Operator MODI_MAILLAGE

1 Drank

To carry out modifications on an existing mesh. The possibilities of modifications are:

- to reorientate meshes of edge being used for applying a pressure,
- reorientating meshes the HEXA8 of modelization SHB,
- checking the directional sense of the norms on the shell elements,
- reorientating meshes the full-course one of elements of joint,
- reactualizing the mesh from a deformed shape calculated previously,
- transforming a mesh of plate into mesh of tube, then possibly of elbow, (macro command MACR_ASCOUF_MAIL),
- transforming a mesh of square into mesh of bypass (MACR_ASPIC_MAIL),
- in a mesh with crack tip, moving the nodes mediums of the edges touching the crack tip with the quarter of these edges,
- relocating a mesh,
- imposing one or more rotations of unspecified axes on a mesh,
- to generate a symmetric mesh compared to a plane in 3D or a line in 2D.

Product a data structure of mesh type or modifies the data structure (operator reentrant).

2 Syntax

```
netted  [mesh] = MODI_MAILLAGE

    (  ♦reuse       = netted,
       ♦MAILLAGE=ma        ,                                        [mesh]

       ◊ORIE_FISSURE = _F   ( ♦GROUP_MA  =l_gm         [l_gr_ma]
                              ),

       ◊ORIE_SHB=_F          ( ♦GROUP_MA  =l_gm           [l_gr_ma]
                           ),
       ◊DEFORME=        _F   (                ♦/OPTION=' TRAN',
                                 /OPTION          =  ' TRAN_APPUI',
                              ♦GROUP_NO_APPUI=lgno          ,   [l_gr_no]
                              ♦GROUP_NO_STRU=lgno           ,   [l_gr_no]
                              ♦DEPL=depl                    ,   [cham_no]
                           ),

       ◊ORIE_PEAU_2D=_F       ( ♦GROUP_MA=            lgrma,
[l_gr_ma]
                              ◊GROUP_MA_SURF=l_gms          ),  [l_gr_ma]

       ◊ORIE_PEAU_3D=_F       ( ♦GROUP_MA=lgrma             ,
[l_gr_ma]
                              ◊  GROUP_MA_VOLU=l_gmv    ),  [l_gr_ma]


       ◊ORIE_NORM_COQUE=_F  ( ♦GROUP_MA=lgrma        ,          [l_gr_ma]
                              ◊VECT_NORM=          (n1, N2, [n3]), [l_R]
                              ◊/NOEUD         =no ,             [node]
                                 /GROUP_NO  =grno ,          [gr_no]
                           ),

       ◊ORIE_LIGNE=_F    (    ♦GROUP_MA=lgrma        ,          [l_gr_ma]
                              ◊VECT_TANG=          (n1, N2, [n3]), [l_R]
                              ◊/NOEUD         =no ,             [node]
                                 /GROUP_NO  =grno ,          [gr_no]
                           ),

       ◊MODI_MAILLE=     _F ( ♦OPTION    =  ' NOEUD_QUART',
                              ♦/     |   GROUP_MA_FOND= lgma_fo, [l_gr_ma]
                                     |   MAILLE_FOND  = lma_fo,  [l_maille]

                                 /   |   GROUP_NO_FOND= lgno_fo, [l_gr_no]
                                     |   NOEUD_FOND   = lno_fo,  [l_noeud]
                           ),
```

```
        ◊/ EQUE_PIQUA=    _F ( ♦GROUP_NO=equerre              ,       [gr_no]
                               ♦E_BASE=epaissor               ,    [R]
                               ♦DEXT_BASE=diametre            ,       [R]
                               ♦L_BASE=longuor                ,       [R]
                               ♦L_CHANF=longuor           ,       [R]
                               ♦H_SOUD=hautor                 ,       [R]
                               ♦ANGL_SOUD=angle           ,           [R]
                               ♦JEU_SOUD=jeu              ,           [R]
                               ♦E_CORPS=epaissor                ,    [R]
                               ♦EXT_CORPS=diameter            ,       [R]
                               ♦AZIMUT=angle              ,           [R]
                               ♦X_MAX=longuor                 ,       [R]
                               ♦RAFF_MAIL=raff            ,           [Txm]
                               ♦TYPE=/                  "TYPE_1"  ,    [Txm]
                                                      /"TYPE_2" ,
                           ) ,
            /  | PLAQ_TUBE=   _F ( ♦DEXT=De                   ,           [R]
                                   ♦EPAIS=e                   ,           [R]
                                   ◊AZIMUT=/q                       ,       [R]
                                                          /90. ,     [DEFAULT]
                                   ♦L_TUBE_P1=l_tube_p1               , [R]
                                   ◊COUTURE=/                 "OUI',
[DEFAULT]
                                                            /  "NON",
                               ) ,

               | TUBE_COUDE=  _F ( ♦ANGLE=                    α        [R]
                                   ♦R_CINTR          =Rc   ,           [R]
                                   ♦L_TUBE_P1=l_tube_p1              , [R]
                               ),

        ◊TRANSLATION=        (n1, N2, [n3]),                           [l_R]

        ◊ROTATION=_F          ( ♦POIN_1=             (n1, N2, [n3]),
[l_R]
                             ♦/POIN_2      =   (n1, N2, [n3]),         [l_R]
                                /DIR          =   (n1, N2, [n3]),          [l_R]
                             ♦ANGLE=/a                ,                 [R]
                                                 /0  . ,               [DEFAULT]
                          ),

        ◊ECHELLE=n1             ,                                      [R]

        ◊MODI_BASE=_F         ( ♦VECT_X       =   (n1, N2, [n3]),         [l_R]
                             ◊VECT_Y=             (n1, N2, [n3]),         [l_R]
                          ),

        ◊SYMETRIE=_F          ( ♦POINT=              (n1, N2, [n3]),
[l_R]
                             ♦AXE_1     =   (n1, N2, [n3]),         [l_R]
                             ◊AXE_2     =   (n1, N2, n3),           [l_R]
                          ),

        ◊INFO   =/1           ,
[DEFAULT]
                     /2 ,
    )
```

