ECE 331 - Homework #8

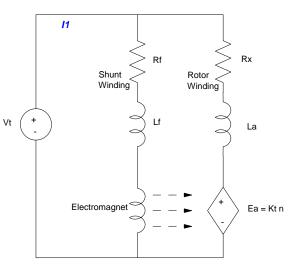## DC Shunt Motors

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:

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

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

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

2) For the motor in problem #1, plot

- 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.