ELEC 3724
Experiment Report

Experiment #5

Induction Motors

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Team:

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Objectives:

In this lab we examined the load-speed characteristics, while determining the equivalent circuit parameters in an induction motor, using the no load test.

Part A: Induction Motor Starting and Speed at No Load:

Inverter Command Frequency [Hz]	Induction Machine Current [A]	Speed [rpm]
30	1.8	897

Table 50. No load condition.

Part B: Speed-Load Characteristics:

Inverter Command Frequency [Hz]	Induction Machine Current [A]	Speed [rpm]
60 Hz	1.7	1798

Table 51. No load test.

Inverter Command Frequency [Hz]	Induction Machine Current [A]	DC Motor Current [A]	Speed [rpm]
60 Hz	1.9	4.8	1785
60 Hz	2.1	5.92	1778
60 Hz	2.3	6.7	1772
60 Hz	2.5	7.26	1767
60 Hz	2.7	7.8	1762

Table 52. Load test 2.

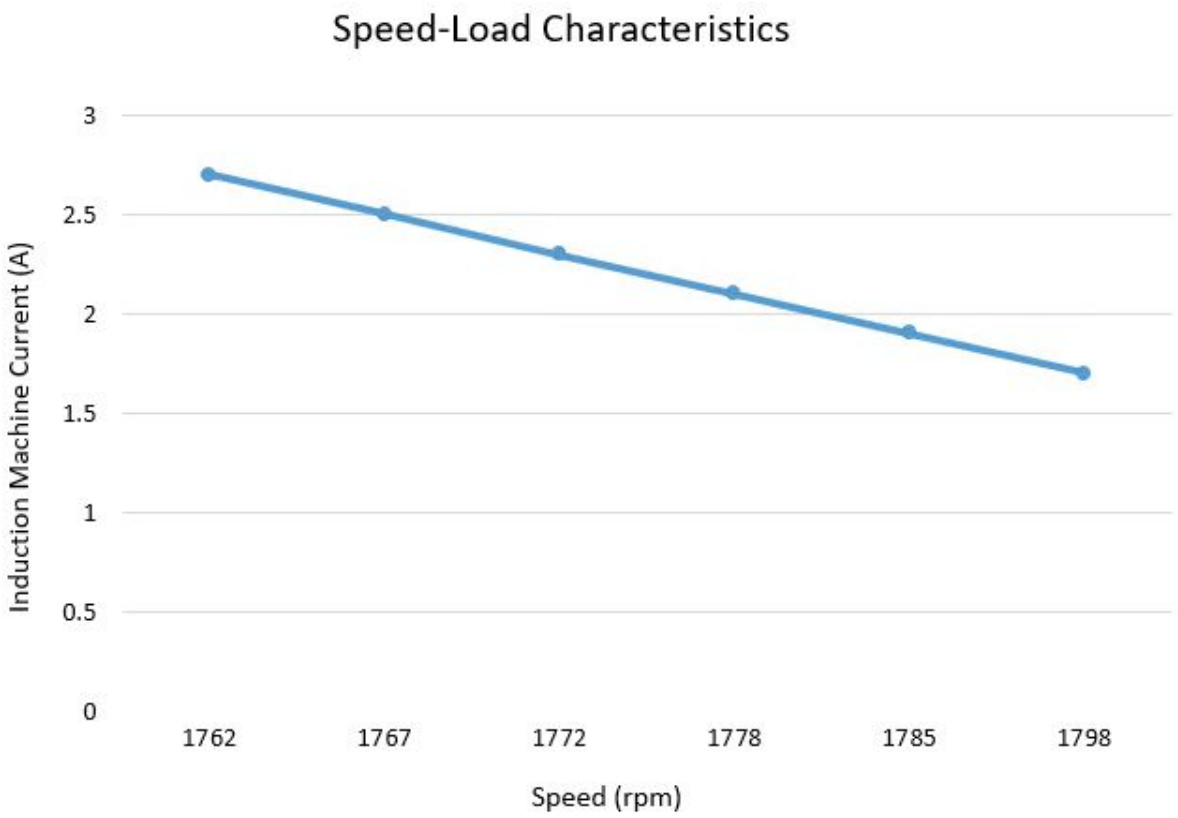
Part C: No Load Test

Command Frequency [Hz]	Phase Voltage V_{UN} [V]	Phase Current I_U [A]	Phase Power P_U [W]	Speed [rpm]
60Hz	143.7	1.59	30.5	1798

Table 53. No load test.

Report

1. Plot the speed-load characterist cs using data from part B on the same graph. Use the speed (rpm) as the X-axis and inverter output current as the Y-axis, including no load speed.



