Modeling GRILLE_EXCENTRE, GRILLE_MEMBRANE and MEMBRANE

Summary:

This document describes for modelings GRILLE_EXCENTRE, GRILLE_MEMBRANE and MEMBRANE:

- degrees of freedom carried by the finite elements which support modeling,
- the related meshs supports,
- supported materials and loadings,
- options of calculations for the elementary matrices and the post treatments,
- nonlinear possibilities as well as the options of the breaking process if they exist.

Modeling GRILLE_EXCENTRE (Phenomenon: MECHANICS) corresponds to finite elements whose meshs supports are triangles with three nodes and is used to represent the reinforcements for modelings reinforced concrete of type hull. Indeed, it makes it possible to take into account the offsetting of the tablecloths of reinforcements compared to the average layer.

Modeling GRILLE_MEMBRANE (phenomenon: MECHANICS) corresponds to finite elements whose meshs supports are triangles with three or six nodes and quadrangles with four or eight nodes and is used to represent the reinforcements for modelings reinforced concrete of the massive type 3D. Indeed, it does not make it possible to take into account offsetting and thus does not require a degree of freedom of rotation, useless in modeling 3D.

Modeling MEMBRANE (phenomenon: MECHANICS) corresponds to finite elements whose meshs supports are triangles with three, six or seven nodes and of the quadrangles with four, eight or nine nodes and is used to represent a behavior linear of unspecified membrane or a nonlinear behavior of isotropic membrane. It does not make it possible to take into account offsetting and presents only degrees of freedom of displacement.

1 Discretization

1.1 Degrees of freedom

Modeling	Degrees of freedom (with each node top)
GRILLE_EXCENTRE	DX : following displacement X DY : following displacement Y DZ : following displacement Z DRX : rotation around X DRY : rotation around Y DRZ : rotation around Z
GRILLE_MEMBRANE and MEMBRANE	DX : following displacement X DY : following displacement Y DZ : following displacement Z

1.2 Mesh support of the matrices of rigidity

The meshs support of the finite elements, in displacement formulation, are triangles.

Modeling	Mesh	Finite element
GRILLE_EXCENTRE	TRIA3	MEGCTR3
	QUAD4	MEGCQU4
GRILLE_MEMBRANE	TRIA3	MEGMTR3
	QUAD4	MEGMQU4
	TRIA6	MEGMTR6
	QUAD8	MEGMQU8
MEMBRANE	TRIA3	MEMBTR3
	QUAD4	MEMBQU4
	TRIA6	MEMBTR6
	QUAD8	MEMBQU8
	SORTED7	MEMBTR7
	QUAD9	MEMBQU9

1.3 Mesh support of the loadings

All the loadings applicable to the facets of the elements of grid and membrane are treated by direct discretization on the mesh support of the element in displacement formulation.

No mesh support of loading is thus necessary for the faces of the elements of grids and membranes.

2 Significance of the symbols

•	corresponds to a functionality available
	corresponds to a functionality which could exist but noncurrently available
Name of CAS-test	corresponds to a test implementing the functionality

3 Assignment of the characteristics

One must affect the characteristics of the elements GRID by using the keyword GRID order AFFE_CARA_ELEM, and characteristics of the elements MEMBRANE with the keyword MEMBRANE.

4 Supported materials

DEFI_MATERIAU	GRILLE_EXCENTRE	GRILLE_MEMBRANE	MEMBRANE
ELAS	SSNS100A	SSNS105A	SSNS115
PINTO_MENEGOTTO	SSNS100C	•	
ECRO_LINE	SSNS100A	SSNS105A	
ECRO_LINE_FO	•	•	
CHABOCHE			
ELAS_MEMBRANE			SSLS138

5 Supported loadings

5.1 Order AFFE_CHAR_MECA

AFFE_CHAR_MECA generals	GRILLE_EXCENTRE	GRILLE_MEMBRANE	MEMBRANE
DDL_IMPO	SSLS109B	SSNS105A	SSLS138
LIAISON_DDL	•	•	•
LIAISON_OBLIQUE	•	•	•
FORCE_NODALE	SSLS109B	•	•

AFFE_CHAR_MECA individuals	GRILLE_EXCENTRE	GRILLE_MEMBRANE	MEMBRANE
FORCE_ELEC			
IMPE_FACE			
INTE_ELEC			
GRAVITY	SSLS132	SSLS132	SSLS132 SSNS116
PRES_REP			SSNS115
ROTATION			
EPSI_INIT	SSLS132	SSLS132	SSLS132
VITE_FACE			

5.2 Order AFFE_CHAR_MECA_F

AFFE_CHAR_MECA_F generals	GRILLE_EXCENTRE	GRILLE_MEMBRANE	MEMBRANE
DDL_IMPO	•	•	•
LIAISON_DDL	•	•	•
LIAISON_OBLIQUE	•	•	•
FORCE_NODALE	•	•	•

AFFE_CHAR_MECA_F individuals	GRILLE_EXCENTRE	GRILLE_MEMBRANE	MEMBRANE
FORCE_ELEC			
IMPE_FACE			
INTE_ELEC			
GRAVITY			
ROTATION			
EPSI_INIT			
VITE_FACE			

6 Non-linear possibilities

Nonlinear behaviors for modelings GRID correspond to particular incrémentaux behaviors in STAT_NON_LINE :

- GRILLE_ISOT_LINE for plasticity with isotropic work hardening,
- GRILLE_ISOT_CINE for plasticity with bilinear kinematic work hardening,
- GRILLE_PINTO_MEN for the behavior of Pinto Menegotto.

For modeling MEMBRANE into nonlinear, the behavior will be used GROT_GDEP in STAT_NON_LINE.

7 Elementary calculations of matrices

OPTIONS elementary	GRILLE_EXCENTRE	GRILLE_MEMBRANE	MEMBRANE
' AMOR_MECA'	•		
' FULL_MECA'	•	•	•
' IMPE_MECA'			
' MASS_MECA'	•		
' MASS_MECA_DIAG'			
' RAPH_MECA'	•	•	•
' RIGI_GEOM'			
' RIGI_MECA'	•	•	•
' RIGI_MECA_HYST'	•		
' RIGI_MECA_TANG'	•	•	•
' RIGI_ROTA'			

8 Postprocessing of calculation

8.1 Options of CALC_FIELD

	GRILLE_EXCENTRE	GRILLE_MEMBRANE	MEMBRANE
'SIEF_ELGA'	•	•	•
'SIGM_ELGA'	•	•	•
'EFGE_ELNO'	•		
'EPSI_ELNO'	•	•	•
'DEGE_ELNO'	•		
'EPOT_ELEM'	•	•	•
'ECIN_ELEM'	•	•	•
'SIEF_ELNO'	SSNS100A	•	•
'VARI_ELNO'	•	•	
'SIGM_ELNO'	SSNS100A	•	•
'FORC_NODA'	SSLS109B	SSNS105A	•
'REAC_NODA'			
'MASS_INER'	•	•	•