3 Operands

3.1 Operand MAILLAGE

♦MAILLAGE = my,

Mesh of the type [mesh] on which will amend and/or checks.

3.2 Operand INFO

◊INFO =

Indicates the level of printing of the results of the operator,

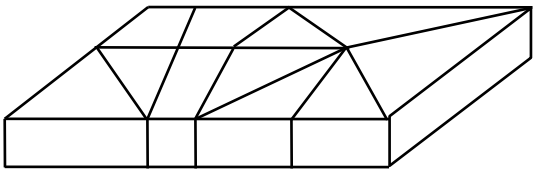
1 = no printing,
2 = printing of meshes whose connectivity was modified, including the printing of old and new connectivities.

The printings are made in the file "MESSAGE".

3.3 Key word ORIE_FISSURE

◊ORIE_FISSURE =

This key word is used to reorientate (if necessary) meshes of a group forming "mono lay down" elements. It functions in 2D or 3D, with a linear or quadratic mesh [Figure 3.4-a].



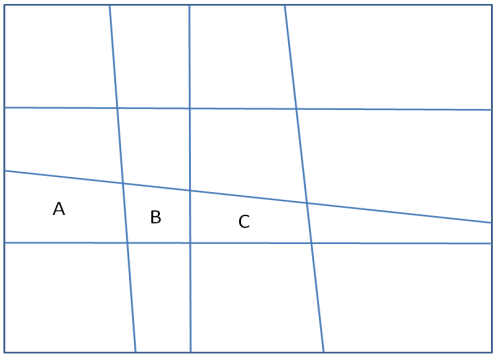
Currently appear

3.4-a, this key word is used to reorientate the elements of joint and the elements of interface (modelizations AXIS_xxx, PLAN_xxx and 3D_xxx with xxx=JOINT or INTERFACES).

