Operator DEFI_GROUP

1 Goal

To define in an existing grid, new groups of nodes or meshs. This can facilitate the definition of new loci for inputs or postprocessings.

To create new groups, one uses topological, logical or geometrical criteria.

Modify a structure of data of the type `grid`, `skeleton` or `grid`.

Contents

2 Syntax

```
my (grid) =      DEFI_GROUP    (

           ◊  reuse = / my,
                      / gr.,
           ♦  | GRID =  my ,                    /          [grid]
                                                /          [skeleton]
              | GRID =  gr.,                    /          [grid]

           ♦  |  DETR_GROUP_MA = _F (
              ♦  NAME =           lgma      ),              [l_group_ma]
              |  DETR_GROUP_NO = _F (
              ♦  NAME =           lgno      ),              [l_group_no]


              |  CREA_GROUP_MA =  (_F (
              ♦  NAME =           gma    ,                 [identifier]
              ◊  TYPE_MESH    =   / 'ALL'                 [DEFECT]
                                  / '3D'/'2D'/'1D'
                                  / 'SEG2'/'TRIA3'/'QUAD4'
                                  / 'QUAD8'/ … / 'PYRAM13'
              ♦  /  MESH      =   lmail  ,                [l_maille]
                 /  ALL    =   'YES'  ,
                 /  INTERSEC  =  lgma   ,                [l_group_ma]
                 /  UNION     =  lgma   ,                [l_group_ma]
                 /  DIFFE     =  lgma   ,                [l_group_ma]
                 /  GROUP_MA  =  gma    ,                [group_ma]
                    /  NUME_INIT =  /  nuini  ,          [I]
                                    /  1      ,          [DEFECT]
                       NUME_FIN  =     nufin  ,          [I]

                    /  POSITION  =  /  'INIT' ,
                                    /  'FINE' ,
                                    /  'MEDIUM',

                 /  OPTION =  'FACE_NORMALE'   ,
                    ♦  /  ANGL_NAUT   = (has, b) ,       [l_R]
                       /  VECT_NORMALE= (X, there, Z)   ,      [l_R]
                    ◊  ANGL_PREC  = / has  ,                [R]
                                    / 0.5,               [DEFECT]
                    ◊  VERI_SIGNE = / 'NOT',
                                    / 'YES',             [DEFECT]

                 /  OPTION =  'SPHERE',
                    ♦  /  NOT = (X, there, Z),              [l_R]
                       /  NOEUD_CENTRE = No,             [node]
                       /  GROUP_NO_CENTRE = grno,        [group_no]
                    ♦  RAY = R,                          [R]

                 /  OPTION =  'CYLINDER',
                    ♦  /  NOT = (X, there, Z),              [l_R]
                       /  NOEUD_CENTRE = No,             [node]
                       /  GROUP_NO_CENTRE = grno,        [group_no]
                    ♦  RAY = R,                          [R]
                    ♦  /  ANGL_NAUT   = (has, b),        [l_R]
                       /  VECT_NORMALE= (X, there, Z),      [l_R]
```

```
                / OPTION =  'BAND',
                  ♦ / NOT = (X, there, Z),                  [l_R]
                    / NOEUD_CENTRE = No,                    [node]
                    / GROUP_NO_CENTRE = grno,               [group_no]
                  ♦ / ANGL_NAUT   = (has, b),               [l_R]
                    / VECT_NORMALE= (X, there, Z),          [l_R]
                  ♦ DIST = D,                               [R]

                / OPTION =  'SUPPORT',
                  ♦ / GROUP_NO = lgno     ,                 [l_group_no]
                    / NODE = lno,                           [l_noeud]
                  ♦ TYPE_APPUI = / 'AU_MOINS_UN'
                                 / 'ALL'
                                 / 'TOP'
                                 / 'MAJORITY'
                / OPTION =  'FISS_XFEM',
                  ♦ CRACK = (fiss1, fiss2,…),               [l_fiss_xfem]
                  ♦ TYPE_GROUP = / 'XFEM'
                                 / 'HEAVISIDE'
                                 / 'CRACKTIP'
                                 / 'MIXED'
                                 / 'FISSUREE'
               ),),


            | CREA_GROUP_NO = (_F (
              / ♦ NAME =          gno    ,                  [identifier]
                ♦ / NODE      =  lnoeu  ,                  [l_noeud]
                  / INTERSEC  =  lgno   ,                  [l_group_no]
                  / UNION     =  lgno   ,                  [l_group_no]
                  / DIFFE     =  lgno   ,                  [l_group_no]
                  / GROUP_NO  =  gno    ,                  [group_no]
                    / NUME_INIT =  /  nuini  ,             [I]
                                   /  1      ,             [DEFECT]
                      NUME_FIN  =     nufin  ,             [I]
                    / POSITION  =  /  'INIT' ,
                                   /  'FINE' ,
                                   /  'MEDIUM',

                / OPTION =  'ENV_SPHERE',
                  ♦ / NOT = (X, there, Z),                  [l_R]
                    / NOEUD_CENTRE = No,                    [node]
                    / GROUP_NO_CENTRE = grno,               [group_no]
                  ♦ RAY = R,                          [R]
                  ♦ PRECISION = eps  ,                      [R]

                / OPTION =  'ENV_CYLINDRE',
                  ♦ / NOT = (X, there, Z),                  [l_R]
                    / NOEUD_CENTRE = No,                    [node]
                    / GROUP_NO_CENTRE = grno,               [group_no]
                  ♦ RAY = R,                          [R]
                  ♦ / ANGL_NAUT   = (has, b),               [l_R]
                    / VECT_NORMALE= (X, there, Z),          [l_R]
                  ♦ PRECISION = eps,                        [R]

                / OPTION =  'PLAN',
                  ♦ / NOT = (X, there, Z),                  [l_R]
                    / NOEUD_CENTRE = No,                    [node]
                    / GROUP_NO_CENTRE = grno,               [group_no]
```

```
    ♦  / ANGL_NAUT   = (has, b),          [l_R]
       / VECT_NORMALE= (X, there, Z),       [l_R]
    ♦  PRECISION = eps,                 [R]

/   OPTION =  'SEGM_DROI_ORDO',
    ♦  /  NODE        = lno   ,         [l_noeud]
       /  GROUP_NO     = gno2 ,         [group_no]
    ♦  /  NOEUD_ORIG   = noA  ,         [node]
       /  GROUP_NO_ORIG= gnoA ,         [group_no]
    ♦  /  NOEUD_EXTR   = noB  ,         [node]
       /  GROUP_NO_EXTR= gnoB ,         [group_no]
    ♦  PRECISION =  prec,               [R]
    ♦  CRITERION   =/  'RELATIVE'    ,
                    /  'ABSOLUTE'    ,

/   OPTION =  'NOEUD_ORDO',
    ♦  GROUP_MA =   gmaAB  ,            [group_ma]
    ◊  /  NOEUD_ORIG   = noA  ,         [node]
       /  GROUP_NO_ORIG= gnoA ,         [group_no]
    ◊  /  NOEUD_EXTR   = noB  ,         [node]
       /  GROUP_NO_EXTR= gnoB ,         [group_no]
    ◊  VECT_ORIE   = (vx, vy, [vz]), [l_R]

/   OPTION =  'TUNNEL',
    ♦  /  ALL         = 'YES'
       /  |  GROUP_MA     = lgma ,   [l_group_ma]
          |  MESH       = lmai   ,   [l_maille]
    ♦  /  MAILLE_AXE   = noA  ,         [l_maille]
       /  GROUP_MA_AXE = gnoA ,         [l_group_ma]
    ♦  /  NOEUD_ORIG   = noA  ,         [node]
       /  GROUP_NO_ORIG= gnoA ,         [group_no]
    ♦     RAY        = R   ,            [R]
    ◊     LENGTH     = long   ,         [R]

/   OPTION =  'INCLUSION',
    ♦  GROUP_MA     = lgma ,            [l_group_ma]
    ♦  CAS_FIGURE     =    / '2D'
                           / '3D'
                           / '2.5D'
    ◊  DISTANCE_MAX = distma            [R]
    ♦  GROUP_MA_INCL = lgma_inc   ,     [l_group_ma]
    ◊  MAILLAGE_INCL = ma_inc ,         [grid]


/   OPTION =  'INTERVALLE_VALE',
    ♦  CHAM_GD    = chno   ,            [cham_no]
    ♦  NOM_CMP    = cmp,                [TXM]
    ♦  VALE       = (vmin, vmax)        [R]

/   OPTION =  'FISS_XFEM',
    ♦  CRACK = (fiss1, fiss2,…), [l_fiss_xfem]
    ♦  TYPE_GROUP = / 'XFEM'
                    / 'HEAVISIDE'
                     / 'CRACKTIP'
                    / 'MIXED'
                    / 'ZONE_MAJ'
                    / 'TORUS'
    #  If TYPE_GROUP = 'TORUS':
    ♦  RAYON_TORE = R,                  [R]
```

```
                    /   OPTION =   'RELA_CINE_BP',
                        ♦   CABLE_BP      = cable_bp,      [cable_precont]
                        ♦   PREF_GRNO     = pref,          [TXM]
                                          = 'RCBP'         [DEFECT]

                    /   GROUP_MA  = lgma,         [l_identificator]
                        ◊   NAME         = lgno,          [l_group_no]
                        ◊   CRIT_NOEUD = / 'ALL'   ,      [DEFECT]
                                         / 'TOP',
                                         / 'MEDIUM',
                                         / 'CENTER',

                    /   TOUT_GROUP_MA: 'YES',
                ),),

            ◊   ALARM  =   /   'YES',                     [DEFECT]
                           /   'NOT',

            ◊   INFORMATION   =   /   1,                          [DEFECT]
                           /   2,
                        )
```

