Operator INTE_MAIL_2D

1 Goal

To define a curve in a grid 2D. At the points of intersection of the curve thus defined with the grid could be carried out, using the operator POST_RELEVE_T, statements of values, calculations (averages, invariants,…) and the storage of the result of these operations in a concept of the type table.

The produced concept is of type curve.

Note:
This order will be removed soon.
It is advised to replace it by the order MACR_LIGN_COUPE

2 Syntax

```
crb [curve] = INTE_MAIL_2D

(  ♦  GRID = my,                                              [grid]

   ◊  /  ALL    =  'YES',
      /  GROUP_MA  =  lgrma,                                  [l_gr_maille]
      /  MESH      =  lmail,                                  [l_maille]

    ♦ /   I  DEFI_SEGMENT=_F (♦    /  ORIGIN      = (xa, it there a),
   [l_R]
                                 /  NOEUD_ORIG   = Noeud,     [node]
                                 /  GROUP_NO_ORIG= grno,      [group_no]
                               ♦ /  END     = (xb, yb),     [l_R]
                                 /  NOEUD_EXTR   = node,      [node]
                                 /  GROUP_NO_EXTR= grno,      [group_no]
                            ),

          I  DEFI_ARC = _F ( ♦  /  CENTER         = (xc, yc), [l_R]
                                 /  NOEUD_CENTRE   = node,    [node]
                                 /  GROUP_NO_CENTRE= grno,    [group_no]
                               ♦ /  ♦   RAY   =  R,           [R]
                                    ♦  SECTOR = (□ inf, □ sup),  [l_R]
                                 /  ♦  /  ORIGIN = (xa, it there a), [l_R]
                                       /  NOEUD_ORIG = node,  [node]
                                       /  GROUP_NO_ORIG=grno, [group_no]
                                    ♦  /  EXTREMITE= (xb, yb),   [l_R]
                                       /  NOEUD_EXTR= node,   [node]
                                       /  GROUP_NO_EXTR=grno, [group_no]
                                ◊ PRECISION =  /   epsilon ,        [R]
                                               /  0,001,        [DEFECT]
                                ◊ CRITERION =     /  'RELATIVE',  [DEFECT]
                                               /  'ABSOLUTE',
                            ),

      /  ♦  DEFI_CHEMIN=_F ( ♦  /  MESH   = e-mail,          [l_maille]
                                /  GROUP_MA = grma,          [l_gr_maille]
                             ),

          ◊ /  NOEUD_ORIG    = node,                          [node]
            / GROUP_NO_ORIG = grno,                          [group_no]

      ◊  PRECISION =     /  epsilon,                             [R]
                         /  0,001,                          [DEFECT]

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

)
```

3 Operands

3.1 Operand GRID

♦ GRID = my

my : name of the concept of type grid on which the curve is located.

3.2 Operands ALL / GROUP_MA / MESH

Apply only for DEFI_SEGMENT and DEFI_ARC.

◊ / ALL = 'YES',

The location is carried out on all the grid.

/ GROUP_MA = lgrma,

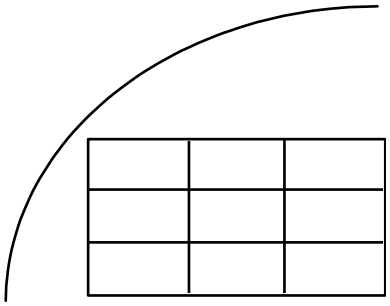
The location is carried out only on the groups of meshs of the list lgrma.

/ MESH = lmail,

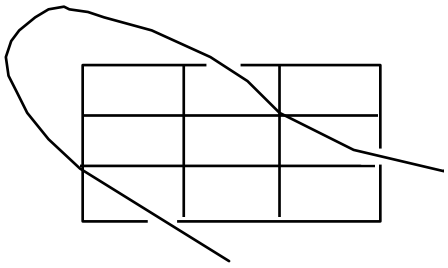
The location is carried out only on the meshs of the list lmail.

