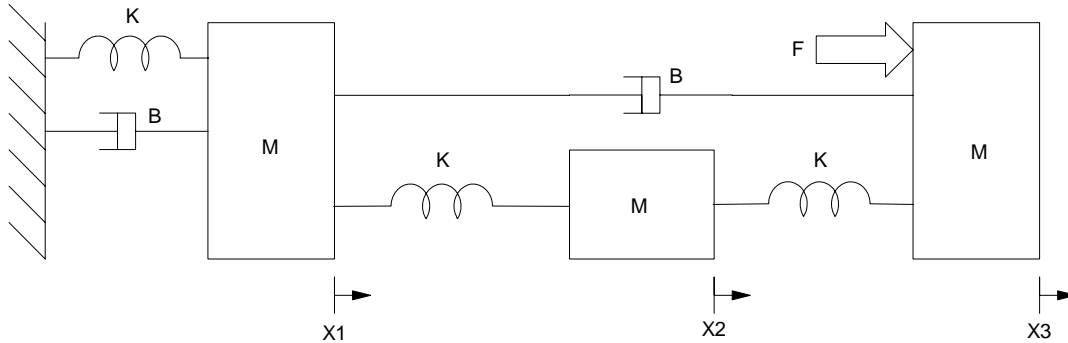


Homework #6: ECE 461/661

Mass-Spring Systems, Rotational Systems, DC Servo Motors. Due Monday, October 8, 2018

Mass Spring Systems

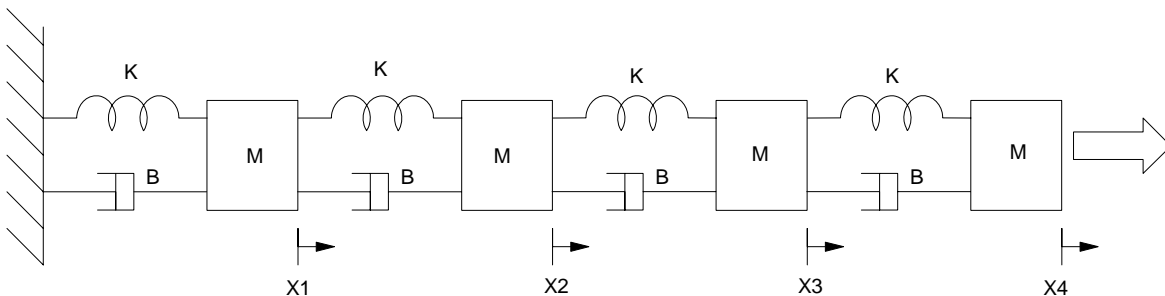
Problem 1: Assume the output is X_3 .



Problem 1: $M = 1\text{kg}$, $K = 100\text{ N/m}$, $B = 2\text{Ns/m}$

- Draw the circuit equivalent for this mass-spring system
- Write the N coupled differential equations which describe this system (i.e. write the voltage node equations)
- Place these equations in state-space form
- Find the transfer function from F to X_3
- Plot the step response from F to X_3 .

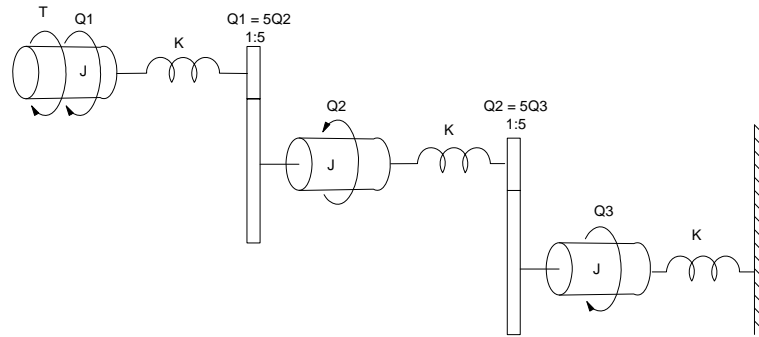
Problem 2: Assume the output is X_4 .



Problem 2: $M = 1\text{kg}$, $K = 100\text{ N/m}$, $B = 2\text{Ns/m}$

- Draw the circuit equivalent for this mass-spring system
- Write the N coupled differential equations which describe this system (i.e. write the voltage node equations)
- Place these equations in state-space form
- Find the transfer function from F to X_4
- Plot the step response from F to X_4 .

Rotational Systems:



Problem 3: $J = 2 \text{ Kg m}^2$, $K = 5 \text{ Nm/rad}$

3) Draw the circuit equivalent for the following rotational system

- Write the dynamics for this system in state-space form
- Find the transfer function from T to Q_3

DC Servo Motors

4) Determine the transfer function and step response for the following DC servo motor:

Baldour MT-3363-B DC Servo Motor: (476W)

- Rotor Inertia: 3.67 kg cm^2
- Viscous Damping: $7.8E-3 \text{ Nm/krpm}$
- Torque Constant: 0.297 Nm/A
- Resistance: 2.4 Ohms
- Inductance: 6.1 mH
- Total Weight: 5 kg (11 lb)
- Price: $\$625$ on ebay



ebay listing: Baldor MTB-3363-BLYCN servo motor servomotor w/brake
Date Sheets: <http://www.baldor.com/mvc/DownloadCenter/Files/BR1202-F>