The user specifies (with key word GROUP_MA) which are meshes the candidates with the reorientation (the "mono one sleeps").
These meshes must be "prisms" (QUAD in 2D, HEXA and PENTA in 3D).

The "transverse" direction with the layer is given in a topological way (and not according to a criterion of flatness). To be able to be reorientated, the elements of the layer must meshes be based (via the bases of the prisms) on others of the same dimension (2D or 3D) which do not belong to the group of meshes to reorientate.

That is to say mesh (2D) opposite.



One wishes to reorientate the group of the 3 meshes A, B and C.
For meshes A and B, meshes of bearing (with the top and the lower part) determine a nonambiguous transverse directional sense (vertical).
On the other hand, the mesh a.c. 3 meshes of bearing (high, low, right) and one cannot determine the transverse direction.
The algorithm of reorientation will fail.

Note:

The "reorientation" which one speaks here actually consists in modifying the definition of the connectivity of meshes. For example, in 2D, convention is that sides 2 and 4 of the quadrangles are transverse with the layer.

♦GROUP_MA= l_gm,

List of the mesh groups which one wishes the checking (and possibly modification) of the directional sense.

3.4 The purpose of key word ORIE_SHB

◊ORIE_SHB =

This factor key word is reorientating correctly meshes voluminal of the finite elements the SHB. It is necessary to modify the local classification of the nodes of meshes to be able to recognize the direction of the norm to the shell.

The connectivity of meshes thus is possibly modified by this operator.

♦GROUP_MA= l_gm,

List of the mesh groups which one wishes the modification of the directional sense.

3.5 Key word DEFORMED

◊DEFORME

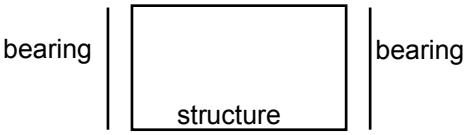
/OPTION = ' TRAN'

Option allowing to add to the initial geometry of the mesh the my values of Translation (dx, Dy (+ dz in 3D)) field of depl displacement given by the key word DEPL.

/OPTION = ' TRAN_APPUI'

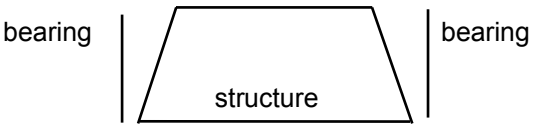
Option allowing besides "TRAN" to reactualize the position of the bearings by taking account of the deformed shape of structure. More precisely:

Initial mesh:



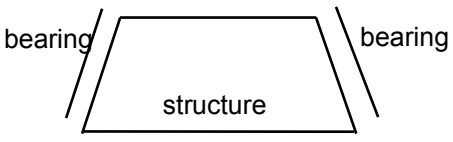
the bearings are blocked for mechanical computation, only the structure becomes deformed:

Deformed shape



One reactualizes the bearings by adding to their coordinates the displacement of the nodes of the structure which are to them in opposite. This gives then:

Reactualization



The mesh in output of MODI_MAILLAGE takes into account the deformed shape of structure and the reactualization of the bearings as explained above

♦GROUP_NO_STRU = lgrno ,
♦GROUP_NO_APPUI = lgrno,

These key words compulsory make it possible to inform the nodes groups structure and bearing whose nodes must be in opposite (for the contact).

♦DEPL = depl,

Field of displacement being used to reactualize the geometry

3.6 Key words ORIE_PEAU_2D / ORIE_PEAU_3D

◊ORIE_PEAU_2D =
◊ORIE_PEAU_3D =

These key words are used to reorientate meshes of edge so that their norms are coherent (towards the outside of the matter). It is an essential precondition if, for example, one wants to apply a loading of pressure to this “skin”.

♦GROUP_MA =lgrma , [l_gr_ma]

Mesh groups to be reorientated.

Meshes are directed in such way that the norm is outgoing. For each edge mesh (edge or face), one seeks the “voluminal” mesh which it “borders”. One directs it in such way that its norm is meaning opposed to the vector connecting its first node to the barycenter of the mesh voluminal.

