

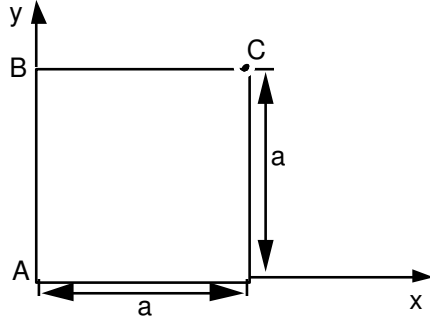
ZZZZ106 - Geometrical criteria in DEFI_GROUP

Summary:

This test validates the various options of creation of groups of meshes (or nodes) by criteria **geometrical** in the order DEFI_GROUP :

- 'SPHERE'
- 'CYLINDER'
- 'BAND'
- 'FACE_NORMALE'
- 'ENV_SPHERE'
- 'ENV_CYLINDRE'
- 'PLAN'

1 Problem of reference



It is about a square plate on side $a=10$. and thickness $t=1$.

1.1 Material properties

$$E=1.$$
$$\nu=0.3$$

1.2 Boundary conditions and loading

The plate is embedded along the side AB .

One has 7 loading cases for modeling A and 5 loading cases for modeling B.

Each loading case corresponds to the superposition of 2 loadings which are cancelled.

One of these loadings applies to one `GROUP_MA` or one `GROUP_NO` defined starting from a geometrical criterion in `DEFI_GROUP`, the other, of opposed sign, applies to `GROUP_MA` or it `GROUP_NO` defined "in extension" (with the hand).

Modeling A uses a model "3D" in hull `DKT`.

Modeling B uses a model "D_PLAN" in `TRIA3`.

The grids are the same ones.

2 Reference solution

2.1 Results of reference

For all the loading cases, the solution is commonplace.

One must have a field of worthless displacements in all the nodes.

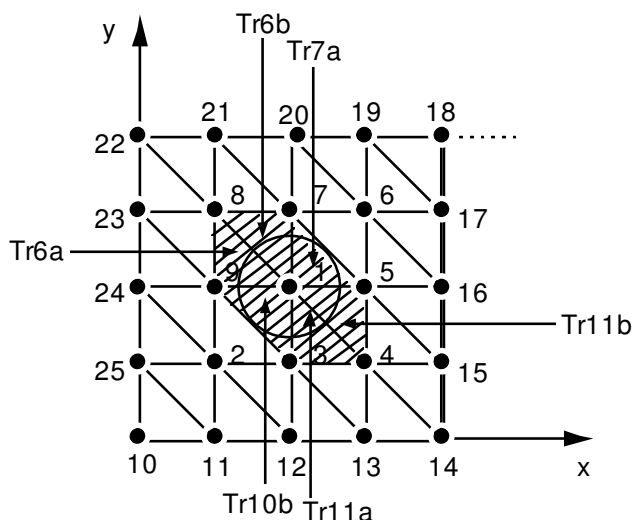
3 Modeling A

3.1 Characteristics of modeling

The elements are DKT.

One defines 7 loading cases in the following way:

Loading case n°1: SPHERE

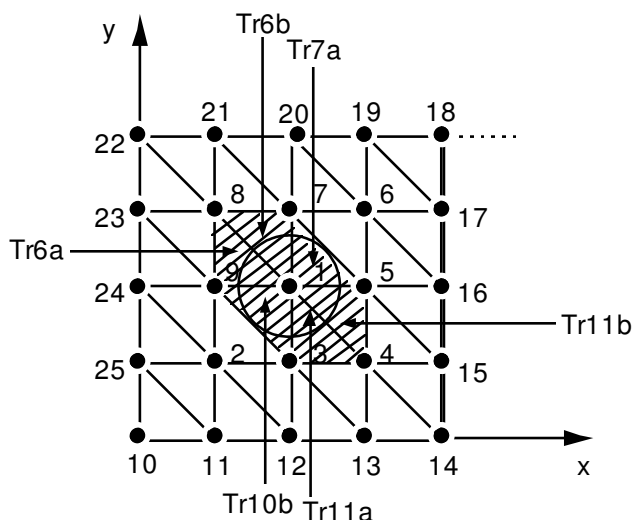


The side of an element is equal to 2.5 .

