ECE 330 HW 8

In class quiz Thu, Mar 15.
Copies of the textbook are kept at the Grainger Engineering Library Reserve

Textbook problem 4.8

Textbook problem 4.9

Special Problem #1
A single-phase rotating machine has one set of windings on the stator with current i_s and one set of windings on the rotor with current i_r. The flux linkages of the stator and the rotor windings are given by:

$$\lambda_s = L_s i_s + M cos(\theta) i_r$$
$$\lambda_r = L_r i_r + M cos(\theta) i_s$$

In operating this electromechanical system, the currents i_s and i_r are kept constant at I_s and I_r, respectively, while the rotor is rotated from $\theta = 0$ to $\theta = \frac{\pi}{2}$. Along this path, compute the energy transferred from the mechanical subsystem into the coupling field.

Special Problem #2
In an electromechanical system. the flux-linkage is given by: $\lambda(i, x) = \frac{0.04i}{x-0.01}$ where x defines the geometry of the mechanical subsystem, and i denotes the current into the system. It is operated on the closed cycle "a-b-c-d-a" as indicated in the table below. Over this cycle, x is held constant along the paths "a-b" and "c-d," and i is held constant along the paths "b-c" and "d-a".

	a	**b**	**c**	**d**	**a**
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

1. Is the system electrically linear? How many electrical and mechanical ports does the system have?
2. Compute i_b and λ_c.
3. Compute the energy stored in the coupling field and the force of electrical origin (f^e) at **b** and **c**.
4. Sketch the cycle on the $\lambda - i$ plane. (Label the points "a,b,c,d")
5. Sketch the cycle on the $f^e - x$ plane. (Label the points "a,b,c,d")
6. Is the system operating as a motor or a generator over this cycle?