

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 #4: Earthquake response of single-degree-of-freedom systems

Problem 1

The concrete frame shown in the figure is located on sloping ground and carries 1220kN of seismic weight. The beam is made much stiffer than the columns and can be assumed as rigid. The cross sections of the concrete column are 250mm x 250mm and their respective lengths are shown in the figure. Determine the following:

1. The natural vibration period of the frame.
2. The base shear in the two columns at the instant of peak response due to the ElCentro ground motion. Assume the damping ratio to be 2%.

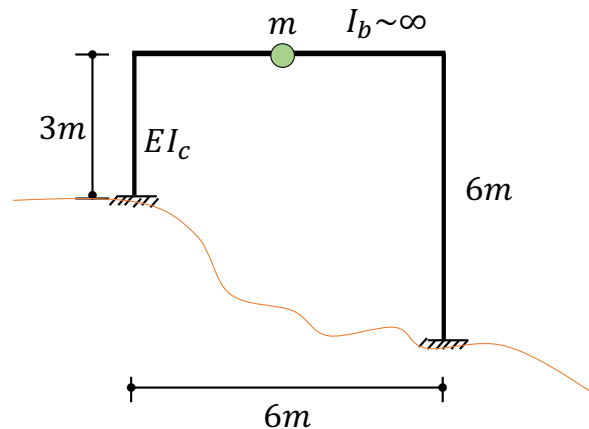


Figure 3.1

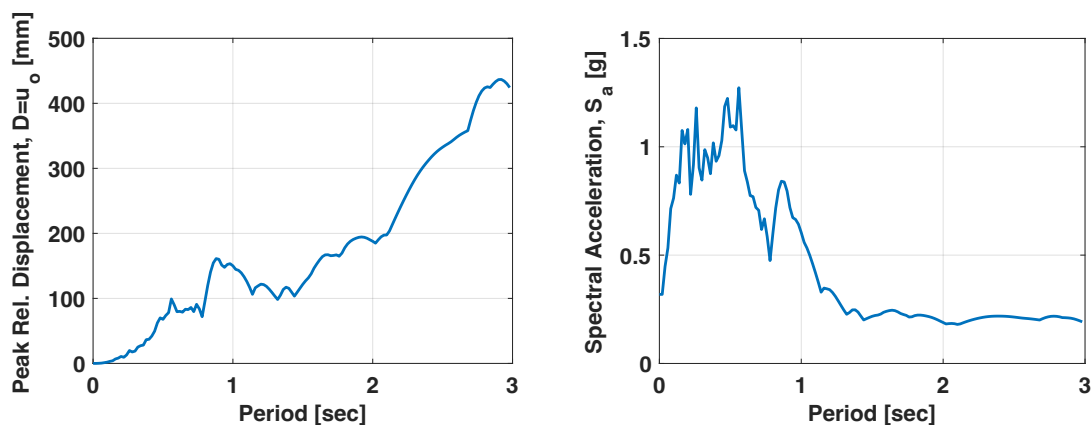


Figure 3.2 response spectra for ElCentro ground motion (2% damping ratio)

Problem 2

Implement the numerical algorithm of the Central Difference Method into a programming language of your choice and compute the deformation response $u(t)$ for $0 \leq t \leq 15\text{sec}$ for an SDF system with natural period of $T_n = 2\text{sec}$ and damping ratio of 0% and 5% to ElCentro 1940 ground motion.