The sphere of ray 2. and centered with node 1 has an intersection not-vacuum with the element hatched on the figure, i.e. *Tr6a* , *Tr6b* , *Tr7a* , *Tr10b* , *Tr11a* and *Tr11b* .

One applies a pressure equalizes with -1 . on this list of name *GM1* built by using the option "SPHERE"of *CREA_GROUP_MA* order *DEFI_GROUP* and a pressure equalizes with 1. on this list defined in extension.

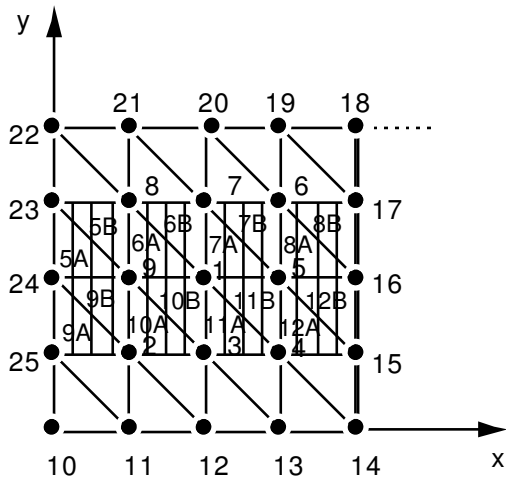
Loading case n°2: CYLINDER



The cylinder of ray 2 of axis z and passing by the node 1 an intersection not - vacuum with the elements hatched on the figure has is *Tr6a* , *Tr6b* , *Tr7a* , *Tr10b* , *Tr11a* and *Tr11b* .

One applies a pressure equalizes with -1 . on this list of name *GM2* built by using the option "CYLINDER"of *CREA_GROUP_MA* order *DEFI_GROUP* and a pressure equalizes to 1. on this list defined in extension.

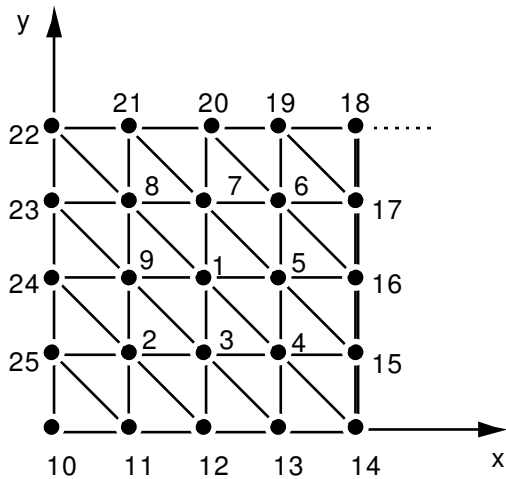
Loading case n°3: BAND



Elements of the shaded zone i.e. $Tr5A$, $Tr5B$, $Tr6A$, $Tr6B$, $Tr7A$, $Tr7B$, $Tr8A$, $Tr8B$, $Tr9A$, $Tr9B$, $Tr10A$, $Tr10B$, $Tr11A$, $Tr11B$, $Tr12A$, $Tr12B$ define the intersection of the plate with the band whose sides are parallel to the axis x , of which the medium passes by the node NI , and the half-width is equal to 2.

One applies a pressure equalizes with $-1.$ on this defined zone thus geometrically of name $GM3$ by employing the option "BAND" of CREA_GROUP_MA order DEF1_GROUP and a pressure equalizes with $1.$ on this zone defined in extension.

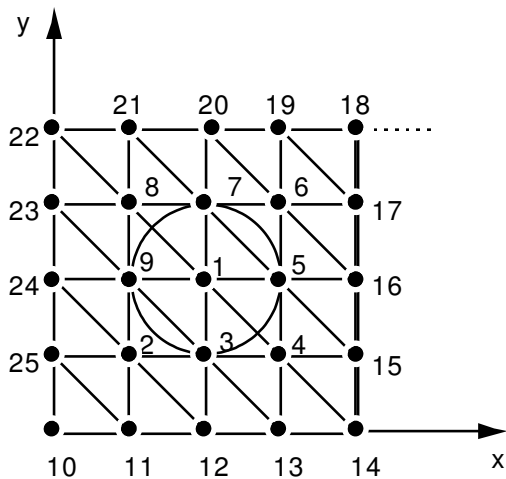
Loading case n°4: FACE_NORMALE



One defines the elements of the plate as being perpendicular to the axis z by using the option "FACE_NORMALE" of CREA_GROUP_MA order DEF1_GROUP.