Type of the result:

If GRID : grid then : grid
: skeleton skeleton
If GRID : grid then : grid

3 Operands

3.1 General information on the operands

This order treats the concepts of the type in the same way grid or skeleton. In the continuation one will use the vocabulary “grid”.

This order makes it possible to define new groups of meshs (or groups of nodes) in an existing grid: the grid is enriched my.

The definition of a new group can be done in several ways:

- in extension: keywords MESH or NODE,
- by Boolean operation on existing groups: intersection (INTERSEC), meeting (UNION) or difference (DIFFE),
- according to a geometrical criterion: meshs whose node belongs to a given sphere,…
- for the groups of nodes, by referring to existing groups of meshs. The group of nodes thus defined contains **all** nodes of the meshs of the group of meshs origin (keywords TOUT_GROUP_MA and GROUP_MA).

The operator treats initially the keyword CREA_GROUP_MA so that one can make use of the groups of meshs thus defined in the keyword CREA_GROUP_NO.

With each occurrence of a keyword CREA_GROUP_MA (_NO) one defines a new group named (keyword NAME). This new group can then be re-used in the following occurrences to define new groups by intersection, meeting,…

Keywords DETR_GROUP_MA and DETR_GROUP_NO allow “to destroy” groups of meshs or nodes. The meshs and the nodes of these groups are not removed, they are only the definitions of the groups which are unobtrusive. These keywords are useful for example in the loops python when one wants to create a group with each iteration of the loop: one starts by destroying this group then one recreates it under the same name. That avoids changing name of group to each iteration.

One can note that most features of DEFI_GROUP are feasible directly in module SMESH of SALOMÉ, namely:

- Boolean operation on existing groups,
- creation of group per type of mesh (filter SMESH Type),
- according to a geometrical criterion (filter SMESH LyingOn),
- according to a criterion of angle of normal for surface meshs (filter SMESH Coplanar),
- for the groups of meshs being based on groups of nodes (function SMESH ‘ Group based one nodes of other groups ‘),
- for the groups of nodes, by referring to existing groups of meshs (function SMESH ‘ Group based one nodes of other groups ‘),
- suppression of groups.

