EE595S Lab 9
Induction Machine Characterization
Fall 2005

Objective

- Measure steady-state torque and current versus speed characteristic
- Determine the “best-fit” parameters of a three-phase induction machine.
- Predict the steady-state torque and current versus speed characteristics
- Compared measured and predicted steady-state characteristics (torque and current versus speed)
- Measure the no-load start-up performance
- Simulate the no-load start-up performance based on the measured parameters
- Compared the measured and simulated no-load performance

Parameter Measurement

- Step 1: Determine stator resistance using 4 wire measurements.
- Step 2: Measure impedance versus speed with rated voltage applied. Record voltage, current (and phase), and torque versus speed. Find impedance and slip versus speed (electrical frequency held constant)
  - Use 1795, 1790, 1780, 1770, 1760, 1750, 1740, 1735 rpm
- Step 3: Use best fit techniques to determine the parameters of the machine based on the input impedance as a function of speed

Parameter Measurement

- Note That

$$Z_{pred}(r_s, L_{ls}, L_M, L_{lr}, r_r, \omega_e, s) = r_s + j\omega_e L_{ls} + \frac{1}{\frac{1}{j\omega_e L_M} + \frac{1}{\frac{r_r}{s} + j\omega_e L'_{rr}}}$$

- Denote Data Points

$$Z_{meas,i} \qquad s_i \qquad \omega_{e,i}$$

- Minimize

$$f = \sum_{i=1}^{N} \left| Z_{meas,\,i} - Z_{pred}(r_s, L_{ls}, L_M, L_{lr}, r_r, \omega_{e_i}, s_i) \right|^2$$

Free Acceleration (On Campus Only)

- Inertia is approximately 4 $mNms^2$
- Free IM from brake and remove coupling.
- Tighten IM back down
- Record a-phase and b-phase current, a- to b-phase line-to-line voltage, b- to c- phase voltage and line-to-line voltage

Deliverables (On and Off Campus)

- Document your calculation of the electrical parameters (and data points)
- Document comparison of measured and predicted torque-speed and current-speed curves

Deliverables (On Campus Only)

- Document comparison of a-phase, b-phase current waveform, a- to b- phase line-to-line voltage, and b- to c-phase line-to-line voltage.

Warnings

- Beware of your couplings !
- There is no shaft guard !
- Turn on the Fan !