1. Consider the coupled acoustic-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. The open pipe has cross sectional area $A$, length $L$ and exit volume velocity $Q_2$

![Diagram of the coupled acoustic-mechanical system]

- **a.** Using mobility analogy where the velocity as the "across" variable, determine the an equivalent circuit for the system.
- **b.** Determine the equations of motion in the Laplace-domain.
- **c.** Determine the equations of motion in the time-domain.
- **d.** Find the transfer function $Q_2(s)/U_o(s)$. 

EECE4130/16.413 Problem Set #2
2. Consider the acoustical system where a rigid piston having a cross sectional area $A$ and mass $M$ is moved at the velocity $u_0$. The piston is placed in a rigid walled cavity having volume $V$. A tube allowing enclosed air to exit the cavity is provided. The tube has a cross section area $A_1$ and length $L$.

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

   b. Determine the equations of motion in the Laplace-domain.

   c. Determine the equations of motion in the time-domain.

   d. Find the transfer function $Q_1/U_0$. 

   

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