3.2 Operands GRID and GRID

♦ | GRID = my

my is the name of the grid which one wants “to enrich”.

| GRID = gr.

gr. is the name of the auxiliary grid which one wants “to enrich”.

3.3 Keywords DETR_GROUP_MA and DETR_GROUP_NO

These two keywords factor make it possible to remove the definition of groups of meshs or nodes. These keywords are sometimes necessary because the code stops in fatal error if one tries to create a group whose name is already used. It is necessary to destroy the group before being able to re-use its name. The behavior of the two keywords is similar and we will speak here only about DETR_GROUP_MA.

Syntax:

```
DETR_GROUP_MA=_F (NOM= (gm1, gm2,…)),
```

The keyword factor DETR_GROUP_MA is a priori répétable but it is never necessary because the keyword NAME allows to indicate a list of names of groups to be destroyed (gm1,gm2,…).

It is important to know that all the occurrences of the keyword DETR_GROUP_MA are treated **front** those of the keyword CREA_GROUP_NO because the objective of this keyword is to be able to re-use the destroyed name. It also should be known that the destruction of a non-existent group does not involve any message of alarm. These choices make it possible for example to make in a loop python:

```
for I in arranges (N):
    DEFI_GROUPE (reuse=MA, MAILLAGE=MA,
                 DETR_GROUP_MA=_F (NAME ('GM1',),
                 CREA_GROUP_MA=_F (NOM=' GM1',…
```

At the time of the first iteration, the group 'GM1' do not exist, one asks his destruction but no message of alarm is transmitted.

Note:

As the destruction takes place at the beginning of the order, it is impossible to modify a group by making only one call with DEFI_GROUP . For example, one cannot make "enlarge" (in a loop) a group by adding a small group to him (b1) :

```
for I in arranges (N):
    b1=nouveau group…
    DEFI_GROUP (reuse=MA, MAILLAGE=MA,
    CREA_GROUP_MA=_F (NOM=' tout', UNION= ('all', 'b1'),),)
```

To do that, it is necessary to invite twice DEFI_GROUP :

```
for I in arranges (N):
    b1=nouveau group…
    DEFI_GROUP (reuse=MA, MAILLAGE=MA,
        DETR_GROUP_MA=_F (NOM=' tout2'),
        CREA_GROUP_MA=_F (NOM=' tout2', UNION= ('all', 'b1'),),)
    DEFI_GROUP (reuse=MA, MAILLAGE=MA,
        DETR_GROUP_MA=_F (NOM=' tout'),
        CREA_GROUP_MA=_F (NOM=' tout', UNION= ('tout2', 'b1'),),)
```

3.4 Keyword CREA_GROUP_MA

| CREA_GROUP_MA

An occurrence of this keyword factor makes it possible to define a new group of meshs.

3.4.1 Operand NAME

♦ NAME = gma

One gives here the name (with "quotes") of the new group of meshs.

3.4.2 Operand TYPE_MAILLE

◊ TYPE_MAILLE= /'ALL'/'3D'/'2D'/'1D' (DEFAUT=' TOUT')
/'SEG2'/'TRIA3'/'QUAD4'/…/'PYRAM13'

This keyword makes it possible to filter the meshs which one will put in the new group of meshs. By default, it does not have there a filter, but if the user writes for example: TYPE_MAILLE=' 2D', the group created will contain only surface meshs.
The user can also filter the group to be created for a kind of mesh individual (TRIA3, HEXA27, …). All types of meshs (POI1,SEG2,SEG3,SEG4, …, PYRAM13) are authorized.

Examples:

CREA_GROUP_MA=_F (NOM=' VOLUM', 'TOUT=' YES', TYPE_MAILLE=' 3D')
allows to create the group of all the voluminal meshs (HEXA, PENTA,…) grid.

CREA_GROUP_MA=_F (NOM=' VOLH27', 'GROUP_MA=' GMA1', TYPE_MAILLE=' HEXA27')
allows to create the group of all the meshs of the type 'HEXA27'contained in GROUP_MA. GMA1.

3.4.3 Operand MESH

/ MESH = lmail

This keyword makes it possible to define the group of meshs in extension: one gives the list of the meshs the component.

3.4.4 Operand ALL

/ ALL = 'YES'

This keyword makes it possible to define a group containing all the meshs of the grid.

3.4.5 Operand INTERSEC

/ INTERSEC = (gma1, gma2, gma3,…),

The new group of meshs will be obtained by taking all the meshs of gma1 who also belong to gma2, gma3,…. The order of the meshs remains that of gma1.

3.4.6 Operand UNION

/ UNION = (gma1, gma2, gma3,…)

The new group of meshs will be obtained by taking all the meshs of gma1, then by adding the meshs of gma2 who do not belong to gma1, then those of gma3 who do not belong nor to gma1 nor with gma2, etc.

3.4.7 Operand DIFFE

/ DIFFE = (gma1, gma2, gma3,…)

The new group of meshs will be obtained by taking all the meshs of gma1 who do not belong to the other groups of the list. The order of the meshs remains that of gma1.

3.4.8 Sub-group of an existing group: keywords GROUP_MA / POSITION / NUME_INIT / NUME_FIN

One can create a new group of mesh by selecting certain meshs of an existing group.

1 era possibility:

A group is created **from only one nets** while specifying by the keyword POSITION the required mesh.

Example:

```
CREA_GROUP_MA = _F (   GROUP_MA = G1,  POSITION = 'INIT',  NAME = G1I)
```

The group G1I the 1 contains[era] mesh of the group G1.

2 ème possibility:

One creates a group containing the meshs ranging between the rows nuini and nufin (included) in an existing group.

Example:

```
CREA_GROUP_MA=_F (GROUP_MA = G1, NUME_INIT = 3,  NUME_FIN = 7,NAME =
G1P)
```

The group G1P contains meshs 3,4,5,..., 7 of G1.

