KING FAHD UNIVERSITY OF PETROLEUM & MINERALS

ELECTRICAL ENGINEERING DEPARTMENT

EE 306 – Term 191

HW # 6: Induction Motors

Due Date: (Dec. 11ᵗʰ, 2019)

Problem # 1:

A 480-V three-phase two-pole 60-Hz induction motor is running at a slip of 2.5 percent. Find:

(a) The speed of the magnetic fields in revolutions per minute

(b) The speed of the rotor in revolutions per minute

(c) The slip speed of the rotor

(d) The rotor circuit (current) frequency in hertz

Problem # 2:

A 50-kW, 460-V, 50-Hz, two-pole induction motor has a slip of 5 percent when operating a full-load conditions. At full-load conditions, the friction and windage losses are 700 W, and the core losses are 600 W. Find the following values for full-load conditions:

(a) The shaft speed n_m

(b) The output power in watts

(c) The load torque τ_{load} in newton-meters

(d) The induced torque τ_{ind} in newton-meters (considering the core loss with the rotational losses)

(e) The rotor circuit (current) frequency in hertz

Problem # 3:

A 3-phase, 460 V, 60 Hz, 20 kW induction machine draws 25 A at a power factor of 0.9 lagging when connected to a 3-phase, 460 V, 60 Hz power supply. The core loss is 900 W, stator copper loss is 1100 W, rotor copper loss is 550 W, and friction and winding loss is 300 W. Calculate

(a) The air gap power, P_{ag}.

(b) The mechanical power developed, P_{mech}.

(c) The output horse power.

(d) The efficiency.

Problem # 4:

A 3-phase, 2-pole, 60 Hz, induction motor operates at 3546 rpm while delivering 20 kW to a load. Neglect all losses. Determine

(a) The slip of the motor.

(b) The developed torque.

(c) The speed of the motor if the torque is doubled. Assume that in the low slip region, the torque speed curve is linear.

(d) The power supplied by the motor for the load condition of (c).