ECE 320: Homework #6

DUE DATE**:** By 5:00pm on Friday October 31.

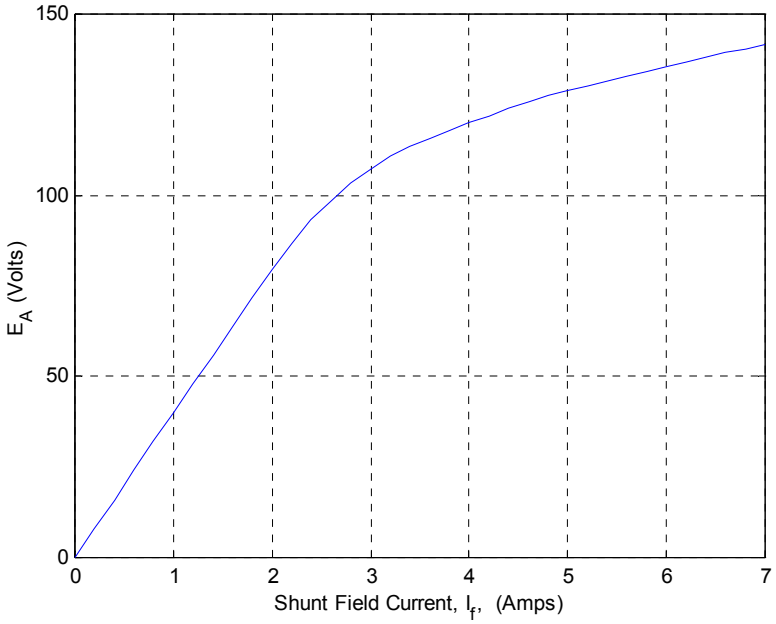
Hand in to my mailbox, my office, or the homework collection box on the second floor of GJL (slot marked EE320).

1. Why does the curving the pole faces in a dc machine contribute to smoother dc output voltage from it?
2. The magnetization curve for a separately excited dc generator is shown in Figure P9-7. The generator is rated at 6kW, 120V, 50A, and 1800 r/min and is shown in Figure P9-8. Its field circuit is rated at 5A. The following data are known about this machine:

   Ra := 0.18ohm Vf := 120V Rf := 24ohm

   Nf := 1000 turns/pole

   The field rheostat, Radj, circuit ranges from 0 to 30 Ohm



Answer the following questions about this generator, assuming no armature reaction

(a) If this generator is operating at no load, what is the range of voltage adjustments that can be achieved by changing Radj?

(b) If this field rheostat is allowed to vary from 0 to 30 ohm and the generator's speed is allowed to vary from 1500 to 2000 r/min, what are the maximum and minimum noload voltages in the generator?

3. A 20 HP, 76 A, 900 r/min series motor has a field winding of 33 turns per pole. Its armature resistance is 0.09 ohm, and its field resistance is 0.06 ohm. The magnetization curve expressed in terms of magnetomotive force versus EA at 900 r/min is given by the following table.

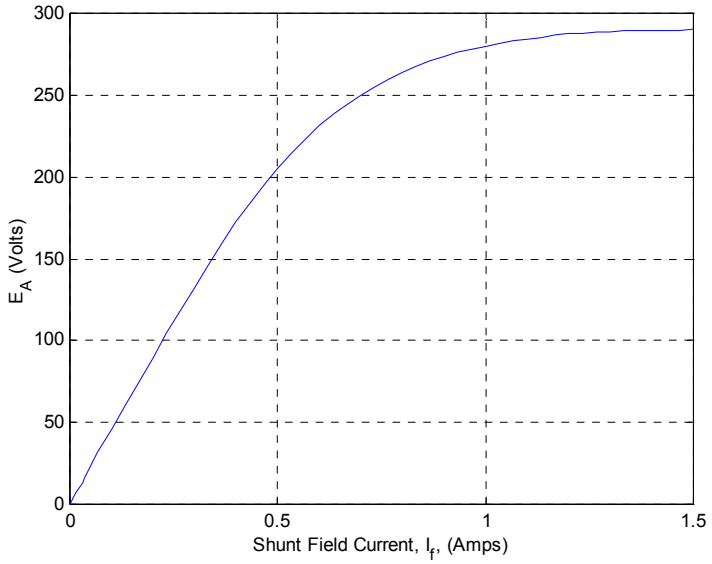
E_A(V)	95	150	188	212	229	243
MMF (A-turns)	500	1000	1500	2000	2500	3000

Armature reaction is negligable in this machine

(a) Compute the motor's torque, speed, and output power at 0, 33, 67, 100, and 133 percent of full load armature current. (Neglect rotational losses)
(b) Plot the torque-speed characteristic of this machine.

4. For the shunt dc motor described below:

Prated := 30hp	ILrated := 110A
VT := 240V	N_F := 2700 turns/pole
n_rated := 1200 RPM	N_SE := 12 turns/pole
R_A := 0.19ohm	R_F := 75ohm
Rs := 0.02ohm	Radj ranges from 100 to 400 ohm



(a) If the motor is operating at full load, and Radj is increased to 175 Ohms, what is the new speed of the motor? Compare this full load speed to the full load speed if Radj is 250 Ohms
(b) What is the starting current of this machine if it is started by connecting it directly to the power supply, V_t? Compare the starting current to the full load current.
(c) If the motor is connected cumulatively compounded and Radj is set to 175 Ohms, what is its no load speed? What is its full load speed? What is its speed regulation?