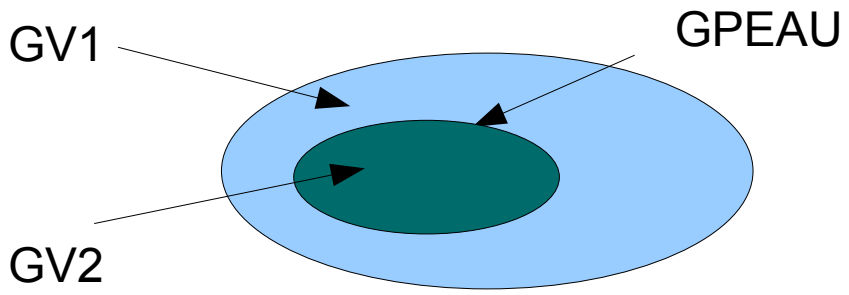
It happens sometimes that the “skin” which one wishes to direct is inserted in the matter (for example, when one does a calculation for which, of meshes is gradually added or withdrawn from the model: modelization of an excavation, or a construction by layers). The algorithm of directional sense describes above fails then because one in general finds 2 meshes voluminal on both sides of the mesh of skin. One does not know then which to use to direct the mesh of skin.

For that, key words optional GROUP_MA_VOLU were introduced (or GROUP_MA_SURF in the case 2D). These keywords make it possible to the user to specify which are meshes the “voluminal ones” to use to direct meshes skin.

Example:

Either 1 group of mesh of skin (GPEAU) which one wants to direct with a directed norm towards outside. It should be indicated that it is the skin of mesh group “voluminal” GV2.
One will write:

```
ORIE_PEAU_2D=_F (GROUP_MA=' GPEAU', GROUP_MA_SURF=' GV2'),
```



3.7 Key word ORIE_NORM_COQUE

◊ORIE_NORM_COQUE = _F (

This key word is used to check that in a list of meshes surface (shells), the norms are coherent between them. In the contrary case, some meshes are reorientated.

♦GROUP_MA =lgrma , [l_gr_ma]

Mesh groups surface to reorientate. Meshes of lgrma must form a “related” group so that one can reorientate them by continuity.

One can impose the sense of direction using key words NOEUD/GROUP_NO/VECT_NORM. If it is not done, the followed orientation will be that of the 1st mesh of lgrma, but it is not inevitably the 1st mesh of the 1st GROUP_MA ! It is thus advised always to use key word VECT_NORM.

◊VECT_NORM = (n1, N2, [n3]), [l_R]

nor : 2 or 3 components (according to dimension) of the normal vector. It is also necessary to specify the node support of this norm:

◊/NOEUD=noeud , [node]
/GROUP_NO =grno , [gr_no]

grno must be a GROUP_NO containing one node.
The selected norm will be that which forms an acute angle with the vector given by VECT_NORM.

3.8 Key word ORIE_LIGNE

◊ORIE_LIGNE = _F (

This key word is used to check that in a list of meshes linear (beams), the tangents are coherent between them. In the contrary case, some meshes are reorientated.

♦GROUP_MA =lgrma , [l_gr_ma]

Mesh groups linear to reorientate. Meshes of lgrma must form a “related” group so that one can reorientate them by continuity.

One can impose the sense of direction using key words NOEUD/GROUP_NO/VECT_TANG. If it is not done, the followed orientation will be that of the 1st mesh of lgrma, but it is not inevitably the first mesh of the first GROUP_MA ! It is thus advised always to use key word VECT_TANG.

◊VECT_TANG = (n1, N2, [n3]), [l_R]

nor : 2 or 3 components (according to dimension) of the tangent vector. It is also necessary to specify the node support of this norm:

◊/NOEUD=noeud , [node]
/GROUP_NO =grno , [gr_no]

grno must be a GROUP_NO containing one node.
The selected tangent will be that which forms an acute angle with the vector given by VECT_TANG.

