Homework #4: ECE 461 / 661

Code Composer Workbench, Mass Spring Systems, Rotational Systems

Code Composer Workbench / PLC Fiddle

note: For the PLC homework assignments, you can use either

- Allen Bradley's Code Composer Workbence along with a Micro810 PLC (lab kits available), or
- PLC Fiddle (plcfiddle.com)

It's kind of fun seeing and hearing the lights and relays opening and closing. PLC Fiddle is a lot more convenient, however, being an online site where there's nothing to download and install. Your pick.

1) Assume there are two 2-digit numbers, AB and CD, taking on the values of 0 to 3 (00 to11). Determine the logic for three outputs:

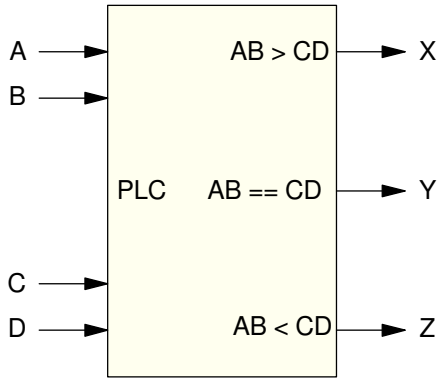
- X is true if AB > CD *OUT-00 (red light) if using a Micro-810*
- Y is true if AB == CD *OUT-01 (yellow light) if using a Micro-810*
- Z is true if AB < CD *OUT-02 (green light) if using a Micro-810*

2) Implement these three outputs using ladder logic using Code Composer Workbench or PLC Fiddle

- It's kind of fun to see and hear the relays opening and closing with CCW and a Micro-810 PLC
- PLC Fiddle is a lot more convenient. You don't have to install anything.
- Your pick (you can use another program if you like)

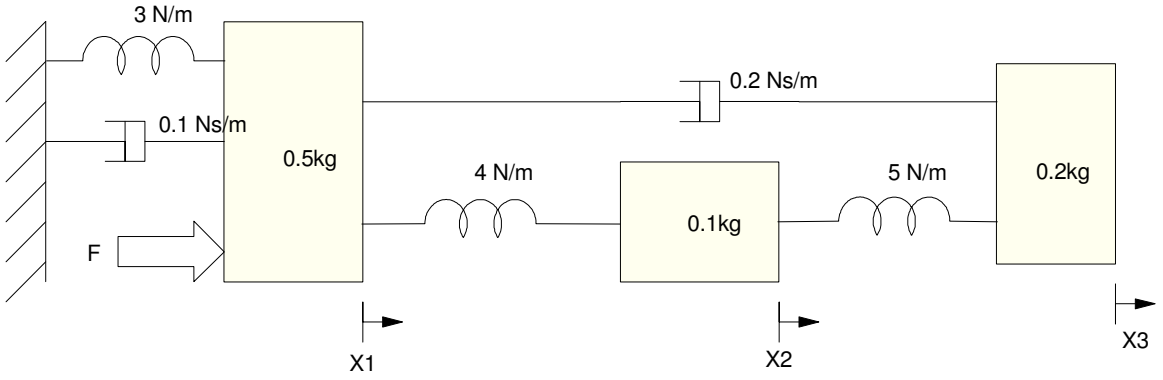
3) Demonstrate your working ladder logic program

- In-person, over zoom, attach a short video, take some screen shots



Mass-Spring Systems

Consider the following mass-spring system:



4) Draw the circuit equivalent for this system

5) Write the differential equations which describe this system

- i.e. Write the voltage node equations.

6) Find the transfer function from F to X3

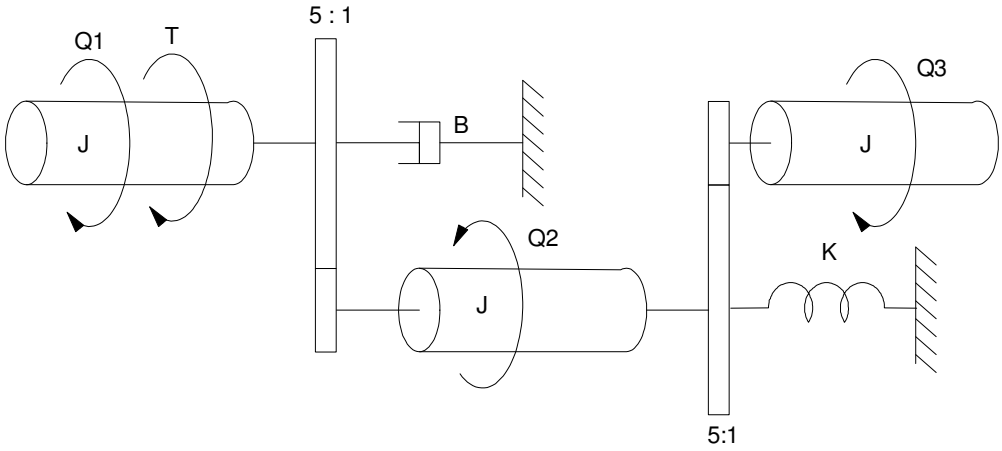
7) Assume F = 0 and X3(0) = 1 meter. What initial condition on X1 and X2 result in the energy in the system decaying

- As fast as possible?
- As slow as possible?

Rotational Systems

Assume for the following rotational system

- J = 0.1 kg m^2
- K = 2 Nm / radian
- B = 0.1 Nms / radian



8) Draw the circuit equivalent for this system

9) Translate all of the impedances over to angle Q1 and write the differential equations which describe this system.

10) Find the transfer function from T to Q1