Caution:

> *These keywords use the concept **of order** meshs in a group of meshs. This order is often unknown to the user. It can depend on the preprocessor. It is the order of the meshs at the time of the definition of GROUP_MA in the file of grid Aster.*

3.4.9 Operand OPTION = 'FACE_NORMALE'

/ OPTION = 'FACE_NORMALE'

This option makes it possible to define one GROUP_MA constituted by surface meshs whose normal is parallel to the direction of the vector defined by its components if the keyword is used VECT_NORMALE or with that of the first vector of the new base defined by the change of reference mark due to the nautical angles.

In 3D, it is supposed that the surface meshs are plane facets. They are of type TRIA3, TRIA6, QUAD4, QUAD8 or QUAD9. If one calls $\boldsymbol{X}_1$, $\boldsymbol{X}_2$, and $\boldsymbol{X}_3$ the vectors position of the first three nodes tops of the element, the normal is determined by the vector product: $(\boldsymbol{X}_2-\boldsymbol{X}_1)\wedge(\boldsymbol{X}_3-\boldsymbol{X}_1)$.

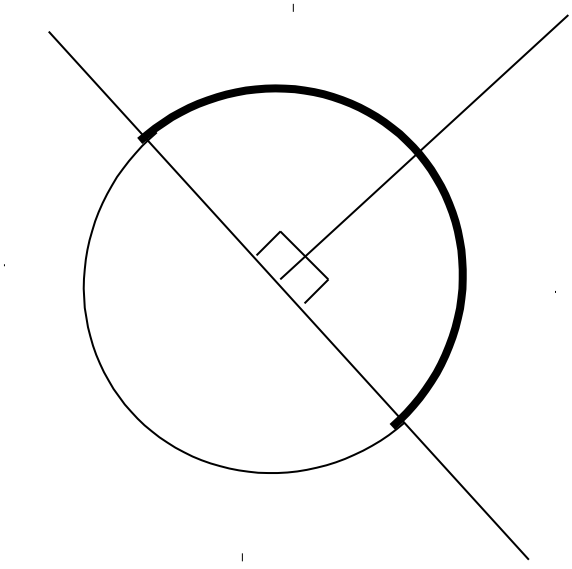
In 2D, it is supposed that the surface meshs are right segments. They are of type SEG2 or SEG3. If one calls $\boldsymbol{X}_1$ and $\boldsymbol{X}_2$ the vectors position of the two nodes ends of the element, the normal is defined by $(\boldsymbol{X}_2-\boldsymbol{X}_1)\wedge z$ where z is the unit vector perpendicular to the plan and where one has affected 0. like third component with $(\boldsymbol{X}_2-\boldsymbol{X}_1)$.

Note:

A mesh "facet" will be retained if its normal is colinéaire with the normal vector defined by VECT_NORMALE . This condition must be checked except for a certain precision (keyword ANGL_PREC).

When one is chosen ANGL_PREC (for example 30. degrees), one defines in fact the group of the meshs whose normal belongs to the cone of axis VECT_NORMALE and of point angle ANGL_PREC .

This can be used (for example) to gather the meshs of a half wraps spherical (ANGL_PREC = 90.).



3.4.9.1 Operand ANGL_NAUT

♦ / ANGL_NAUT = has in 2D
(has, B) in 3D

Nautical angles (has, b) defined in degrees, are the angles allowing to pass from the total reference mark of definition of the coordinates of the nodes to a reference mark whose first vector indicates the direction according to which the normal of the surface meshs is directed that one wishes to recover.

For the definition of the nautical angles, to see the operator AFFE_CARA_ELEM [U4.42.01] operand ORIENTATION.

3.4.9.2 Operand VECT_NORMALE

♦ / VECT_NORMALE = (X, there) in 2D
(X, there, Z) in 3D

Coordinates X, there, Z are those giving the direction according to which the normal of the surface meshs is directed that one wishes to recover.

3.4.9.3 Operand ANGL_PREC

◊ ANGL_PREC = has

It is the tolerance, in degrees, that one accepts on the angle formed by the vector provided by the user and the normal vector to the surface element to affirm that these two vectors have the same direction.

The value by default of has is 0.5 degree.

3.4.9.4 Operand VERI_SIGNE

◊ VERI_SIGNE = / 'NOT' ,
/ 'YES' , [DEFECT]

If the value is affected 'NOT' with VERI_SIGNE, it GROUP_MA will be made up by the surface meshs whose normal is parallel to the vector given by the user.

If the value is affected 'YES', it GROUP_MA will be made up by the surface meshs whose normal is parallel and has the same orientation as the vector given by the user.

The value by default is 'YES'.

3.4.10 Operand OPTION = 'SPHERE'

/ OPTION = 'SPHERE'

This option makes it possible to define one GROUP_MA constituted by the meshs whose at least node belongs to a sphere (a circle in 2D) defined by its centre and its.

3.4.10.1 Operand NOT

♦ / NOT = (X, there) in 2D
(X, there, Z) in 3D

X there Z are the coordinates of the center of the sphere.

3.4.10.2 Operand /NOEUD_CENTRE /GROUP_NO_CENTRE

♦ / NOEUD_CENTRE = No
/ GROUP_NO_CENTRE = grno

These two keywords make it possible to indicate which is the node coinciding with the center of the sphere.

3.4.10.3 Operand RAY

♦ RAY = R

R is the radius of the sphere (circle in 2D).

3.4.11 Operand OPTION = 'CYLINDER'

/ OPTION = 'CYLINDER'

This option makes it possible to define one GROUP_MA constituted by the meshs whose at least node belongs to a cylinder defined by its axis and its ray.

The axis is defined by a vector and a point pertaining to this axis. This option has direction only in 3D.

3.4.11.1 Operand NOT

♦ / NOT = (X, there, Z)

X there Z are the punctual coordinates located on the axis of the cylinder.

3.4.11.2 Operand /NOEUD_CENTRE /GROUP_NO_CENTRE

♦ / NOEUD_CENTRE = No
/ GROUP_NO_CENTRE = grno

These two keywords make it possible to indicate a node located on the axis of the cylinder.