2. Calculate the % slip using data from part B.

$$Slip\ \ Percent = \frac{n_{sync} - n_m}{n_{sync}} * (100)$$

At Induction Machine current (1.7A) (**no load**), **Slip1%** = $Slip_1\% = \frac{1800 - 1798}{1800} * (100) = 0.11\%$

At Induction Machine current (1.9A), **Slip2%** = $Slip_2\% = \frac{1800 - 1785}{1800} * (100) = 0.833\%$

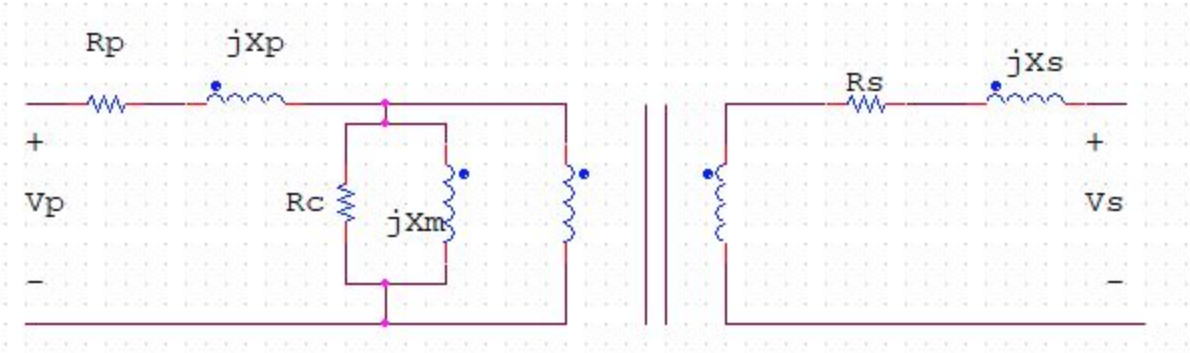
At Induction Machine current (2.1A), **Slip3%** = $Slip_3\% = \frac{1800 - 1778}{1800} * (100) = 1.22\%$

At Induction Machine current (2.3A), **Slip4%** = $Slip_4\% = \frac{1800 - 1772}{1800} * (100) = 1.56\%$

At Induction Machine current (2.5A) **$Slip_5\%$ =** $$Slip_5\% = \frac{1800 - 1767}{1800} * (100) = 1.83\%$$

At Induction Machine current (2.7A) **$Slip_6\%$ =** $$Slip_6\% = \frac{1800 - 1762}{1800} * (100) = 2.11\%$$

3. Draw an equivalent circuit of induction machine.



4. Calculate X_m and R_m using data from Part C. Include an equivalent circuit for no-load test in your answer.

$$I_U = 1.59A$$

$$V_{UN} = 143.7V$$

$$P_U = 30.5W$$

$$S = VI^* = (143.7)(1.59) = 228.48VA$$

$$S = 228.48VA$$

$$R_C = \frac{(143.7)^2}{30.5} = 677.04\Omega$$

$$\boxed{R_C = 677.04\Omega}$$

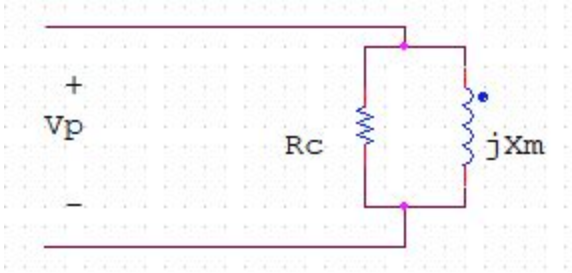
$$Q = \sqrt{(S)^2 - (P_U)^2} = \sqrt{(228.48)^2 - (30.5)^2} = 226.49VAR$$

$$Q = 226.49VAR$$

$$X_m = \frac{(V_{UN})^2}{Q} = \frac{(143.7)^2}{226.44} = 91.19\Omega$$

$$X_m = 91.19\Omega$$

Equivalent Circuit for no load test:



5. Calculate no load test rpm.

No load test rpm = 1798 rpm

***From the video, we don't need to calculate this, just list the value.**

6. Calculate R_2 using locked-rotor test data below. Include an equivalent circuit for locked rotor test in your answer.

   Locked-rotor voltage (Line-to-line) $80V_{rms}$
   Locked-rotor phase current 7.5A
   Locked-rotor phase power 600W

***From the video lecture, this question was eliminated.**

Conclusion:

In this lab we determined equivalent circuits and examined load speed characteristics for an induction motor, specifically while using the no load test. From this data examined a series of concepts in the report questions. First, I observed that as induction machine current increased, the speed decreased, when performing the speed load characteristic examinations in part B. Next, using speed data from part B I was able to determine the slip percentages. In examining these slip percentages, as induction machine current decreased, the speed increased, while the slip percentage decreased, achieving the lowest recorded slip percentage value in the data (0.11%) at the highest recorded speed in the data (1798 rpm).

After this I translated the equivalent circuit for our circuit. Next I calculated Xm and Rc, with the values being: Rc = 677.04Ω and Xm = 91.19Ω. Lastly I noted the no load speed (rpm) determined previously in this lab. From my work in this lab I achieved a better understanding of load speed characteristics and how to examine the equivalent circuits of an induction motor, while utilizing the no load test in this lab.