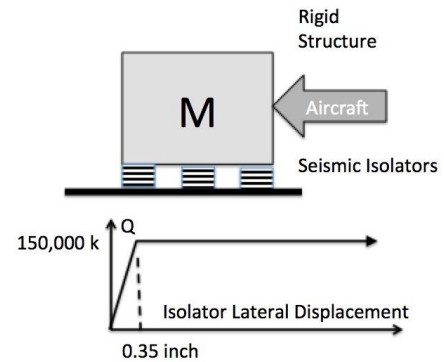


Preliminary Examination in Dynamics

1. Consider the seismically isolated structure to the right. Using engineering fundamentals, estimate the maximum lateral displacement of the isolators, if an aircraft strikes the structure.

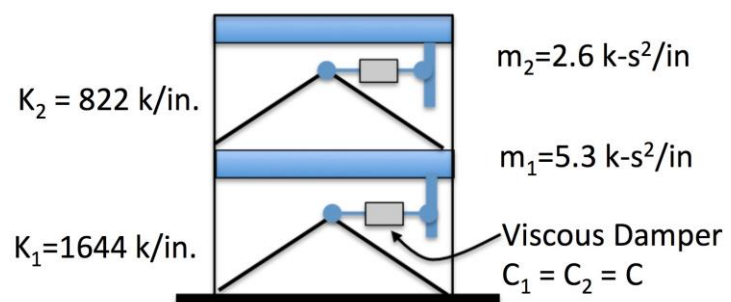
The structure above the isolators weighs 1,000,000 kips and can be considered completely rigid. The isolators have elastic-perfectly plastic properties in the lateral direction as shown to the right. Vertically, the isolators are inextensible. The aircraft weighs 450 kips and is traveling horizontally at 800 ft/sec at the time of impact.

The aircraft “sticks” to the structure during/following the impact. The duration of the impact loading is 0.1 sec, which may be considered significantly shorter than the natural period of the structure. Energy dissipation of the structure, other than in the isolators, should be considered minimal (zero).



2. Consider the elastic two degree-of-freedom shear building shown below. Floor masses and story stiffnesses are indicated in the figure below. You should ONLY consider the first mode dynamic response to horizontal base seismic excitations. The structure may be assumed to have zero inherent viscous damping. It is desired to increase the effective viscous damping in the first mode to 10% by adding linear fluid viscous dampers between each floor as shown below. The viscous dampers may be assumed to provide NO stiffness to the structure, and can be assumed to provide a transverse velocity dependent force between each level of $F_d = C\dot{v}$, where C is the damping coefficient, and $\dot{v}$ is the relative lateral velocity between adjacent floors. Identical dampers are to be placed in each story. The braces used to hold the dampers in place may be assumed to be inextensible. You may make any other common simplifying assumptions in your analyses, but please indicate all such assumptions.

Determine the value of C necessary to achieve the 10% effective viscous damping ratio in the first mode (note C is to be the same for both stories).



Name: _____

Name: _____