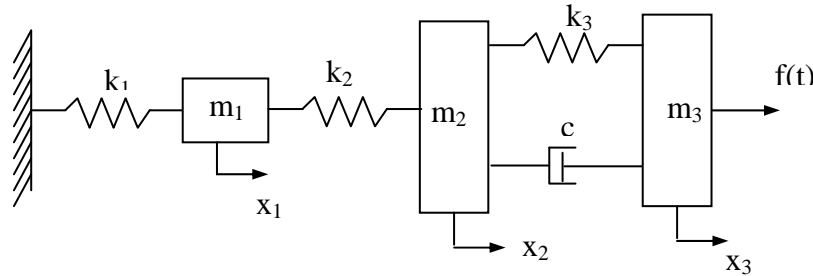


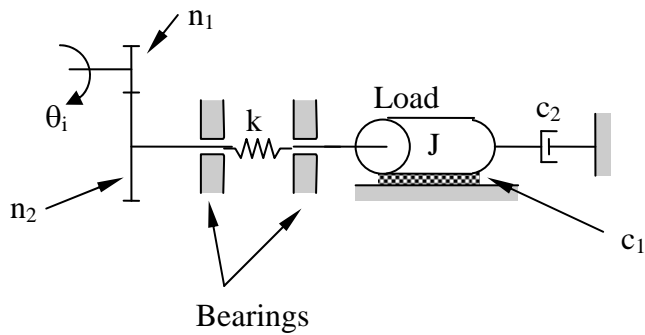
Homework Lecture 3
ES205

Problem 3.1 Consider the translational system shown below. Assume that the system is constrained to move in a vertical plane in a horizontal direction. Draw the necessary free-body diagrams and derive the differential equations. Put the equations in standard 2nd order form.



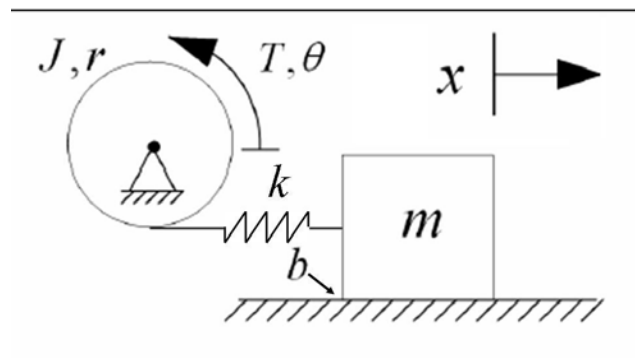
Problem 3.2

Determine the EOM relating the input θ_i to the output θ_{LOAD} for the torsional system shown. Neglect the mass of the gears. Find the system natural frequency and damping ratio.



Problem 3.3 The disk with moment of inertia about the pin, J and radius r is turned by a motor torque T . The disk is connected to the block of mass m through a linear spring with constant k . Motion of the mass with respect to the ground is resisted by viscous damping with constant b .

- a) Find the two coupled 2nd order differential equations relating the input torque to the output displacement of the mass, $x(t)$, and output rotation of the disk $\theta(t)$.
- b) Express the DEs in state space form.



Hint: assume the spring will transmit both compression and tension forces.