ECE 331 - Homework #11

DC Shunt Motors - Due Monday, April 28th, 4PM

DC Shunt Excited Motors:

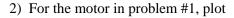
1) Assume a DC motor with Vt = 120VDC, Rf = 150 Ohms, Rx = 3 Ohm, Nf = 30, Na = 30, and a reluctance of 1000. Plot the speed vs. load torque relationship.

Note: The torque constant is related to the current If:

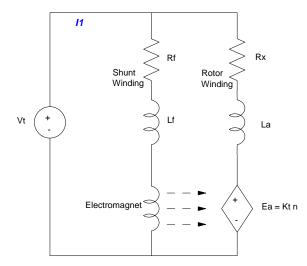
$$I_f = \frac{120V}{200\Omega} = 0.6A$$

$$\Phi_P = \frac{N_f I_f}{Rel} = \frac{(30)(0.6)}{800} = 0.0225 Wb$$

$$K_t = \frac{2N_a \Phi_P}{\pi} = 0.4297 \frac{V}{\text{rad/sec}}$$



- Speed vs. power out
- · Speed vs. efficiency



3) Increase the field current by 3x (reduce Rf to 50 Ohms). Plot

- · Load torque vs. speed
- · Speed vs. power out
- · Speed vs. efficiency

4) Design a DC shunt excited motor. The motor is to produce 15kW with Vt = 120VDC at 3000 rpm. Specify Rf, Rx, Kt.

5) Determine the efficiency of the DC motor you designed for problem #4 at this operating condition.