3.4.11.3 Operand RAY

♦ RAY = R

R is the ray of the cylinder.

3.4.11.4 Operand ANGL_NAUT

♦ / ANGL_NAUT = (has, B)

Nautical angles has, B defined in degrees, are the angles allowing to pass from the total reference mark of definition of the coordinates of the nodes to a reference mark whose first vector indicates the direction of the axis of the cylinder.

For the definition of the nautical angles to see the operator AFFE_CARA_ELEM [U4.42.01] operand ORIENTATION.

3.4.11.5 Operand VECT_NORMALE

♦ / VECT_NORMALE = (X, there, Z)

X there Z are the coordinates of a vector directing the axis of the cylinder.

3.4.12 Operand OPTION = 'BAND'

/ OPTION = 'BAND'

This option makes it possible to define one GROUP_MA constituted by the meshs whose at least node belongs to a "band" defined by a plan "medium" (a line in 2D) and the half-width on both sides of this plan.

The plan is defined by a normal vector in this plan and a point belonging to him.

3.4.12.1 Operand NOT

♦ / NOT = (X, there) in 2D
(X, there, Z) in 3D

X there Z are the punctual coordinates pertaining to the plan "medium" of the band.

3.4.12.2 Operand / NOEUD_CENTRE / GROUP_NO_CENTRE

♦ / NOEUD_CENTRE = No
/ GROUP_NO_CENTRE = grno

These two keywords make it possible to define one belonging to the plan “medium” of the band.

3.4.12.3 Operand ANGL_NAUT

♦ / ANGL_NAUT = has in 2D
(has , B) in 3D

Nautical angles has, B defined in degrees, are the angles allowing to pass from the total reference mark of definition of the coordinates of the nodes to a reference mark whose first vector is orthogonal with the plan “medium” of the band.

For the definition of the nautical angles, to see the operator AFFE_CARA_ELEM [U4.42.01] operand ORIENTATION.

3.4.12.4 Operand VECT_NORMALE

♦ / VECT_NORMALE = (X, there) in 2D
(X, there, Z) in 3D

X there and Z are the components of a vector perpendicular to the plan “medium” of the band.

3.4.12.5 Operand DIST

♦ DIST = D

D is the half-width of the band.

3.4.13 Operand OPTION = 'SUPPORT'

This option makes it possible to recover the group of the meshs whose certain nodes belong to the whole of the nodes specified by the keywords NODE and GROUP_NO.

♦ / GROUP_NO = l_gno
. / NODE = l_no

These 2 keywords make it possible to define the list of the nodes which will be used as support with the meshs.
Let us call lno1 this list.

♦ TYPE_APPUI =
/ 'ALL' : the mesh will be retained if **all** its nodes belong to lno1
/ 'TOP' : the mesh will be retained if **all** its nodes “ **top** ” belong to lno1
/ 'AU_MOINS_UN' : the mesh will be retained **at least one** of its nodes belongs to lno1
/ 'MAJORITY' : the mesh will be retained if **more half** of its nodes belong to lno1

3.4.14 Operand OPTION = 'FISS_XFEM'

This option makes it possible to recover the group of the meshs of the type X-FEM specified by the keywords TYPE_GROUP.

♦ CRACK = (fiss1, fiss2,…)

♦ TYPE_GROUP =
/ 'HEAVISIDE' : the mesh will be retained if it is of Heaviside type
/ 'CRACKTIP' : the mesh will be retained if it is of type Ace-tip

/ 'MIXED' : the mesh will be retained if it is of Mixed type (Heaviside and Ace-tip)
/ 'XFEM' : the mesh will be retained if it is of Heaviside type, Ace-tip or Mixed
/ 'FISSUREE' : the mesh will be retained if **all** its nodes are nouveau riches

For a definition specifies concepts of Heaviside mesh and mesh Ace-tip, to see R7.02.12, §3.2.5.

3.5 Keyword CREA_GROUP_NO

| CREA_GROUP_NO

An occurrence of this keyword factor makes it possible to define a new group of nodes (for the keywords GROUP_MA and TOUT_GROUP_MA, one creates several groups of nodes "at a stretch").

3.5.1 Operand NAME

/ ♦ NAME = gno

One gives here the name (with "quotes") of the new group of nodes.

3.5.2 Operand NODE

/ NODE = lnoeu

This keyword makes it possible to define the group of nodes in extension: one gives the list of the nodes the component.

3.5.3 Operand INTERSEC

/ INTERSEC = (gno1, gno2, gno3,…)

The new group of nodes will be obtained by taking all the nodes of gno1 who also belong to gno2, gno3,…. The order of the nodes remains that of gno1.

3.5.4 Operand UNION

/ UNION = (gno1, gno2, gno3,…)

The new group of nodes will be obtained by taking all the nodes of gno1, then by adding the nodes of gno2 who do not belong to gno1, then those of gno3 who do not belong nor to gno1 nor with gno2, etc.

3.5.5 Operand DIFFE

/ DIFFE = (gno1, gno2, gno3,…)

The new group of nodes will be obtained by taking all the nodes of gno1 who do not belong to the other groups of the list. The order of the nodes remains that of gno1.

3.5.6 Under group of an existing group: keywords GROUP_NO / POSITION / NUME_INIT / NUME_FIN

One can create a new group of node by selecting certain nodes of an existing group.

1 era possibility:

A group is created **of only one node** while specifying by the keyword POSITION the required node.

Example:

```
CREA_GROUP_NO = _F (GROUP_NO = G1,  POSITION = 'INIT',  NAME = G1I)
```

The group G1I the 1 contains[er] node of the group G1.

2 ème possibility:

One creates a group containing the nodes ranging between the rows nuini and nufin (included) in an existing group.

Example:

```
CREA_GROUP_NO=_F (GROUP_NO = G1, NUME_INIT = 3NUME_FIN = 7, NAME = G1P)
```

The group G1P node 3,4,5,…, 7 contains of G1.