One applies a pressure equalizes with $-1.$ on this list of name $GM4$ and a pressure equalizes with $1.$ on the same list defined in extension (here all meshes).

Loading case n°5: ENV_SPHERE

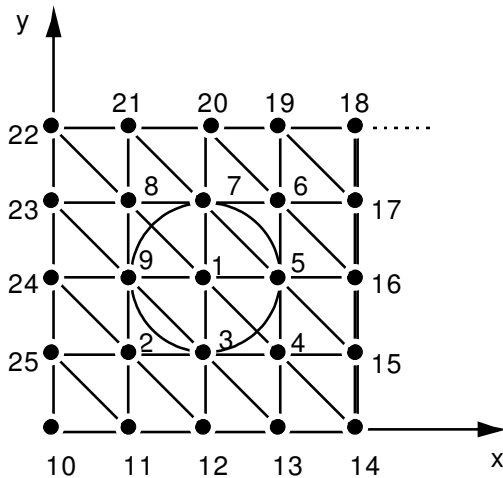


Nodes 3,5,7 and 9 are defined as being the nodes of the grid pertaining to the intersection of the plate with the sphere of center NI and of ray 2.5 (it is the length on the side of an element).

This list of nodes of name GNI is defined by using the option "ENV_SPHERE" of CREA_GROUP_NO order DEF1_GROUP.

A nodal force is applied $F_z = -1$ in each node of this list and a nodal force $F_z = 1$ in each node of the same list defined in extension ($N3, N5, N7, N9$).

Loading case n°6: ENV_CYLINDRE

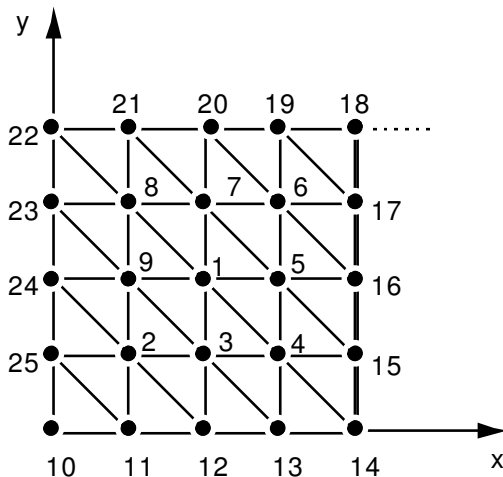


Nodes 3,5,7 and 9 are defined as being the nodes of the grid pertaining to the intersection of the plate with the cylinder of axis z passing by node 1 and from ray 2.5.

This list of nodes of name $GN2$ is defined by using the option "ENV_CYLINDRE" of CREA_GROUP_NO order DEFI_GROUP.

A nodal force is applied $F_z = -1$ in each node of this list and a nodal force $F_z = 1$ in each node of the same list defined in extension ($N3, N5, N7, N9$).

Loading case n°7: " PLAN "



Nodes 14,15,16,17 and 18 are definite as pertaining to the plan passing by the node 14 and whose normal is parallel to x .

This list of nodes of name $GN3$ is defined by using the option "PLAN" of CREA_GROUP_NO order GROUP_NO.

A nodal force is applied $F_z = -1$ in each node of this list and a nodal force $F_z = 1$ in each node of the same list defined in extension.

3.2 Characteristics of the grid

The grid comprises 32 meshes DKT.

3.3 Features tested

One tests the following options of creation of group of meshes of the order DEFI_GROUP for the 3D:

- 'SPHERE'
- 'CYLINDER'
- 'BAND'
- 'FACE_NORMALE'

and following options of creation of group of nodes of the order DEFI_GROUP :

- 'ENV_SPHERE'
- 'ENV_CYLINDRE'
- 'PLAN'

4 Results of modeling A

4.1 Values tested

Identification	Reference
Loading case n°1: <i>DZ (C)</i>	0.
Loading case n°2: <i>DZ (C)</i>	0.
Loading case n°3: <i>DZ (C)</i>	0.
Loading case n°4: <i>DZ (C)</i>	0.
Loading case n°5: <i>DZ (C)</i>	0.
Loading case n°6: <i>DZ (C)</i>	0.
Loading case n°7: <i>DZ (C)</i>	0.

