ZZZZ369 – Validation of the option MASS_MECA for the elements MEMBRANE and GRILLE_MEMBRANE

Summary

This dynamic test enters within the framework of the validation of the elements MEMBRANE and GRILLE_MEMBRANE. A concrete plate (modelled in HULL) contains two tablecloths of reinforcements confused on the average layer of the plate. The plate is subjected to a specific effort in its center.

In modeling A, the grids are modelled by elements GRILLE_EXCENTRE. This modeling is used as reference. In modeling B, the grids are modelled by elements MEMBRANE. In modeling C, the grids are modelled by elements GRILLE_MEMBRANE.

This test aims at validating the options MASS_MECA and MASS_MECA_DIAG elements MEMBRANE and GRILLE_MEMBRANE.

1 Problem of reference

1.1 Geometry

The concrete console is modelled by elements of hull (DKT). The tablecloths of reinforcement (not offset) are modelled by modelings GRILLE_ENCENTRE for modeling A, MEMBRANE for modeling B and GRILLE_MEMBRANE for modeling C.

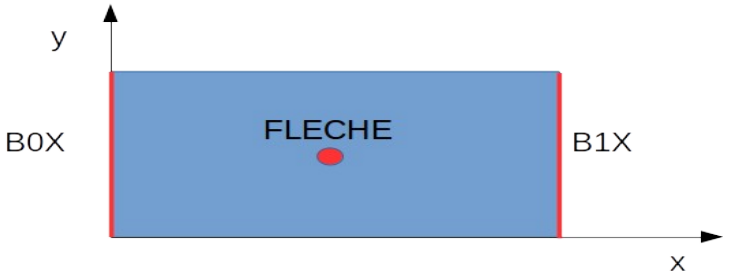

Figure 1-1: definition of the geometry

1.2 Properties of materials

Concrete console: $E=3.10^{10}\,Pa$, $\nu=0$, $\rho=2500\,kg/m^3$

Thickness of the console: $0.2\,m$; ANGL_REP = (0; 0)

Tablecloths of steel reinforcement: $E=2.10^{11}\,Pa$, $\nu=0$, $\rho=7800\,kg/m^3$

Tablecloth of high reinforcement: section per linear meter = $0.2\,m^2/ml$; ANGL_REP = (0; 0)
Tablecloth of low reinforcement: section per linear meter = $0.2\,m^2/ml$; ANGL_REP = (0; 0)

1.3 Boundary conditions and loadings

The boundary conditions and the loadings break up in the following way:

Edges $B0X$ and $B1X$ embedded
Nodal force $FX=10^7\,N$ with the node $FLECHE$ (node in the center of the plate), applied with the multiplying function f following:

Time (S)	f
0	0
0.001	1
0,01	1

2 Reference solution

Modeling A is used as reference to other modelings.

3 Modeling A

3.1 Characteristics of modeling

The grids are modelled with the elements GRILLE_EXCENTRE.

3.2 Results of modeling A

MASS_DIAG = 'NOT' :

INST	Field	Node	Component	Values (m)
0.0025	DEPL	*FLECHE*	DZ	0.0109567646193
0.005	DEPL	*FLECHE*	DZ	0.0265838623891
0.0075	DEPL	*FLECHE*	DZ	0.0365051574438
0.01	DEPL	*FLECHE*	DZ	0.0501669081693

MASS_DIAG = 'YES' :

INST	Field	Node	Component	Values (m)
0.0025	DEPL	*FLECHE*	DZ	0.00528882214692
0.005	DEPL	*FLECHE*	DZ	0.0216344276355
0.0075	DEPL	*FLECHE*	DZ	0.0379492541791
0.01	DEPL	*FLECHE*	DZ	0.0481037546229

4 Modeling B

The grids are modelled with the elements MEMBRANE.

4.1 Results of modeling B

MASS_DIAG = 'NOT' :

INST	Field	Node	Component	Values (m)	Precision (%)
0.0025	DEPL	*FLECHE*	DZ	0.0109567646193	1E-6
0.005	DEPL	*FLECHE*	DZ	0.0265838623891	1E-6
0.0075	DEPL	*FLECHE*	DZ	0.0365051574438	1E-6
0.01	DEPL	*FLECHE*	DZ	0.0501669081693	1E-6

MASS_DIAG = 'YES' :

INST	Field	Node	Component	Values (m)	Precision (%)
0.0025	DEPL	*FLECHE*	DZ	0.00528882214692	1E-6
0.005	DEPL	*FLECHE*	DZ	0.0216344276355	1E-6
0.0075	DEPL	*FLECHE*	DZ	0.0379492541791	1E-6
0.01	DEPL	*FLECHE*	DZ	0.0481037546229	1E-6

5 Modeling C

The grids are modelled with the elements GRILLE_MEMBRANE.

5.1 Results of modeling C

MASS_DIAG = 'NOT' :

INST	Field	Node	Component	Values (m)	Precision (%)
0.0025	DEPL	*FLECHE*	DZ	0.0109567646193	1E-6
0.005	DEPL	*FLECHE*	DZ	0.0265838623891	1E-6
0.0075	DEPL	*FLECHE*	DZ	0.0365051574438	1E-6
0.01	DEPL	*FLECHE*	DZ	0.0501669081693	1E-6

MASS_DIAG = 'YES' :

INST	Field	Node	Component	Values (m)	Precision (%)
0.0025	DEPL	*FLECHE*	DZ	0.00528882214692	1E-6
0.005	DEPL	*FLECHE*	DZ	0.0216344276355	1E-6
0.0075	DEPL	*FLECHE*	DZ	0.0379492541791	1E-6
0.01	DEPL	*FLECHE*	DZ	0.0481037546229	1E-6

6 Conclusions

The results between three modelings are identical. That validates the calculation of the matrices of mass for the elements MEMBRANE and GRILLE_MEMBRANE.