BRUFACE
MA1 Civil Engineering

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Dynamics of Structures
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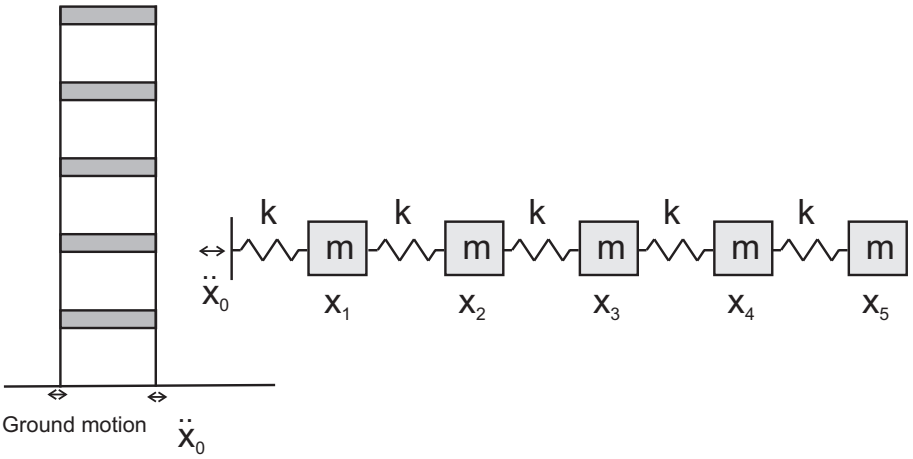
Session 3 : MDOF systems

Exercise 1



Consider a building with five storeys, which can be approximated by a 5 dofs model as shown in the figure.

- Write the equations of motion in the matrix form. The excitation of the system is in the form of a ground acceleration $\ddot{x_0}$.
- Compute the mode shapes and eigenfrequencies of the building for $k = 100N/m$ and $m = 7g$, and a fixed base (eig function in Matlab). Represent the mode shapes using a bar graph ($barh$).
- Compute the transfer function between the relative displacement of the top floor and the ground acceleration using the decomposition in the modal domain and explicit analytical expressions. Take a value of $\xi_i = 0.01$ for all five modes

Exercise 2

Using the same earthquake data as in Session 2 ($quake.mat$ file),

- Compute the relative displacement of the top floor as a function of time using a convolution and modal decomposition
- Show the influence of the modal damping ξ_i (increase for example to $\xi_i = 0.05$ for all modes)
- Vary the value of m in order to change the first natural frequency of the building and illustrate the effect of 'low-tuning' and 'high-tuning' (plot $x_r/\sqrt{m}$ as explained in the course slides)