4.2 Remarks

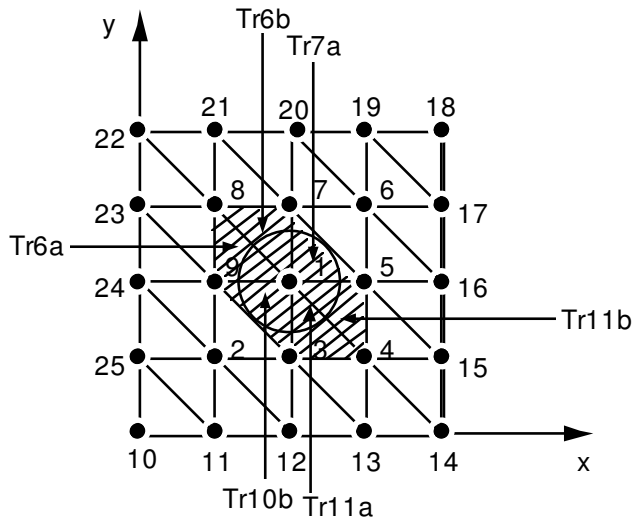
The values are tested in absolute and the tolerance is equal to $1.E-10$.

5 Modeling B

5.1 Characteristics of modeling

The elements are TRIA3 in plane deformation. One defines 5 loading cases in the following way:

Loading case n°1: SPHERE

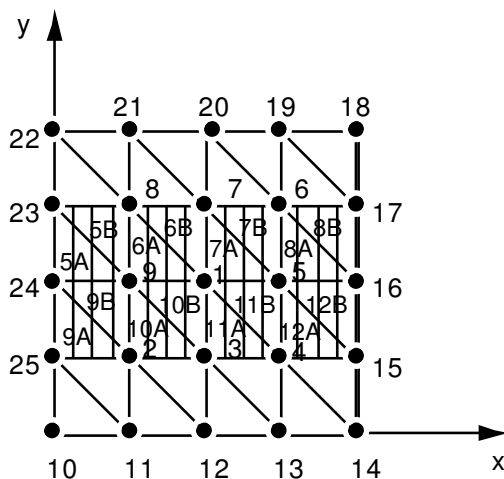


The side of an element is equal to 2.5 .

The circle of radius 2. and centered with node 1 has an intersection not-vacuum with the element hatched on the figure, i.e. *Tr6a* , *Tr6b* , *Tr7a* , *Tr10b* , *Tr11a* and *Tr11b* .

One applies a voluminal force of density -1 according to y on this zone of name *GM1* defined by employing the option "SPHERE" of CREA_GROUP_MA order DEFI_GROUP and a voluminal force opposite on this zone defined in extension.

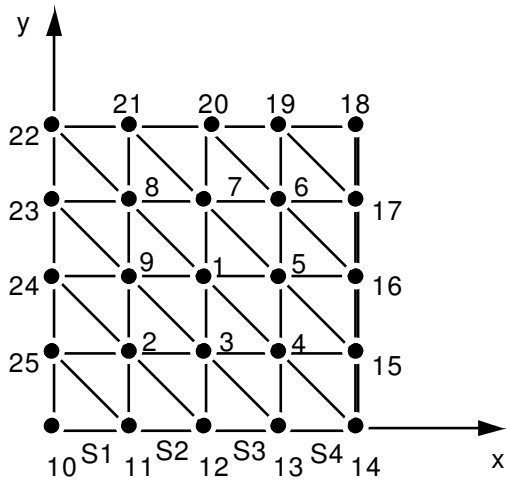
Loading case n°2: BAND



Elements of the shaded zone i.e. *Tr5A* , *Tr5B* , *Tr6A* , *Tr6B* , *Tr7A* , *Tr7B* , *Tr8A* , *Tr8B* , *Tr9A* , *Tr9B* , *Tr10A* , *Tr10B* , *Tr11A* , *Tr11B* , *Tr12A* , *Tr12B* define the intersection of the plate with the band whose sides are parallel to the axis x , of which the medium passes by the node *N1* , and the half-width is equal to 2 .

One applies a voluminal force of density -1 according to y on this defined zone thus geometrically of name *GM3* by employing the option "BAND" of CREA_GROUP_MA order DEFI_GROUP and voluminal density forces 1. opposed to the preceding one on this same zone defined in extension.