Caution:

*These keywords use the concept **of order** nodes in a group of nodes. This order is often unknown to the user. It can depend on the preprocessor. It is the order of the nodes at the time of the definition of GROUP_NO in the file of grid Aster.*

3.5.7 Operand OPTION = 'ENV_SPHERE'

/ OPTION = 'ENV_SPHERE'

This option makes it possible to define one GROUP_NO constituted by the nodes located on the envelope of a sphere except for a precision given.

3.5.7.1 Operand NOT

♦ / NOT = (X, there) , in 2D
(X, there, Z), in 3D

X there Z are the coordinates of the center of the sphere.

3.5.7.2 Operand /NOEUD_CENTRE /GROUP_NO_CENTRE

♦ / NOEUD_CENTRE = No
/ GROUP_NO_CENTRE = grno

These two keywords make it possible to define the node coinciding with the center of the sphere.

3.5.7.3 Operand RAY

♦ RAY = R

R is the ray of the sphere.

3.5.7.4 Operand PRECISION

◊ PRECISION = eps

eps is the tolerance with which one defines the membership of one node in the envelope of the sphere. This tolerance is to be taken with the following direction:

if d is the distance from a node in the center of the sphere, one says that this node belongs to the group if:

$$|d-r| \leq \text{eps}$$

3.5.8 Operand OPTION = 'ENV_CYLINDRE'

/ OPTION = 'ENV_CYLINDRE'

This option makes it possible to define one GROUP_NO constituted by nodes located on the envelope of a cylinder except for a precision given.

This option has direction only in 3D.

3.5.8.1 Operand NOT

♦ / NOT = (X, there, Z)

X there Z are the punctual coordinates pertaining to the axis of the cylinder.

3.5.8.2 Operand /NOEUD_CENTRE /GROUP_NO_CENTRE

♦ / NOEUD_CENTRE = No
/ GROUP_NO_CENTRE = grno

These two keywords make it possible to define a node belonging to the axis of the cylinder.

3.5.8.3 Operand RAY

♦ RAY = R

R is the ray of the cylinder.

3.5.8.4 Operand ANGL_NAUT

♦ / ANGL_NAUT = (has , B)

Nautical angles has, B defined in degrees, are the angles allowing to pass from the total reference mark of definition of the coordinates of the nodes to a reference mark whose first vector indicates the direction of the axis of the cylinder.

For the definition of the nautical angles, to see the operator AFFE_CARA_ELEM [U4.42.01] operand ORIENTATION.

3.5.8.5 Operand VECT_NORMALE

♦ / VECT_NORMALE = (X, there, Z)

X there Z are the coordinates of a vector directing the axis of the cylinder.

3.5.8.6 Operand PRECISION

◊ PRECISION = eps

eps is the tolerance with which one defines the membership of one node in the cylinder clothing.

This tolerance is to be taken with the following direction:

if d indicate the distance from the point running to the axis of the cylinder, one says that the point running belongs to the cylinder clothing if:

$$|d-r| \leq \text{eps}$$

3.5.9 Operand OPTION = 'PLAN'

This option makes it possible to define one GROUP_NO constituted by nodes located on a line (in 2D) or in a plan (in 3D) except for a precision given.

3.5.9.1 Operand NOT

♦ / NOT = (X, there) , in 2D
(X, there, Z), in 3D

X there Z are the punctual coordinates pertaining to the plan (with the right-hand side).

3.5.9.2 Operand /NOEUD_CENTRE /GROUP_NO_CENTRE

♦ / NOEUD_CENTRE = No
/ GROUP_NO_CENTRE = grno

These 2 keywords make it possible to define a node pertaining to the plan (with the right-hand side).

3.5.9.3 Operand ANGL_NAUT

♦ / ANGL_NAUT = has , in 2D
(, has B), in 3D

Nautical angles has, B defined in degrees, are the angles allowing to pass from the total reference mark of definition of the coordinates of the nodes to a reference mark whose first vector is orthogonal with the plan 'medium' of the band.

For the definition of the nautical angles, to see the operator AFFE_CARA_ELEM [U4.42.01] operand ORIENTATION.

3.5.9.4 Operand VECT_NORMALE

♦ / VECT_NORMALE = (X, there) , in 2D
(X, there, Z), in 3D

X there and Z are the components of a vector perpendicular to the plan (with the right-hand side).

3.5.9.5 Operand PRECISION

◊ PRECISION = eps

eps is the tolerance with which one defines the membership of a node in the plan (or with the right-hand side).

This tolerance is to be taken with the following direction:

if d indicate the distance from the node to the plan (or the right-hand side), it is said that this node belongs to this plan (or on this line) if:

$$|d| \leq \text{eps}$$

3.5.10 Operand OPTION = 'SEGM_DROI_ORDO'

This option is used to order a set of nodes roughly located on a segment of right-hand side AB.

♦ / NODE = lno2,
/ GROUP_NO = gno2,

One defines the whole of the nodes which one wants to order.

♦ / NOEUD_ORIG = noA , ♦ / NOEUD_EXTR = noB ,
/ GROUP_NO_ORIG= gnoA , / GROUP_NO_EXTR= gnoB ,

The nodes are defined A and B, origin and end of the segment AB.

♦ PRECISION = prec,
♦ CRITERION =/ 'RELATIVE' ,
/ 'ABSOLUTE' ,

These two arguments are parapets, they are used to check that the nodes which one seeks to order (lno2 or gno2) are of course the segment AB. If the variation of a node with AB is higher than prec the code stops in fatal error.
If the selected criterion is 'RELATIVE', the distance from a node with AB will be divided by the length of AB.

3.5.11 Operand OPTION = 'NOEUD_ORDO'

This option is used to create one group_no **ordered** containing the nodes of a set of meshs formed by segments (SEG2, SEG3 or SEG4). The whole of these meshs must form a continuous line. The line can be "open" (with 2 ends) or "closed" (it is then a simple loop).

