

Introduction

The following is a “take-home” lab assignment that is to be performed individually.

Assignment

A 3 Φ , 460V, 40hp, 6-pole, 60Hz, squirrel-cage induction machine has the following parameters:

$$R_s = 0.105 \Omega \quad R_r' = 0.160 \Omega \quad X_s = 0.415 \Omega \quad X_r' = 0.610 \Omega \quad R_{fe} = 115 \Omega \quad X_m = 12.8 \Omega.$$

Assuming that the machine is supplied with rated voltage and frequency and that the machine has negligible mechanical losses:

1. Plot the total **mechanical power** “produced” by the machine, P_{mech} , as a function of rotor speed as speed varies continuously from **-1200 rpms \rightarrow 2400 rpm**.
2. Plot the **torque** developed by the machine, T_D , as a function of rotor speed as speed varies continuously from **-1200 rpms \rightarrow 2400 rpm**.
3. Plot the magnitude of the **line current** for the machine, $|\tilde{I}_{line}|$, as a function of rotor speed as speed varies continuously from **-1200 rpms \rightarrow 2400 rpm**.
4. From your plots, determine the **rated speed** of the machine when operating as a motor. (I.e. – at what speed does it produce rated shaft power?)
5. **Discuss** the general operation of the machine as a function of its rotational speed when operating within the speed ranges of:
-1200 rpm \rightarrow 0 rpm
0 rpm \rightarrow 1200 rpm
1200 rpm \rightarrow 2400 rpm

Report Guide

The completed assignment should be submitted electronically as a memo-style report. Within the report you should restate the assigned problem, show the work (formulas, etc.) required to complete the tasks, and present the final results in the order that they were assigned.

Note that a full page should be utilized for each plot and that the plots should be completely formatted (titles, axis labels, etc.).