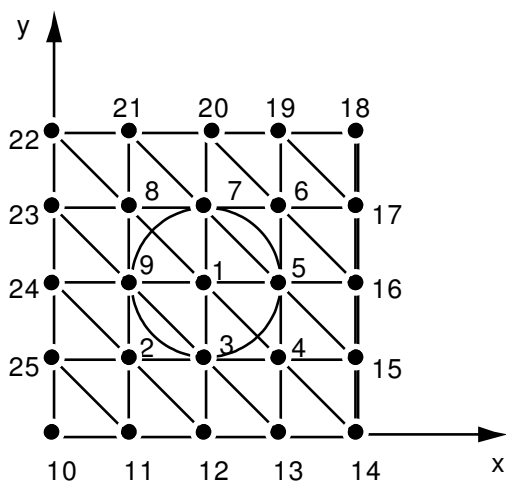
Loading case n°3: FACE_NORMALE



The list of the elements of the geometrical type `SEG2`, `S1`, `S2`, `S3`, `S4` is defined as the list of the elements of the grid perpendicular to the direction y .

One applies a pressure equalizes with -1 on this list of name `GM4` defined geometrically in the way indicated, by employing the option "FACE_NORMALE" of `CREA_GROUP_MA` order `DEF1_GROUP` and a pressure with 1 on this same list defined in extension.

Loading case n°4: ENV_SPHERE

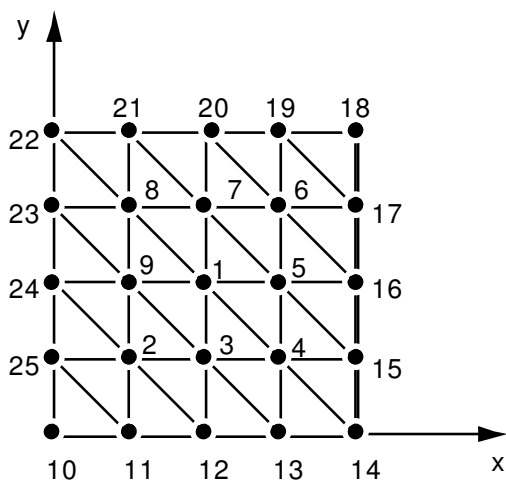


Nodes 3,5,7 and 9 are defined as being the nodes of the grid pertaining to the intersection of the plate with the circle of center `N1` and of ray `2.5` (it is the length on the side of an element).

This list of nodes of name `GN1` is defined by using the option "ENV_SPHERE" of `CREA_GROUP_NO` order `DEF1_GROUP`.

A nodal force is applied $F_y = -1$ in each node of this list and a nodal force $F_y = 1$ in each node of the same list defined in extension.

Loading case n°5: PLAN



Nodes 14,15,16,17 and 18 are definite as pertaining to the right-hand side passing by the node 14 and whose normal is parallel to x .

This list of nodes of name `GN3` is defined by using the option "PLAN" of `CREA_GROUP_NO` order `GROUP_NO`.

A nodal force is applied $F_y = -1$ in each node of this list and a nodal force $F_y = 1$ in each node of the same list defined in extension.

5.2 Characteristics of the grid

The grid comprises 32 meshes TRIA3 and 4 meshes SEG2.

5.3 Features tested

One tests the following options of creation of group of meshes of the order DEFI_GROUP for the 2D:

- 'SPHERE'
- 'BAND'
- 'FACE_NORMALE'

and following options of creation of group of nodes of the order DEFI_GROUP for the 2D:

- 'ENV_SPHERE'
- 'PLAN'

6 Results of modeling B

6.1 Values tested

Identification	Reference
Loading case n°1: <i>DY (C)</i>	0.
Loading case n°2: <i>DY (C)</i>	0.
Loading case n°3: <i>DY (C)</i>	0.
Loading case n°4: <i>DY (C)</i>	0.
Loading case n°5: <i>DY (C)</i>	0.

6.2 Remarks

The values are tested in absolute and the tolerance is equal to $1.E-10$.

7 Summary of the results

The results are good: groups calculated by the order DEFI_GROUP are well the expected groups.

Attention however with the fact that the test 3D is actually a test on a plate in the plan *XOY* : the role of the 3^{ème} coordinated in FORTRAN is thus not tested.