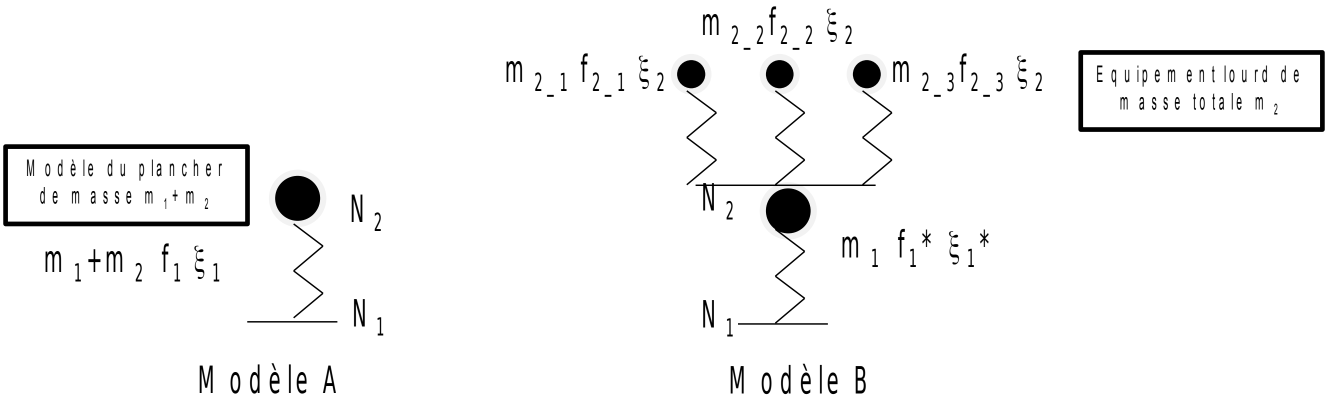
SDLD109 – Calculation of the spectra with the taking into account of the interaction floor-material

Summary:

This case test gives an example of the use of the macro-order CALC_SPECTRE_IPM [U4.32.12] who allows the taking into account of the interaction of heavy equipment in the calculation of the spectra of floor. One validates the treatment in relative or absolute reference mark and the correction of the initial state.

1 Problem of reference

1.1 Geometry



The model With, representing the mode of inflection of a floor with the taking into account of a heavy equipment, is modelled.

1.2 Properties of the model

The floor has the following properties:

- mass $m_1=1$,
- vertical stiffness $k_1=4000$,
- damping $\xi_1=0.07$.

The Eigen frequency of the floor is $f_1^*=10.07$.

The equipment has the following properties:

- mass $m_{2-1}=0.05$ $m_{2-2}=0.025$ $m_{2-3}=0.025$,
- vertical stiffness $k_{2-1}=200$ $k_{2-2}=800$ $k_{2-3}=50$,
- damping $\xi_2=0.05$.

The Eigen frequencies of each equipment are: $f_{2-1}=10.07$, $f_{2-2}=28.47$ and $f_{2-3}=7.12$.

In the studied case, the report of the masses is $\lambda=\frac{m_2}{m_1}=0.1$. The frequency of equipment being identical to that of the support, one is in a case where the interaction is maximum.

1.3 Boundary conditions and loadings

Boundary conditions: the N1 node is blocked.

Loading: a sinusoidal acceleration is imposed on the system mass-arises $f(t)=\sin(2\pi 20t)$

The transitory answer of the system is calculated with the operator `DYNA_VIBRA` on physical basis (`BASE_CALCUL=' PHYS'`) in transient (`TYPE_CALCUL=' TRAN'`), with a step of 0.1 ms time.

2 Reference solution

The reference solution corresponds to the model B.

3 Modeling A

3.1 Characteristics of modeling

One models model A thanks to elements DIS_T

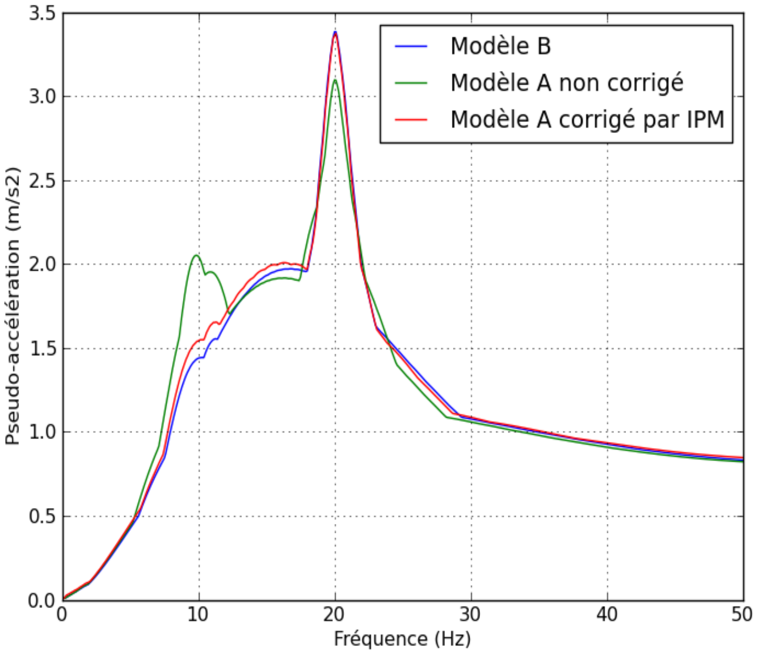
3.2 Characteristics of the grid

Many nodes: 2
Many meshs: 3 DIS_T to model the mass (M_T_D_N), stiffness (K_T_D_L) and the shock absorber (A_T_D_L)

3.3 Results

The spectrum of vertical answer obtained thanks to the macro-order CALC_SPECTRE_IPM starting from vertical acceleration of the node NR02 is compared to that obtained thanks to the model B. One is in a case with resolution in relative reference mark (loading mono-support).

One carries out a checking of the values of pseudo_acceleration for several values of acceleration.



Node	Frequency	Reference	Type of reference	Tolerance
N02	5	0,425896	'AUTRE_ASTER'	3 %
N02	10	1.44050	'AUTRE_ASTER'	3 %
N02	15	1.93754	'AUTRE_ASTER'	0.1 %
N02	20	3.39816	'AUTRE_ASTER'	0,5 %
N02	25	1.46011	'AUTRE_ASTER'	1%
N02	30	1.08058	'AUTRE_ASTER'	1.1 %
N02	35	1.00117	'AUTRE_ASTER'	0,9 %
N02	40	0.929183	'AUTRE_ASTER'	0,3 %
N02	45	0.871687	'AUTRE_ASTER'	1%
N02	50	0.833936	'AUTRE_ASTER'	1,9 %

One validates also the treatment of the case in absolute reference mark, by comparison with the result into relative with a signal of null training.

Lastly, one validates the initial correction (`CORR_INIT=' OUI'`) for which one needs a not-worthless initial acceleration. For that, one will slightly shift in time the signal of training: $f(t)=\sin(2\pi 20.(t+0.00001))$. The answer obtained will thus remain very close to initial calculation without this shift.

4 Summary of the results

The got results show a very good agreement with the reference solution. The variations are lower than 3 % and one could still to decrease by decreasing the step of time of resolution, to the detriment of the computing time.