3.9 Key word MODI_MAILLE

♦OPTION = "NOEUD_QUART",

the displacement of the nodes mediums of the edges touching Activates the crack tip with the quarter of these edges (towards the crack tip).

```
♦/     |   GROUP_MA_FOND =lgma_fo ,    [l_gr_ma]
       |   MAILLE_FOND   =lma_fo      ,    [l_maille]

   /   |   GROUP_NO_FOND =lgno_fo ,    [l_gr_no]
       |   NOEUD_FOND    =lno_fo     ,    [l_noeud]
```

In 2D, one returns the node of the crack tip (by NOEUD_FOND or GROUP_NO_FOND).

In 3D, one returns either the nodes of the crack tip, or meshes the SEG3 of the crack tip (and not meshes of the lips of crack or meshes of matter leaned with the bottom).

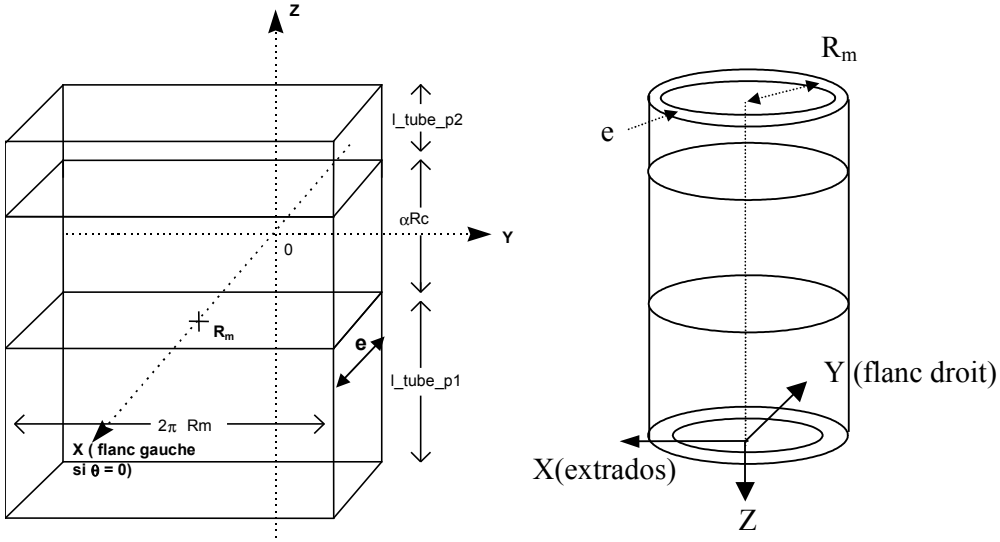
3.10 Key word PLAQ_TUBE

Attention

This functionality is called by macro-command MACR_ASCOUF_MAIL.

/ | PLAQ_TUBE =

Key word factor for the transformation of the mesh of a plate of thickness e and width $2\pi R_m$ in a mesh of tube per rolling up around the axis (Z), rotation of an angle θ given around the axis (Z) and change of reference:



♦DEXT= Of,

Diameter external of the tube $(2R_m+e)$.

♦EPAIS= E,

Thickness of the tube or the plate.

◊AZIMUT= θ,

swing Angle in degrees (counted positively from the suction face to the underside via the left side) applied to the tube from initial rolling up (useful for the positioning of a crack defined on the plate). The angle $\theta=90°$ corresponds to a crack located at the center of the plate and consequently on the left side of the tube.

♦L_TUBE_P1= l_tube_p1,

Length of the lower nozzle (intervenes in the change of reference). It is recommended to take a nozzle length higher than the damping length of the bending wave being propagated since the part bends and being worth $L_{amor}=\frac{3}{2}\sqrt{\frac{R_m^3}{e}}$.

◊COUTURE = "OUI', [DEFAULT]
/ "NON",

In the case of a mesh of a quarter of structure (key word SYME of MACR_ASCOUF_MAIL for a mesh with only one under-thickness), this key word COUTURE is used to prevent the resticking ("NON") at the time of the transformation out of tube.

