

ECE 331 - Homework #5

AC Induction Motors used as generators and single-phase operation

3-phase induction motors / generators:

1) Write a subroutine in MATLAB or SciLab which allows you to input the resistance and reactance (r_1 , r_2 , x_1 , x_2), and returns the output torque, power, and efficiency for a slip from -1 to +1.

Assume a three-phase, two pole, 20hp, 120V_{LN} (line-to-neutral), 60Hz, Y connected induction motor.

Assume the stator core losses are 500W and the rotational losses are 400W. At no-load, the motor draws 10A with a power factor of 0.1 lagging.

2) Plot the torque vs. speed relationship for this motor with

$$r_1 = 0.1 \text{ Ohm}, \quad x_1 = 0.35 \text{ Ohms}$$

$$r_2 = 0.12 \text{ Ohms} \quad x_2 = 0.40 \text{ Ohms}$$

3) Find r_2 so that the starting torque is 90% of the peak torque.

Single-phase induction motors :

note: ECE 331 - Lab on Single Phase Induction Motors pushed back to next week (March 11th)

4) Explain how a 3-phase induction motor is able to keep running when a phase is lost.

5) Explain why this same 3-phase motor won't start once it stops.

(changed homework problems)

6) Using the following data data, give the results for a short-circuit and open-circuit test for a single-phase induction motor (same as homework #4 but for single phase). Assume a line-to-neutral voltage $V_{LN} = 120V$

$$r_1 = 0.1 \text{ Ohm}, \quad x_1 = 0.35 \text{ Ohms}$$

$$r_2 = 0.12 \text{ Ohms} \quad x_2 = 0.40 \text{ Ohms}$$

$$x_c = 40 \text{ Ohms}$$

7) Determine and plot the torque vs. speed relationship for this motor.

Lab: L-Z this week (Feb 24). A-K next week (Mar 3).

(30 pt - turn in as a part of your homework). Determine a model for an actual AC induction motor using a short-circuit test, open circuit test, and DC test. Include your data, your calculations, and the model for this motor.