

ECE 330 HW 7

In class quiz: Friday, July 12.

Copies of the textbook are kept at the Grainger Engineering Library Reserve

Text problem 4.8

Text problem 4.9

Text problem 4.12

Special Problem #1, partial answer: $MI_s I_r$

A single-phase rotating machine has one coil on the stator with current i_s and one coil on the rotor with current i_r . The inductances for this machine are (assume linear magnetic core): $L_{ss} = L_s$, $L_{sr} = M \cos(\theta)$, $L_{rs} = M \cos(\theta)$, $L_{rr} = L_r$. The machine is being operated such that the currents i_s and i_r can be assumed to be constants at I_s and I_r respectively while the shaft is rotated from $\theta = 0$ to $\theta = \pi/2$. For this change from “point a” to “point b”, find:

- The energy transferred from the mechanical system into the coupling field as the system moved from point a to point b with constant currents.
- The energy transferred from the electrical system into the coupling field as the system moved from point a to point b with constant currents.

Special Problem #2, partial answer: 16 Joules, -800 N

An electromechanical system is described by the following flux-linkage vs current characteristic:

$$\lambda = \frac{0.04i}{x - 0.01} \quad (1)$$

It is operated on the closed cycle a - b - c - d - e as indicated below, with x constant during a - b and also c - d. The current is constant during b - c and also d - e.

	a	b	c	d	e
i (Amps)	0	i_b	i_b	0	0
λ (Wb turns)	0	8	λ_c	0	0
x (meters)	.03	.03	.02	.02	.03

Find the following things:

- i_b and λ_c .
- The energy stored in the coupling field at points b and c.
- The force of electric origin at points b and c.

- d. Sketch this cycle in the λ vs i plane (label points a, b, c, d, and e)
- e. Sketch this cycle in the force vs x plane (label points a, b, c, d, and e)
- f. Is this is a motor or a generator?