SDLX101 - Checking of chaining MISS3D -*Code_Aster* in the case of a building of big size

Summary:

This test of nonregression implements a calculation of interaction ground-structure carried out thanks to the chaining *Code_Aster* - MISS3D by the frequential method of coupling on a model 3D of building resting on a homogeneous ground.

Spectra of answer obtained starting from the model 3D of this building and using the chain *Code_Aster* - MISS3D constitute a first result of reference.

One validates by comparison itS modeS of CALC_MISS/TYPE_RESU 'TRAN_GENE' and 'HARM_GENE', for the loadings by signal in acceleration and displacement, defined in time or frequency.

1 Problem of reference

1.1 Geometry

Software MISS3D uses the frequential method of coupling to take account of the interaction ground - structure. This method, based on of dynamic under-structuring, consists in cutting out the field of study in three under-fields:

- ground,
- the foundation,
- the building.

The geometry taken into account is that of a building extended on erasing single.

Geometry of the model of the foundation

The foundation raft is cruciform, as shows it below it [Figure 1.1-a]:

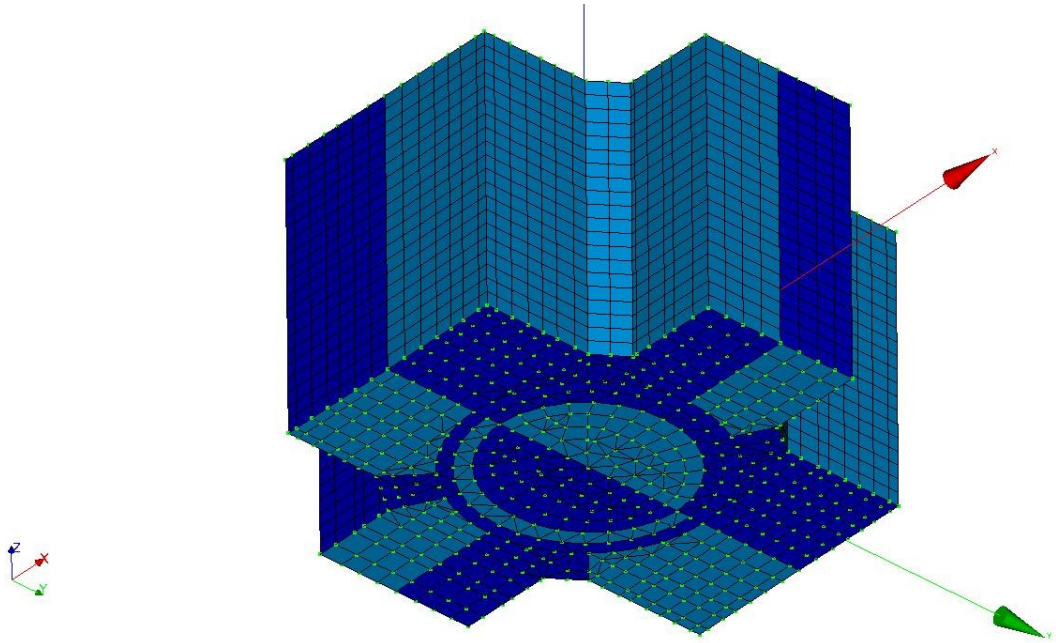

Figure 1.1-a: Foundation of the building

1.2 Properties of materials

An average homogeneous ground is considered whose characteristics are summarized in table Ci - afterwards:

Sleep	Thickness (m)	$\rho\,(kg/m^3)$	ν	$E\,(MPa)$	β
Lay down 1	113.4	2100	0.4	7000	0.1

Table 1.2-1: Soil mechanics characteristics homogeneous

The foundation and the building are out of reinforced concretes, prestressed and rigid:

Material	$E\,(Pa)$	$\rho\,(kg/m^2)$	ν
armed	3.5 E10	$0 \Rightarrow 12500$	0.2
prestressed	4.0 E10	2.5 E3	0.2
rigid	4.0 E11	0.	0.2

1.3 Boundary conditions and loadings mechanical

The foundation is regarded as rigid. This condition is ensured by a solid connection on the group of meshs of the foundation.

The seismic excitation of the structure is carried out by applying 3 accélérogrammes such as:

Direction	Accélérogramme	Normalizes
X	acc1.c2	$0.1\,g$
Y	acc2.c2	$0.1\,g$
Z	acc3.c2	$0.06\,g$

Table 1.3-1: Seismic excitations

One thus gives here the accélérogramme (normalized to $0.1\mathrm{g}$) and the spectrum of each elementary excitation for a damping of 4%.