3.3 Way: Keywords DEFI_SEGMENT / DEFI_ARC / DEFI_CHEMIN

The way can be defined by one or more occurrences of DEFI_CHEMIN, or one or more occurrences of DEFI_ARC and DEFI_SEGMENT units.
If an occurrence of DEFI_SEGMENT, DEFI_ARC or DEFI_CHEMIN a curve defines which does not cut the grid, an error message fatal is emitted.



refusé



accepté

3.3.1 Keyword DEFI_SEGMENT

Keyword factor whose each occurrence defines a segment of right-hand side by the data of its points origin and end (in the form of coordinates or of names of nodes or group_no). The segment is directed origin towards the end.

3.3.2 Keyword DEFI_ARC

Keyword factor whose each occurrence defines an arc of a circle by the data of its center and, either of a ray and an angular sector, or of 2 points origin and end of the arc.

The center of the circle is introduced by one of the 3 keywords:

```
CENTER          = (xc, yc),  coordinates of the center of the circle,
NOEUD_CENTRE    = node,      name of the node centers circle,
GROUP_NO_CENTRE = grno,      name of group_no containing the only node centers,
```

The radius of the circle is introduced by the keyword:

```
RAY = R                      with R > 0
```

The angular sector by the keyword:

SECTOR = $(\theta_{inf}, \theta_{sup})$ with $(\theta_{inf}, \theta_{sup})$ angles in degrees checking $-180 < \theta_{inf} \leq \theta_{sup} \leq 180$

The point origin of the arc by one of the 3 keywords:

```
ORIGIN          = (xa, it  coordinates of the node origin,
there a),
NOEUD_ORIG      = node,      name of the node origin,
GROUP_NO_ORIG = grn O,       name of group_no containing the only node origin.
```

The point end of the arc by one of the 3 keywords:

```
END     = (xb, yb),          coordinates of the node end,
NOEUD_EXTR    = node,        name of the node end,
GROUP_NO_EXTR= grno,         name of group_no containing the only node end.
```

PRECISION = epsilon

Precision valid for an occurrence of the keyword factor DEFI_ARC. Allows to overload the precision valid for all the order [§3.3].

```
CRITERION =      /   'RELATIVE',              [DEFECT]
                 /   'ABSOLUTE',
```

If Q is the quantity searched with a precision ε, then the interval of research is:

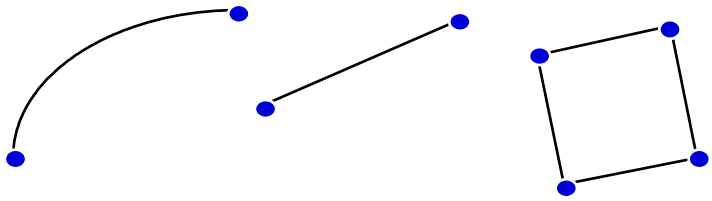
$\left[q(1-\varepsilon), q(1+\varepsilon)\right]$ in 'RELATIVE'
$\left[q-\varepsilon, q+\varepsilon\right]$ in 'ABSOLUTE'

3.3.3 Keyword DEFI_CHEMIN

Keyword factor whose each occurrence admits for argument a list of names of meshs (keyword MESH) or a list of names of groups of meshs (keyword GROUP_MA). These meshs being of the type SEG2 or SEG3.

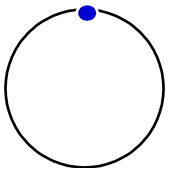
The way (or possibly ways) is made up starting from the meeting of the various meshs. INTE_MAIL_2D analysis this unit to determine topology. It detects:

- the existence or not of several independent ways:

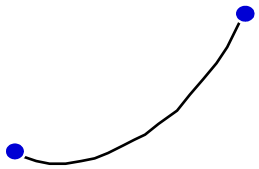


3 chemins

- for each way, the open cycles and arcs are distinguished:



cycle



arc ouverts

The ways are directed starting from the mesh of smaller number for the cycles and starting from the mesh end of smaller number for the open arcs. This number corresponds to the order of appearance in the file of grid.

The user can nevertheless impose the node origin of the way by the keyword NOEUD_ORIG (name of the node origin) or GROUP_NO_ORIG (name of group_no formed by the only node origin).

