EXTRAIDO DE: ELECTRIC MACHINERY FUNDAMENTALS -- S. CHAPMAM - 2º EDIÇAO - 1991

10-7. *A* 208-V four-pole 6O-Hz Y-connected wound-rotor induction motor is rated at 15-*hp.* lts equivalent circuit components are

$RI = 0.210\ \Omega$ $R2 = 0.137\ \Omega$ $X_M = 13.2\ \Omega$

$X_1 = 0.442\ \Omega$ $X_2 = 0.442\ \Omega$

P mech = 300 W P core = 200 W

For a slip of 0.05, find

(a) The line current I_L

(h) The stator copper losses P_{SCL}

(c) The air-gap power P_{AG}

(d) The power converted from electrical to mechanical form P_{conv}

(e) The induced torque T_{ind}

(f) The load torque T_{load}

(g) The overall machine efficiency

(h) The motor speed in revolutions per minute and radians per second

10-8. For the motor in Prob. 10-7, what is the slip at the pullout torque? What is the pullout torque of this motor?

10-9. For the motor of Prob. 10-7, how much additional resistance (referred to the stator circuit) would it be necessary to add to the rotor circuit to make the maximum torque occur at starting conditions (when the shaft is not moving)?

10-19. A 230-V four-pole 10hp 6O-Hz Y-connected three-phase induction motor develops its full-load induced torque at 3.8 percent slip when operating at 60 Hz and 220 V. The per-phase circuit model impedances of the motor are

$R_1 = 0.36\ \Omega$ $X_M = 15.5\ \Omega$ $X_1 = 0.47\ \Omega$ $X_2 = 0.47\ \Omega$

Mechanical, core, and stray losses may be neglected in this problem.

(a) Find the value of the rotor resistance R_2.

(b) Find T_{max} , s_{max} and the rotor speed at maximum torque for this motor.

(c) Find the starting torque of this motor.

10-21. A 460 V- 25-hp six-pole 6O-Hz three-phase induction motor has a full-load slip of 4 percent, an efficiency of 89 percent, and a power factor of 0.86 lagging. At start-up, the motor develops 1.75 times the full-load torque but draws 7 times the rated current at the rated voltage. This motor is to be started with an autotransformer reduced voltage starter.

(a) What should the output voltage of the starter circuit be to reduce the starting torque until it equals the rated torque of the motor?

(b) What will the motor starting current and the current drawn from the supply be at this voltage?

10-22. A wound-rotor induction motor is operating at rated voltage and frequency with its slip rings shorted and with a load of about 25 percent of the rated value for the machine. If the rotor resistance of this machine is doubled by inserting external resistors into the rotor circuit, explain what happens to the following:

(a) Slip s

(b) Motor speed n_m

(c) The induced voltage in the rotor

(d) The rotor current

(e) T_{ind}

(f) P_{out}

(g) P_{RCL}

(h) Overall efficiency

10.24. When it is necessary to stop an induction motor very rapidly, many induction motor controllers reverse the direction of rotation of the magnetic field by switching any two stator leads. When the direction of rotation of the magnetic fields is reversed, the motor develops an induced torque opposite to the current direction of rotation, so it quickly stops and tries to start turning in the opposite direction. If power is removed from the stator circuit at the moment when the rotor speed goes through zero, then the motor has been stopped very rapidly. This technique for rapidly stopping an induction motor is called *plugging.* The motor of Prob. 10-19 is running at rated conditions and is to be stopped by plugging.

(a) What is the slip s before plugging?

(b) What is the frequency of the rotor before plugging?

(c) What is the induced torque T_{ind} before plugging?

(d) What is the slip s immediately after switching the stator leads?

(e) What is the frequency of the rotor immediately after switching the stator leads?

(f) What is the induced torque T_{ind} immediately after switching the stator leads?