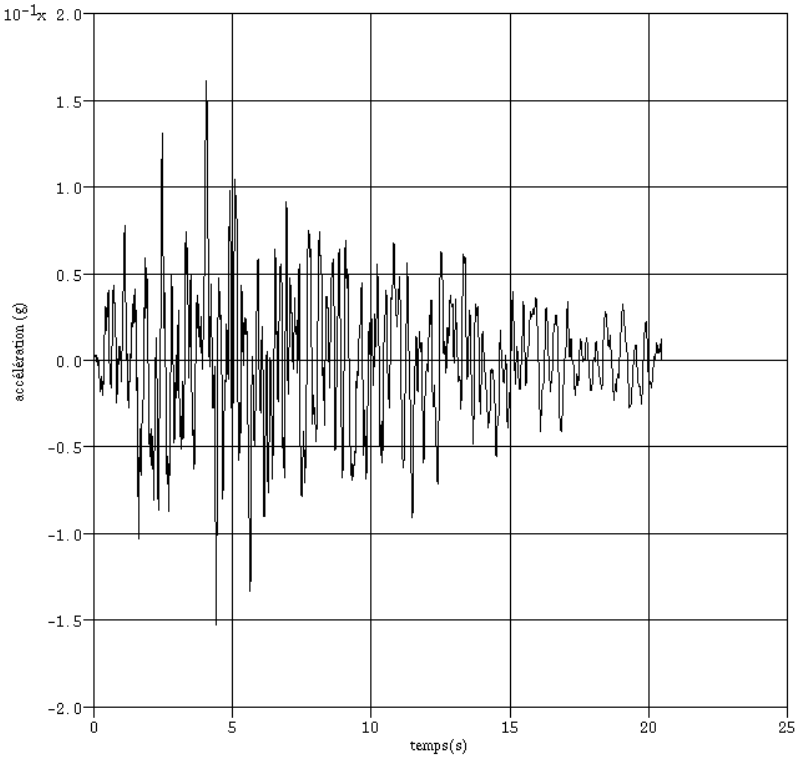

Figure 1.3-a: Accélérogramme `acc1.c2`

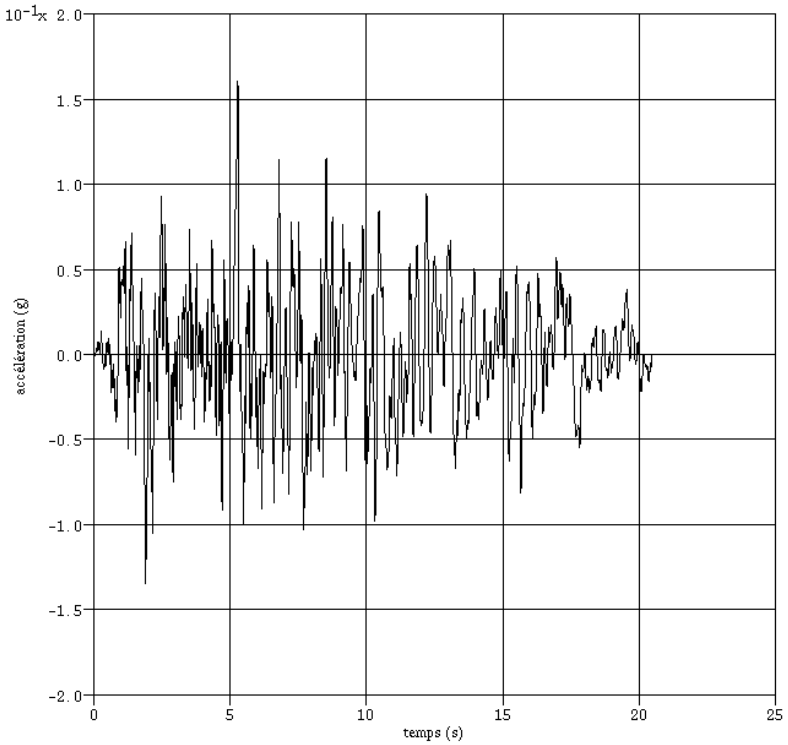

Figure 1.3-b: Accélérogramme `acc2.c2`

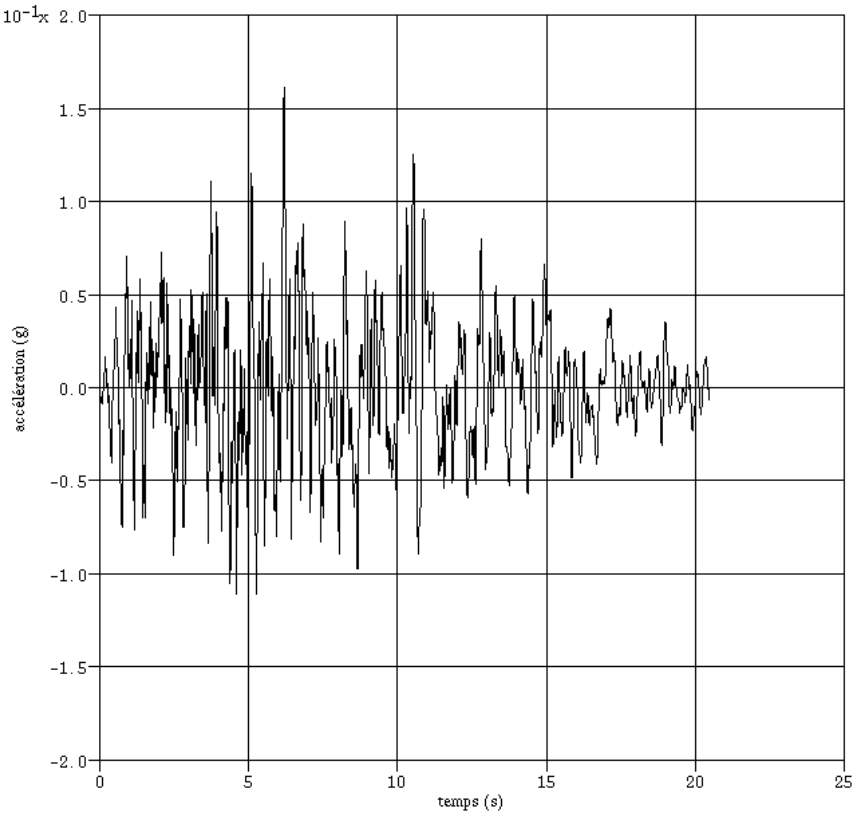

Figure 1.3-c: Accélérogramme `acc3.c2`

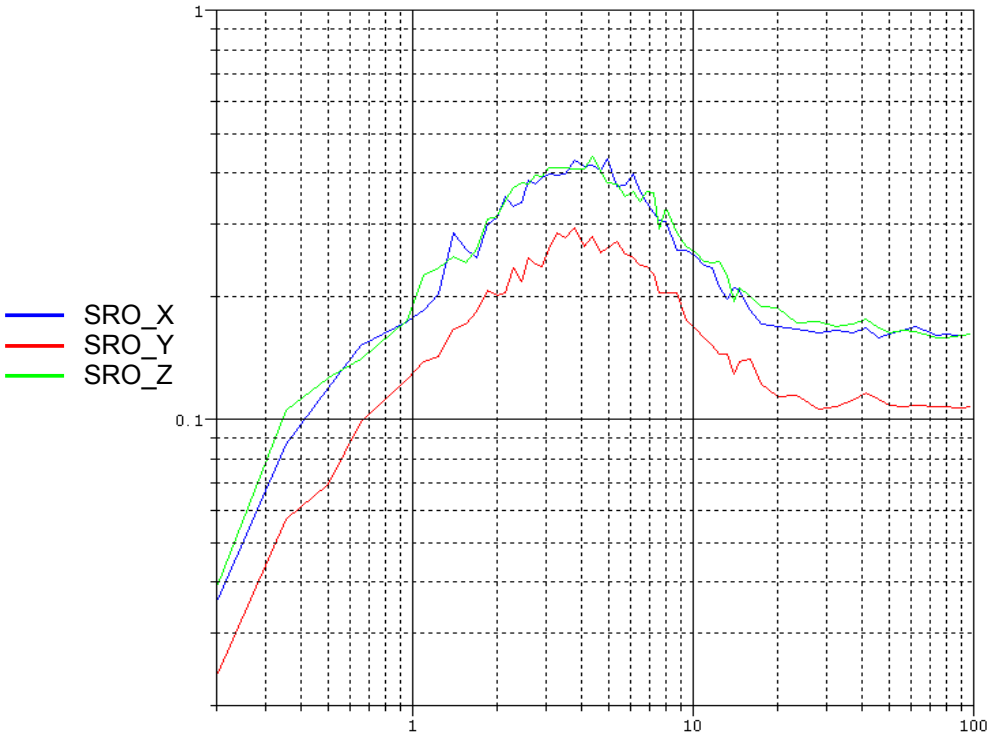

Figure 1.3-d: Spectra of the excitation

A second calculation is done by providing accélérogrammes on frequential basis directly. The results are then compared with the first calculation.
One also checks by direct comparison itS modeS of CALC_MISS/TYPE_RESU 'TRAN_GENE' and 'HARM_GENE', for the loadings by signal in acceleration and displacement. The comparison being done on spectra of oscillator, one calculates previously the FFT reverses harmonic result with the operator REST_SPEC_TEMP.

