Project #2: Induction Machine

Description: In this project you will simulate an induction machine in *abc* variables. The machine is 50 HP (37.285KW). Table I below details the electrical and mechanical parameters of the machine. You may assume for this problem that there is no rotor damping, but if you desire to have some rotor damping to add a bit more reality use B = 0.00001.

Note: This will be a "free acceleration" problem. In other words, you will have no torque load on the shaft of the machine.

Table I: Parameters for 50HP Induction Machine

Parameter	50HP
Volts	460 $V_{rms\ (l\text{-}l)}$
Poles	4
Base Speed ω_B	377 rad/s
Excitation Frequency ω_e	377 rad/s
r_s	0.087 ohms
X'_{lr}	0.302 ohms
r'_r	0.228 ohms
X_{ls}	0.302 ohms
X_M	13.8 ohms
J	1.662 kg-m^2

Project Deliverables:

I. Basic calculations/simulations

For each machine produce (at least) the following graphs:

1. Rotor current of a single phase and stator current for a single phase.
2. Electromagnetic torque (in N-m) versus the rotor speed in rpm.

For the two parts above conduct the following analysis.

II. Advanced Analysis
    1. For the machine calculate the *in-rush* current (*peak current in one of the stator phase windings during start-up*).
    2. What is the maximum peak-to-peak value of torque during start-up?
    3. Calculate the instantaneous power in the machine for a - d over your run and compare these values. Why are they different, what does this mean?
        a. Stator (the power dissipated by the windings)
        b. Rotor (the power dissipated by the windings)
        c. Shaft (the power at the shaft of the machine)
        d. Total instantaneous power flowing into the machine

III. Produce an IEEE style written report.
IV. The report is due April 1st at midnight.