♦ GROUP_MA = gmaAB

Name of group_ma which one wants to order the nodes.
Meshs of gmaAB must form an open line.

```
◊  /  NOEUD_ORIG    = noA  ,          ◊  /  NOEUD_EXTR    = noB  ,
   /  GROUP_NO_ORIG= gnoA ,             /  GROUP_NO_EXTR= gnoB ,
```

The keywords make it possible to define the nodes A and B, origin and end of the line AB.

The node A will be numbered in first, then one makes use of the topology of the meshs of gmaAB to number the nodes gradually.

If the node A is not provided by the user, the program will choose like node “origin”, the first node of gmaAB who belongs only to only one nets segment. The origin is thus arbitrary: the program could just as easily have fallen on the other end.

It is checked that the last numbered node is well B (if this one is given).

3.5.11.1 Case of the closed lines

If the line is a loop, one cannot determine his ends automatically. To define the origin of the curvilinear X-coordinates, the user is **obliged** to inform the nodes origin and end. It is necessary that these 2 nodes are identical.

To direct a closed line, one cannot make use of the knowledge of the node origin (since it is identical to the node end). If it wishes it, the user can then inform the keyword VECT_ORIE (2 or 3 cordonnées according to the dimension of space). One will choose as direction of course of the loop, the mesh of gmaAB who touches the node origin and who minimizes the angle with the vector provides by VECT_ORIE.

3.5.12 Operand OPTION = 'TUNNEL'

This option is used to create it group_no formed by the nodes located inside a “tunnel” which one provides the axis and the ray. The nodes selected will be those whose distance to the axis is lower than the ray.

The axis of the “tunnel” is defined by the linear meshs provided via the keywords MAILLE_AXE and GROUP_MA_AXE.

The axis of the tunnel must have a “origin” defined by the keywords NOEUD_ORIG and GROUP_NO_ORIG.

The keyword RAY is used to define the “ray” of the tunnel.

One can limit the tunnel by giving his length by the keyword LENGTH. This length is measured starting from the origin of the tunnel.

The nodes candidates to be part of the tunnel are those carried by the meshs defined by the keywords: TOUT=' OUI', GROUP_MA and MESH.

3.5.13 Operand OPTION = 'INCLUSION'

```
/  OPTION =  'INCLUSION',
   ♦  GROUP_MA     = lgma ,          [l_group_ma]
   ♦  CAS_FIGURE     =    / '2D'
                          / '3D'
                          / '2.5D'
   ◊  DISTANCE_MAX = distma
   ♦  GROUP_MA_INCL = lgma_inc   ,   [l_group_ma]
   ◊  MAILLAGE_INCL = ma_inc ,       [grid]
```

This option makes it possible to create the group of the nodes of the meshs of lgma who are geometrically inside the meshs of Lgma_inc.

If MAILLAGE_INCL is not provided, lgma_inc is a list of GROUP_MA grid which one enriches (my). If not it is GROUP_MA of ma_inc.

The keyword CAS_FIGURE is obligatory, it is used to determine which are the meshs of lgma_inc who must be used to determine inclusion:

'2D' : one is interested only in the surface meshs (SORTED and QUAD) of a grid 2D (plan XOY).

'3D' : one is interested only in the voluminal meshs (TETRA, PENTA,...)

'2.5D' : one is interested only in the surface meshs (SORTED and QUAD) of a grid 3D (hull).

The keyword DISTANCE_MAX is optional. It is used to give a small tolerance to determine whether a node is included in a mesh. Indeed, a node located "just" on an interface between 2 meshs, is likely to be regarded as "outside" with the 2 meshs and thus like not being part of inclusion. This is why a value by default of distma is taken by the code. One chose 1% length of the smallest edge of the grid ma_inc.
In the case of a grid of type "hull" (2.5D), if surface is not plane, it is almost impossible that an element of facet is geometrically included in other meshs: there is almost always a variation in the "normal" direction on the surface. It will thus be necessary in general, in this case, to provide a value of distma higher than the value by default.

3.5.14 Operand OPTION = 'INTERVALLE_VALE'

This option is used to create it group_no formed by the nodes of which the value of a component (cmp) of a field to the nodes (cham_no) lies between two values (vmin and vmax).

The field and the component which will be used to select the nodes are given by the keywords CHAM_GD and NOM_CMP.

Values vmin and vmax are provided via the keyword VALE.

Example:

```
DEFI_GROUP (reuse  = E-MAIL, GRID = E-MAIL,
            CREA_GROUP_NO = _F (NOM=' GN700', OPTION=' INTERVALLE_VALE',
            CHAM_GD=TEMPER, NOM_CMP=' TEMP', VALE= (700. , 800.),),);
```

GROUP_NO 'GN700' will be made of all the nodes of the grid E-MAIL of which the temperature in the field TEMPER is understood enters 700. and 800.

3.5.15 Operand OPTION = 'FISS_XFEM'

This option makes it possible to recover the group of the nodes of the type XFEM specified by the keywords TYPE_GROUP.

♦ CRACK = (fiss1, fiss2,…)

♦ TYPE_GROUP =

/ 'XFEM' : the node will be retained if it is an enriched node

/ 'HEAVISIDE' : the node will be retained if it is a node enriched by Heaviside type

/ 'CRACKTIP' : the node will be retained if it is a node enriched by Cracktip type

/ 'MIXED' : the node will be retained if it is a node enriched by Mixed type (Heaviside and Cracktip)

/ 'ZONE_MAJ' : the node will be retained if it is contained in the zone of update of the level sets. If the grid of the crack passed by the keyword GRID (§ 3.2) , the zone of update coincides:

- in the absence of an auxiliary grid associated with the crack, with the field of calculation around the bottom,
- in the presence of an auxiliary grid associated with the crack, with the field of projection between grid and grid , independently of the field of calculation used on the grid.

If a grid passed by the keyword GRID (§ 3.2) , the zone of update always coincides with the field of calculation used on the grid.