2 Reference solution

2.1 Method of calculating used for the reference solution

Case test of nonregression for the first calculation (accélérogrammes on temporal basis), reference 'AUTRE_ASTER' for the second calculation (accélérogrammes on frequential basis) with the first calculation for reference.

2.2 Results of reference

The spectra of floor were calculated in pseudo-acceleration with a damping of 4% in the horizontal directions X and Y at the top of the building.

One calculates the spectra on certain nodes of the top of the grid. The final spectrum is obtained by taking the envelope of the directions X and Y.

2.3 Bibliographical reference

1) G. QUILTON: “Presentation and examples of use of CLASSI: Computer code of analysis of the effects of the interaction ground - structure on the seismic answer of the buildings” E SE MT 82 - 01 SG 1

3 Modeling A

3.1 Characteristics of modeling

Grid of the foundation

The foundation in the shape of cross:

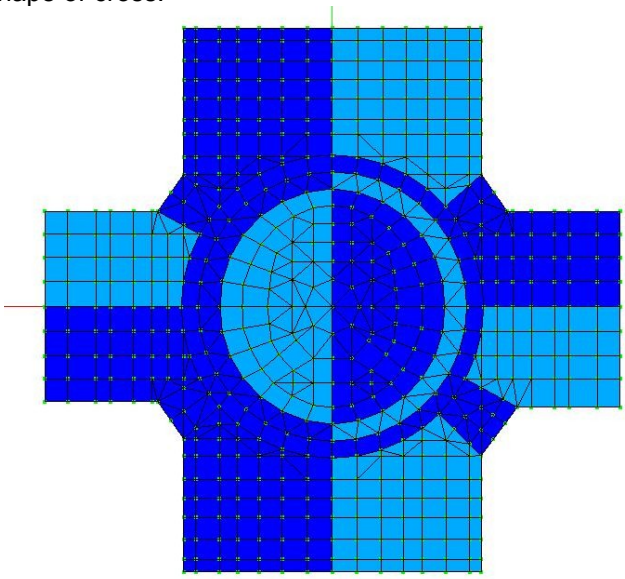

Figure 3.1-a: Grid of the foundation

Grid of the building

The model hollow 3D of the building consists of elements of plates:

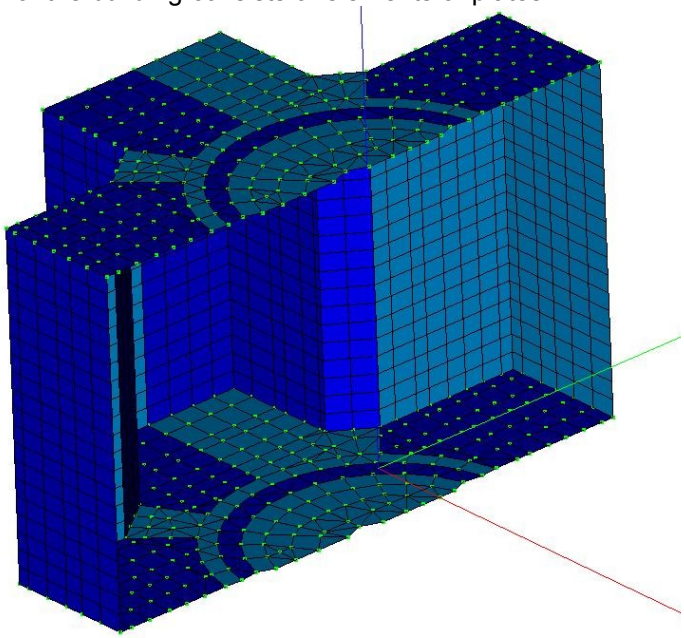

Figure 3.1-b: Representation out of cut of the grid of the building

Damping is initially regarded as modal damping taken equal to 7% for all the clean modes of the structure on embedded basis calculated in the seismic range for Eigen frequencies lower than $23\,Hz$.

An alternative modeling of damping consists in representing the damping of the structure in the form of a combination of Rayleigh with: $\alpha = 2.48\text{E-}3$, $\beta = 0.78$.

3.2 Characteristics of the grid

The model is composed of 3,149 nodes and 3,432 elements plates.

3.3 Sizes tested and results

3.3.1 Withmortissement modal

The values of spectra tested are those obtained with the assumption of modal damping. The imposed requests are the accelerations given on [Figures 1.3] above.

3.3.2 Withmortissement of Rayleigh

The values of spectra tested are those obtained with the assumption of damping of Rayleigh the imposed requests are dieplacements resulting from a double integration of the accelerations given on [Figures 1.3] above.

4 Summary of the results

The got results constitute tests of nonregression.