ECE 461 - Homework Set #6

Rotational Systems, Error Constants, Routh Criteria - Due Monday, October 12th

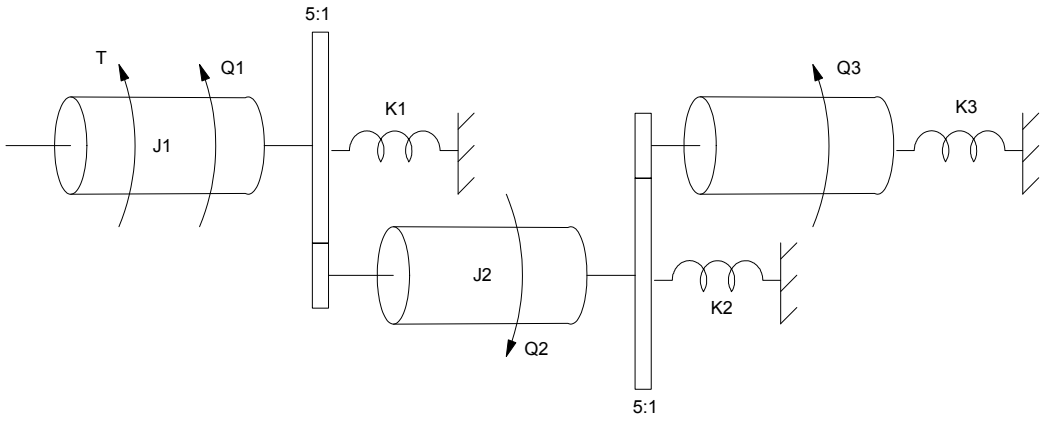
1) The parameters for a 750W (1hp) DC motor as follows ($1126 ea)

Data Sheets:

http://servosystems.com/pdf/amp/m0750-102-5-000.pdf

What is the transfer function for this motor from Volts to Speed (rad/sec)?

2) For the following rotational system



2a) Draw the circuit equivalent

2b) Remove the gears and bring everything to node Q1

2c) Determine the dynamics assuming J = 0.01 kg m2/s2 and K = 5Nm/rad

3) The Determine the system type and stead-state error for a step and ramp input

G(s)	System Type	Kp	Kv	Error for a Step Input
$\left(\frac{100}{(s+3)(s+10)}\right)$				
$\left(\frac{100}{(s-3)(s+10)}\right)$				
$\left(\frac{100}{s(s+3)(s+10)}\right)$				
$\left(\frac{100}{s^2(s+3)(s+10)}\right)$				

4) Determine the range of k that results in a stable system using a Routh table

$$(s+1)(s+5)(s+10)+10k=0$$

5) Determine the range of k that results in a stable system using a Routh table

$$(s-1)(s+5)(s+10)(s+15)+10k=0$$

Lab (Friday)

Determine the dymamics of the DC servo motor used in lab

$$\omega = \left(\frac{K_t}{(Js+B)(Ls+R)+K_t^2}\right) V_{in}$$

6) Measure the resistance and inductance

R	L

7) Apply a DC voltage to the motor (such as 10V). Measure the speed and current. From this compute the torque constant (Kt)

Vin	Iin	w (rad/sec)	Kt

At constant speed: $V_{in} = I_{in}R + K_t\omega$

8) Measure the step response (apply a 10V step input and measure the speed vs. time). From this, compute a first-order model for the motor. (L = 0)

$$\frac{K_t}{(Js+B)(R+K_t^2} = \frac{a}{s+b}$$

Match terms to get J and B

1st Order Model	J	B