3.4 Operand PRECISION

◊ PRECISION = epsilon

Optional keyword allowing the user to define the threshold in lower part of which 2 points are regarded as confused.

3.5 Operand INFORMATION

Allows to obtain impressions on the file 'MESSAGE'.

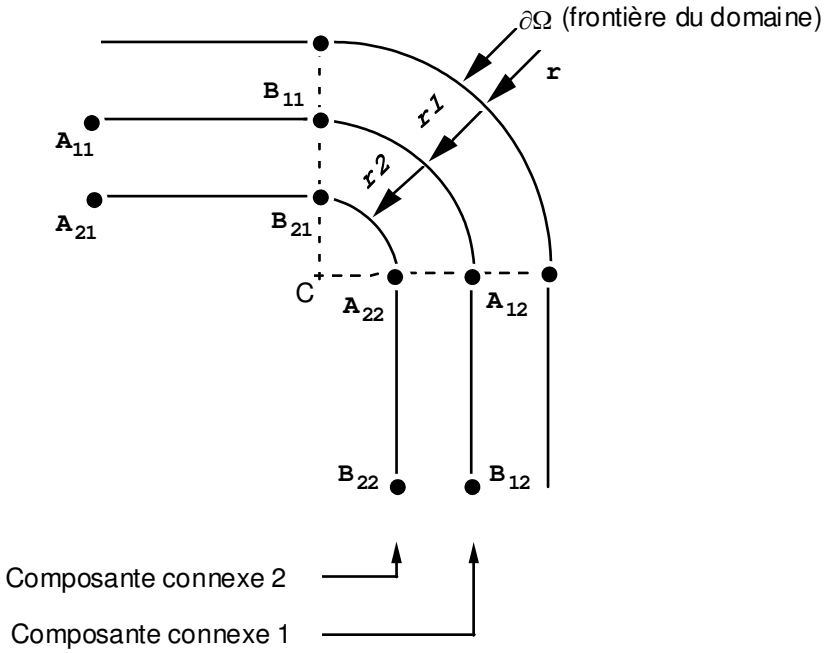
INFORMATION = 1, pas d' impressions
INFORMATION = 2, impression of the meshs crossed by the way

4 Possibilities and operational limits

4.1 Curves obtained like meeting of segments of right-hand side and/or arcs of a circle

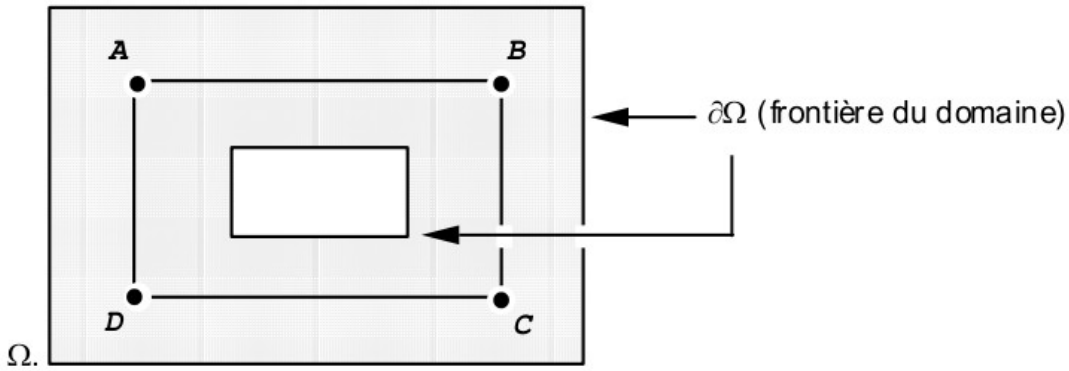
Example 1

Let us suppose that the border of the field □ is reduced locally to 2 segments of right-hand side and an arc of a circle and that the user is interested in the behavior of the structure in the vicinity of this border. It will be able to then define curves such as A_{11}, B_{11}, A_{12}, B_{12} or A_{21}, B_{21}, A_{22}, B_{22}.




```
Corner = INTE_MAIL_2D

(  GRID = name of the grid,

   DEFI_SEGMENT = (
   _F (  ORIGIN = (xA11, yA11), END = (xB11, yB11),),
   _F (  ORIGIN = (xA21, yA21), END = (xB21, yB21),),
   _F (  ORIGIN = (xA12, yA12), END = (xB12, yB12),),
   _F (  ORIGIN = (xA22, yA22), END = (xB22, yB22),),),

    DEFI_ARC = (
   _F (  CENTER = (xc1, yc1),
         RAY  = r1, SECTOR = (  0. ,   90.),  ),
   _F (  CENTER = (xc2, yc2),
         RAY  = r2, SECTOR = (  0. ,   90.),  ),),
)
```