/ 'TORUS' : the node will be retained if it is contained in a torus built around the bottom of crack of ray given by the keyword RAYON_TORE . If the localization of the field were used for the calculation of the crack, this option cannot be selected. In this case, the group of nodes is created by using the zone of update (one selects the option automatically TYPE_GROUP=' ZONE_MAJ') and the choice of the user is ignored.

For a definition specifies concepts of enriched node, node Heaviside, node Ace-tip, auxiliary grid, field of calculation and its localization, to see R7.02.12, §3.2.5.

3.5.16 Operand RAYON_TORE

If TYPE_GROUP=' TORE'
♦ RAYON_TORE = R,

The ray is specified R torus to be used for the selection of the nodes.

3.5.17 Operand OPTION = 'RELA_CINE_BP'

For each triplet of connections (3 directions of space) contents in the list of relations kinematics of a concept cable_precont resulting from DEFI_CABLE_BP, this option created a group of nodes containing it node of cable and them nodes of concrete concerned. The name of this group is the value given to PREF_GRNO followed by the name of node of cable.

♦ CABLE_BP = cable_bp
Name of the concept cable_precont.

♦ PREF_GRNO = pref
Prefix given to the groups of nodes created.

3.5.18 Operands GROUP_MA and NAME

/ GROUP_MA = lgma

For each group of meshs of the list lgma, one creates a group of nodes formed by the nodes carried by the meshs of this group of meshs.

◊ NAME = lgno

If lgno is provided by the user, this list must be of the same length than lgma. These are the names that one wants to give to the new groups of nodes.

If lgno is not provided, the groups of nodes will bear the same names as the groups of meshs which gave them rise.

◊ CRIT_NOEUD =
/'ALL' [DEFECT] : all the nodes of each mesh are taken.
/'TOP' : one takes only the nodes "top" of the meshs (i.e. ends of the edges).
/'MEDIUM' : one takes only the nodes "medium" of the edges of the meshs.
/'CENTER' : one takes only the nodes which is neither "top" nor "medium" it is - with - to say the nodes to the center of the facets or the voluminal elements.

3.5.19 Operand TOUT_GROUP_MA

/ TOUT_GROUP_MA = 'YES'

This keyword has the same meaning as the precedent, except that one creates groups of nodes for **all** existing groups of meshs of the grid.

3.5.20 Operand ALARM = 'YES' [DEFECT] / 'NOT'

if ALARM = 'NOT', the code does not emit alarm; for example when one asks him to create one GROUP_NO and that this group is empty. The value by default of this keyword is 'YES'.

3.5.21 Operand INFORMATION

if INFORMATION = 1, one print in the file 'MESSAGE', the number of groups create and for each group, the name of the group and the number of entities the component.

if INFORMATION = 2, one prints in the file 'MESSAGE', the number of groups create and for each group, the name of the group, the number of entities the component then the list of the entities setting up the groups.

4 Examples

Example 1 (topological criteria and logics):

That is to say my a grid containing the groups of meshs already:

```
M1   M2   M3
```

and groups of nodes:

```
N1   N2   N3
```

```
my = DEFI_GROUP (reuse = my, GRID = my,
           CREA_GROUP_MA = ( _F  (   NAME = NM1,    MESH = (MA7, MA9,…)   ),
                             _F  (   NAME = NM2,    UNION =(M1, NM1)),
                             _F  (   NAME = NM3,    DIFFE =(NM2, M2)),),
           CREA_GROUP_NO = _F    (   TOUT_GROUP_MA = 'YES'),                 )

my = DEFI_GROUP (reuse = my, GRID = my,
           CREA_GROUP_MA = _F    (   NAME = NM4,    MESH = (MA7, MA11, MA13))
           CREA_GROUP_NO = (_F   (   NAME = NN1,    INTERSEC=  (NM1, N1)),
                             _F (    GROUP_MA = NM4)))
```

After these two calls to the order DEFI_GROUP, the grid contains then:

- groups of meshs:
  - M1, m2, m3 (initial)
  - NM1 = (meshs: MA7, MA9,…)
  - NM2 = M1 "union" NM1
  - Nm3 = NM2 "minus" m2
  - NM4 = (MESHS: MA7, MA11, MA13)
- groups of nodes:
  - N1, N2, N3 (initial)
  - M1, M2, M3, NM1, NM2, NM3 : group_no containing the nodes of group_ma of **same names**. These group_no are created by the 1era order DEFI_GROUP.
  - NN1 = NM1 "intersection" N1
  - NM4 = (nodes of group_ma NM4)

Example 2 (geometrical criteria):

```
my = DEFI_GROUP   (reuse = my, GRID = my,
           CREA_GROUP_MA= (_F (NAME = facesup   ,   OPTION =   'FACE_NORMALE',
                               VECT_NORMALE = (0. ,  0. ,  1.)),
                           _F  (NAME = S01    ,       OPTION =   'SPHERE',
                               NOT = (0. ,  0. ,  0.),  RAY = 1.),),
           CREA_GROUP_NO = (_F   (NAME = BO_S01 ,   OPTION =   'ENV_SPHERE',
                               POINT= (0. , 0. , 0.), RAYON=1., PRECISION=0.01),
                          _F  (NAME = S01_1  ,   GROUP_MA = S01),
                          _F  (NAME = S01_2  ,   OPTION = 'ENV_SPHERE',
                               POINT= (0. , 0. , 0.), RAYON=0.5,
PRECISION=0.5),),
                    )
```

Afterwards DEFI_GROUP grid my will contain 2 new GROUP_MA and 3 new GROUP_NO :

- facesup contains the facets whose normal is directed according to OZ (towards $Z>0$),
- S01 contains **all** the meshs of which **one of the nodes** belongs to the sphere of ray 1. and centered in O (origin of the axes),
- B0_S01 is the group of the nodes which are in the vicinity of the envelope of the preceding sphere (S01),
- S01_1 is the group of all the nodes of the meshs of the group of meshs S01 ; caution: certain nodes of this group can be outside the sphere!
- S01_2 is the group of the nodes included in the sphere S01 : $|d(M,O)-0.5|\leq 0.5$