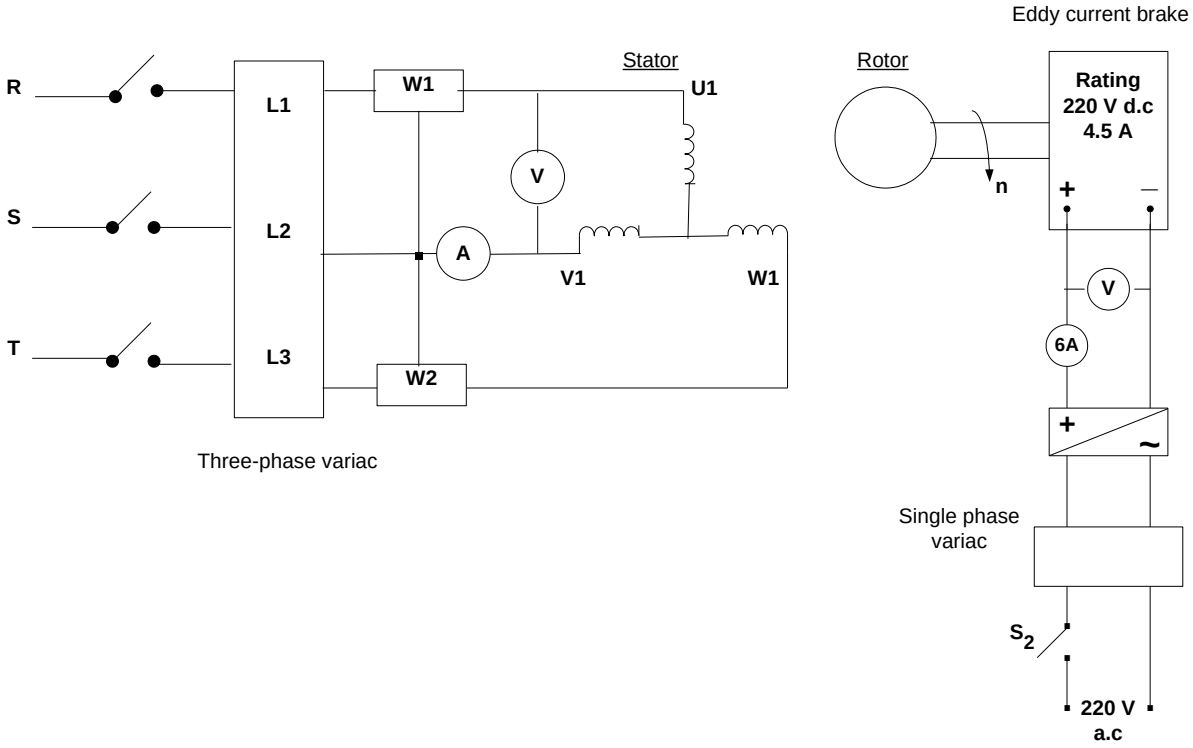


Figure 2

E.1. Table of results for C1 and

n	I_1(A)	W_1	W_2	T

V_{stator}= 200V (line to line)

E.1. Table of results for C1 and

n	I_1(A)	W_1	W_2	T

V_{stator}= 250V

E.1. Table of results for C1 and

n	I_1(A)	W_1	W_2	T

V_{stator}= 300V

E.1. Table of results for C1 and C2

n	I_1(A)	W_1	W_2	T

V_{stator}= 380V

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