Example 2 : Study in the vicinity of an interior hole in a field

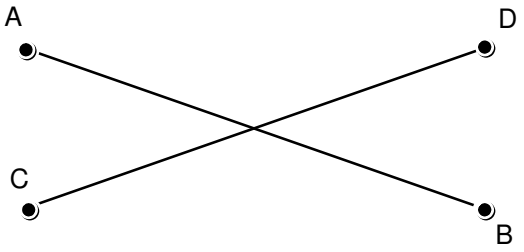


The curve ABCD is defined like meeting of 4 segments of right-hand side.

```
turn = INTE_MAIL_2D

    (   GRID = carré_percé,

        DEFI_SEGMENT = (
        _F  (   ORIGIN = (xA, it there a), END = (xB, yB)   ),
        _F  (   ORIGIN = (xD, yD), END = (xC, yC)),
        _F  (   ORIGIN = (xA, it there a), END = (xD, yD)   ),
        _F  (   ORIGIN = (xB, yB), END = (xC, yC)),),
    )
```

Example 3 : an operational limit

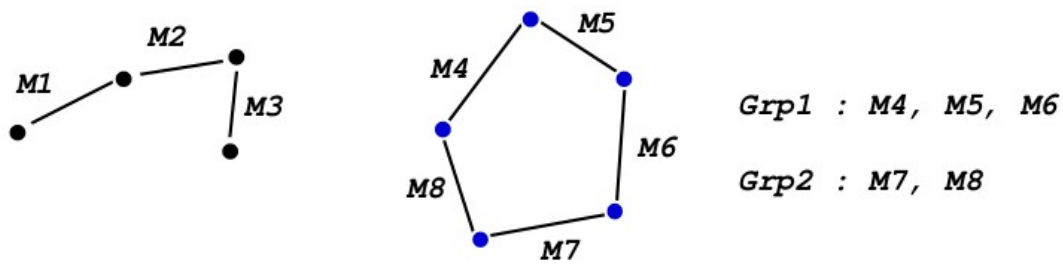
It relates to the possibility of intersection of the segments and/or the arcs into cubes points which are not one of their end.



This case is not the object of any particular treatment. The 2 segments of right-hand side are taken as two pieces perfectly independent of the same concept. Their intersection is ignored. The management of such cases is with the load of the user.

4.2 Curves obtained like meeting of meshs 1D of the field

Example 1

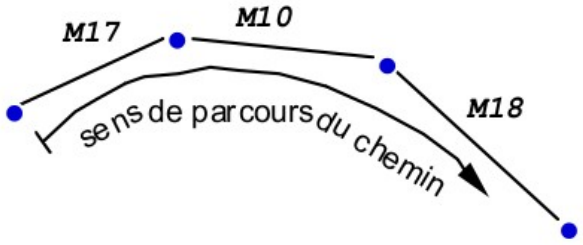


The curve is reduced to the simple way made up of the meshs M1, M2, M3 and with the cycle corresponding to the groups of meshs Grp1 and Grp2. The simple way and the cycle constitute the two related components of the curve.

The order in which the meshs of a way are traversed depends on the classification of the meshs.

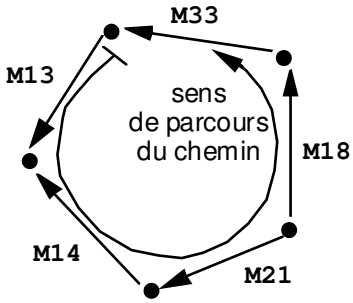
In the case of a way simple (open arc) it is the classification of the meshs “end” which determines the order of course.

