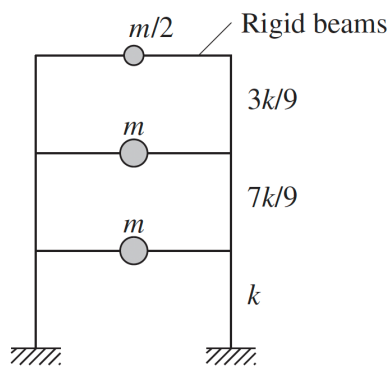


Téléphone : +41 21 693 24 27
 Fax : +41 21 693 28 68
 E-mail : dimitrios.lignos@epfl.ch
 Site web : <http://resslab.epfl.ch>
 Address: EPFL ENAC IIC RESSLAB
 GC B3 485, Station 18,
 CH-1015, Lausanne

Exercise #10: Damping models

Problem 1

The properties of a three-story shear building are given in Figure 1.1. These include the floor masses, story stiffnesses, natural vibration frequencies and modes. Derive a Rayleigh damping matrix such that the damping ratio is 5% for the first and third modes. Compute the damping ratio for the second mode.



$$m = 45,000 \text{ kg} \quad k = 300 \text{ kN/cm}$$

$$\omega_n = 12.17, 25.82, 39.44 \text{ rad/s}$$

$$\phi_1 = \begin{Bmatrix} 0.4837 \\ 0.9673 \\ 1.4510 \end{Bmatrix}, \quad \phi_2 = \begin{Bmatrix} -0.7454 \\ -0.7454 \\ 1.4907 \end{Bmatrix}, \quad \phi_3 = \begin{Bmatrix} -1.1970 \\ 0.8550 \\ -0.3420 \end{Bmatrix}$$

Figure 1.1 Schematic and properties of the building