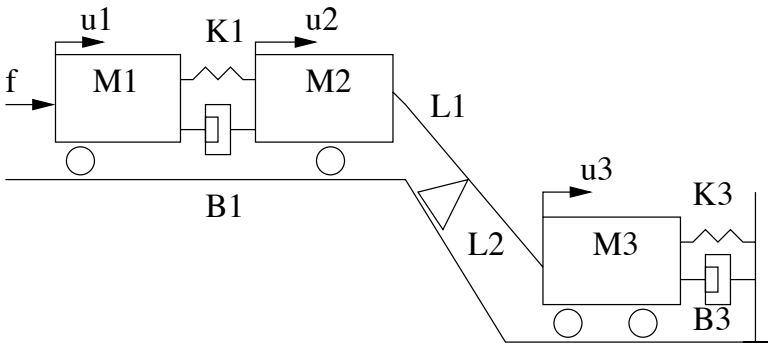
Department of Electrical and Computer Engineering
University of Massachusetts Lowell

16.413 Problem Set #1

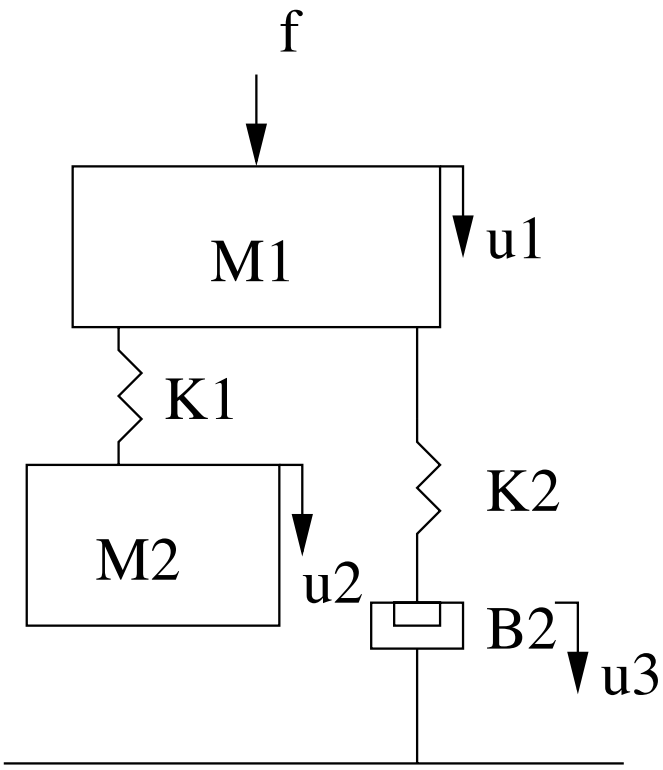
1.Consider the mechanical system. The velocity of the masses are given by u and applied force by the variable f. The variables k represent the mechanical stiffness, M the mass and b the damping coefficient.



a. Using mobility analogy where the velocity as the "across" variable, determine the an equivalent circuit for the system.

b. Determine the equation of motion in the Laplace domain.

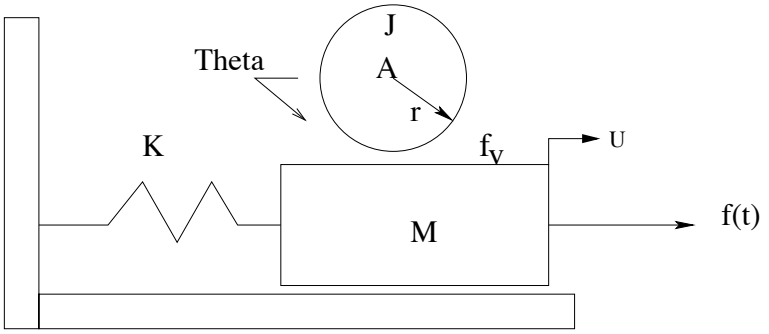
2.Consider the mechanical system. The velocity of the masses are given by u and applied force by the variable f. The variables k represent the mechanical stiffness, M the mass and b the damping coefficient.



a. Using mobility analogy where the velocity as the "across" variable, determine the an equivalent circuit for the system.

b. Determine the equation of motion in the Laplace domain.

c. Determine the transfer function $U_3(s)/U_1(s)$.



3. In the system shown, the inertia, J of a disk of radius, r is constrained to move only about the stationary axis A. The relationship for the torque T at A is equal to

$$J\frac{d^2\Theta}{dt^2} = T$$

A viscous damping force f_v exists between the bodies J and M. The viscous force is equal to $b\Delta u$ where Δu is the relative velocity. If an external force f is applied to the mass find the transfer function $G(s) = \Theta(s)/F(s)$.