For example:



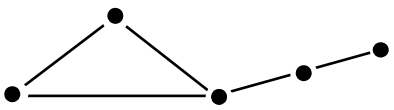

```
Course = INTE_MAIL_2D

    (   GRID = Maya,

        DEFI_CHEMIN = _F (   MESH          = ('M1', 'M2', 'M3'),
                             GROUP_MA = ('Grp1', 'Grp2'), )
    )
```

Dans le cas d’un cycle, le chemin est parcouru en partant de la maille de plus petit numéro et dans le sens de la connectivité de cette maille



Exemple 2 : une restriction importante
L’opérateur suppose que les cycles et les chemins simples sont disjoints, ainsi le cas suivant est illicite.

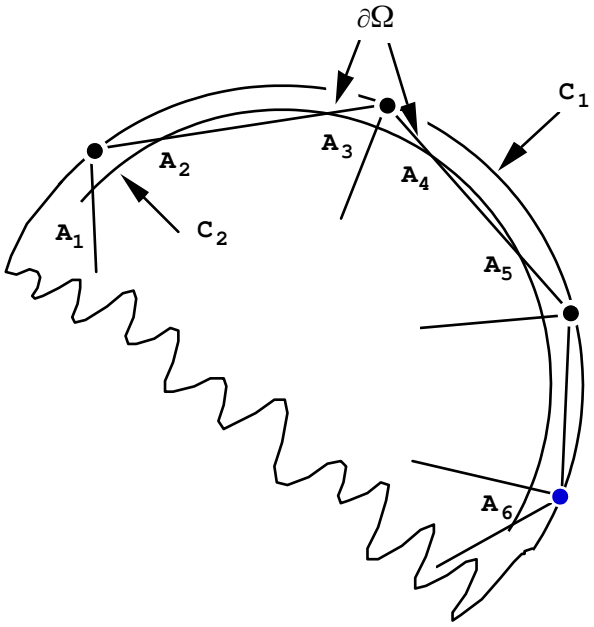
Ce cas n’est pas détecté mais doit être évité.



Example 3 : an operational limit for the curved edge

For a field of which part of the border is an arc of a circle, it is trying to define an arc of a circle, by means of the keyword DEFI_ARC, which would cut the grid in the vicinity of the border. Unfortunately, the edge of the grid is not an arc of a circle but a polygon and the definite way can leave the grid.

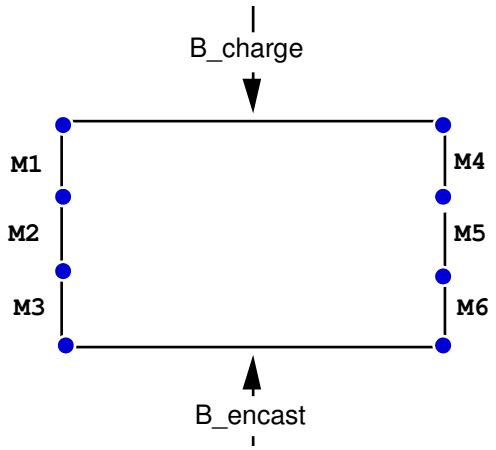
For example:



C_1 : external circle
C_2 : interior circle
$d\Omega$: broken line

- The arc of a circle C_1, which coincides with part of □□, the grid does not cross of □ that into cubes nodes: INTE_MAIL_2D will give an empty intersection.
- The arc of a circle C_2 is strictly included in □ but in the grid of □ INTE_MAIL_2D will locate 2 holes.

Example 4 : study on the border of a plate




```
Edge = INTE_MAIL_2D

    (  GRID = plate,

       DEFI_CHEMIN = _F (  MESH = ('M1', 'M2', 'M3', 'M4', 'M5',
'M6',),
                           GROUP_MA = ('B_charge',  'B_encast'),)
    )
```

To study the behavior of the structure on its embedded edge, it is advised to define another curve as follows:

```
Bord_Enc = INTE_MAIL_2D

    (  GRID = plate,

       DEFI_CHEMIN = _F (GROUP_MA = ('B_encast'),),
    )
```