SDNV112 - Building of civil engineer under seismic request of standard multi-support

Summary:

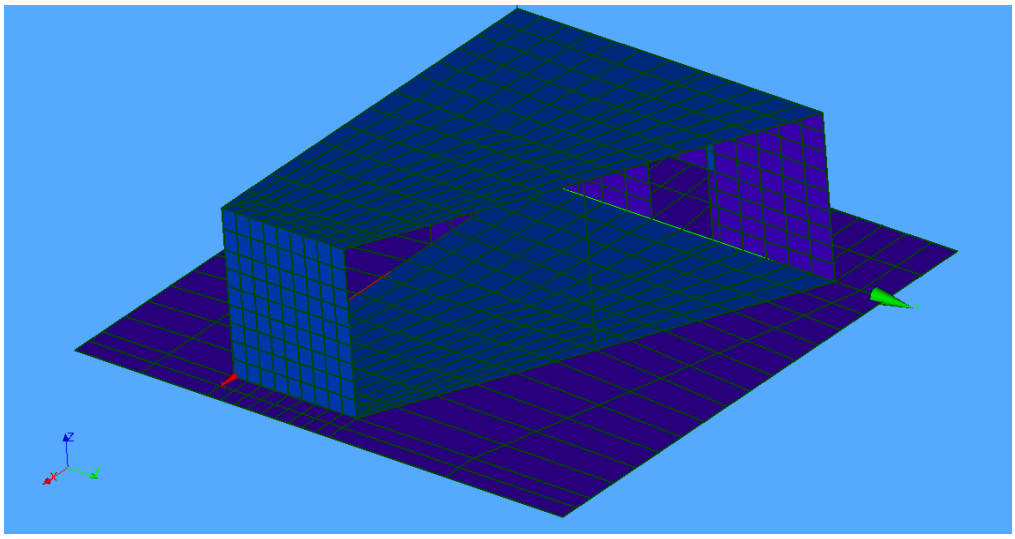
The objective of this test is to validate the order MACR_SPECTRE in the case of a multi-supported three-dimensional structure.

1 Problem of reference

1.1 Geometry

The geometry is a simplified building comprising three veils, a floor, a sole and a foundation raft. Moreover part of the ground is represented.

The elements of civil engineer have a thickness of $0,1\,m$ while the foundation raft and the sole have a thickness respectively of $0.5\,m$ and of $0.35\,m$. The post has a rectangular section of $0.2\times 0.2\,m$ and the beam has a section of $0.15\times 0.325\,m$. The point of anchoring of the post is named S. This point is not in contact with the foundation raft.



1.2 Properties of material

The material is elastic isotropic whose properties are:

- $E=200\,000\,MPa$
- $\nu=0.3$
- $\rho=7800.\mathrm{Kg}/m^3$

1.3 Boundary conditions and loadings

The veils of the building are connected to the foundation raft. This one has a rigid movement of body. The group of nodes CDG belongs to the foundation raft. These nodes have a different acceleration according to time t in each direction.
The group of nodes S, end of the post with dimensions foundation raft. These nodes have a different acceleration according to time t in each direction.

Group of nodes	Acceleration according to X	Acceleration following there	Acceleration according to Z
CDG	$\cos(60\pi t)$	$\cos(90\pi t+\pi/3)$	$20\cos(30\pi t+\pi/4)$
S	$\cos(90\pi t+\pi/3)$	$20\cos(30\pi t+\pi/4)$	$\cos(60\pi t)$

2 Reference solution

2.1 Method of calculating

The result of reference was got by calculating the spectrum envelope of the floor (level 1) of the building using classical orders, orders gathered under the order MACR_SPECTRE.

2.2 Results of reference

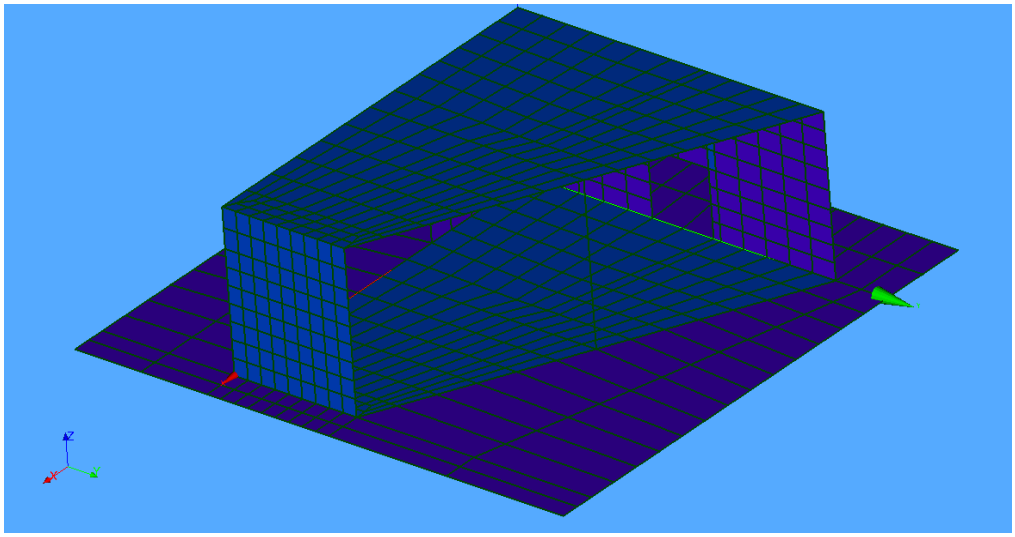
The spectrum of floor envelope obtained for a damping equal to $0,05$ to the various frequencies is presented below.

Frequency (Hz)	Acceleration (m/s^2)
$0,1$	5.10535E-03
$0,2$	1.62051E-02
$0,3$	2.55750E-02
$0,41$	3.53812E-02
$0,52$	4.53316E-02
$10,0$	2.89311E+00
$15,0$	1.87495E+01
$20,0$	6.32936E+00

3 Modeling A

3.1 Characteristics of the model

A modeling is used DKT for the veils, floors and the foundation raft and a modeling POU_D_T for the beams and columns.



3.2 Characteristics of the grid

The grid consists of: 19 SEG2
793 QUAD4

3.3 Sizes tested and results

One tests acceleration at the frequency of $0,52\ Hz$

Size	Reference	Tolerance (%)
$Accélération$ with $0,52\ Hz$	$4.53316\mathrm{E}-02\ m\ s^{-2}$	1E-4

4 Summary of the results

The good agreement of the results provided by the sequence of the order and order MACR_SPECTRE allows to validate the latter for the case multi-supports.