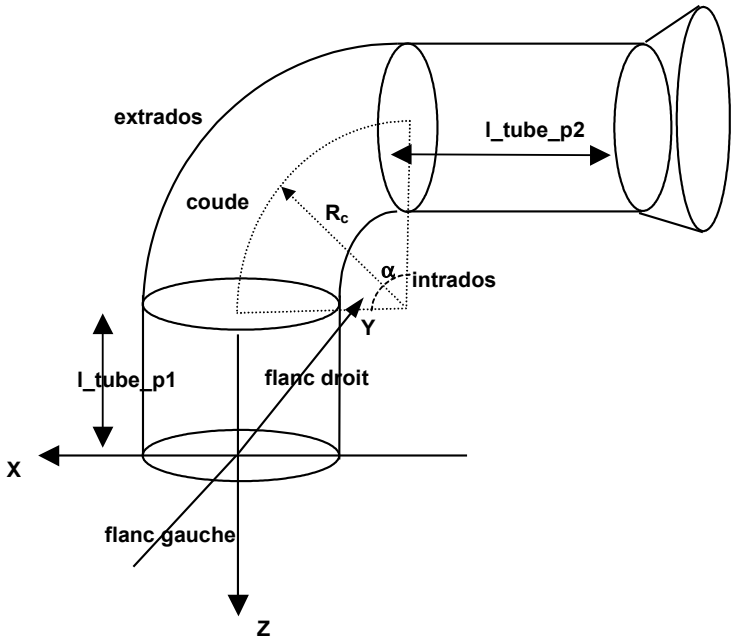
3.11 Key word TUBE_COUDE

Attention

This functionality is called by macro-command MACR_ASCOUF_MAIL.

| TUBE_COUDE =

Key word factor for the transformation of the mesh of tube in a mesh of elbow.



♦ANGLE= α .

Angle in degrees of the elbow.

♦R_CINTR= Rc,

Value of the bend radius of the elbow.

♦L_TUBE_P1= l_tube_p1,

Length of the lower nozzle of the tube (intervenes in the change of reference). It is recommended to take a nozzle length higher than the damping length of the bending wave being propagated since the part bends and being worth $L_{amor}=\frac{3}{2}\sqrt{\frac{R_m^3}{e}}$.

3.12 Key word EQUE_PIQUA

Attention

This functionality is called by macro-command MACR_ASPIC_MAIL.

◊EQUE_PIQUA =

Key word factor for the transformation of the mesh of thick square in a mesh of bypass.

♦GROUP_NO=equerre , [gr_no]

Nodes group undergoing the transformation.

♦E_BASE=epaissor , [R]

Value of the thickness of the pipe in the zone of connection with the body.

♦DEXT_BASE=diametre , [R]

Value of the diameter external of the pipe in the zone of connection with the body.

♦L_BASE=longuor , [R]

Value length of the base of the pipe counted from surface external of the body.

♦L_CHANF=longuor , [R]

Value length of the chamfer.

♦H_SOUD=hautor , [R]

Value height of weld counted from surface external of the body.

♦ANGL_SOUD=angle , [R]

Value of the angle of weld **in degrees**.

♦JEU_SOUD=jeu , [R]

Value of the space located between the body and the pipe representing the clearance of weld.

♦E_CORPS=epaissor , [R]

Value of the thickness of the body.

♦DEXT_CORPS=diameter , [R]

Value of the diameter external of the pipe with the top of the chamfer.

♦AZIMUT=angle , [R]

Position of the center of crack, counted positively from the axis X of the body.

♦X_MAX=longuor , [R]

Value length of the body on both sides of the origin of the reference specifying the localization of the load vector force. This value must correspond to the computed value with a relative accuracy of thousandths.

♦RAFF_MAIL=/ "GROS",
/ "FIN",

Is used to indicate if one wants a mesh coarse or fine around crack.

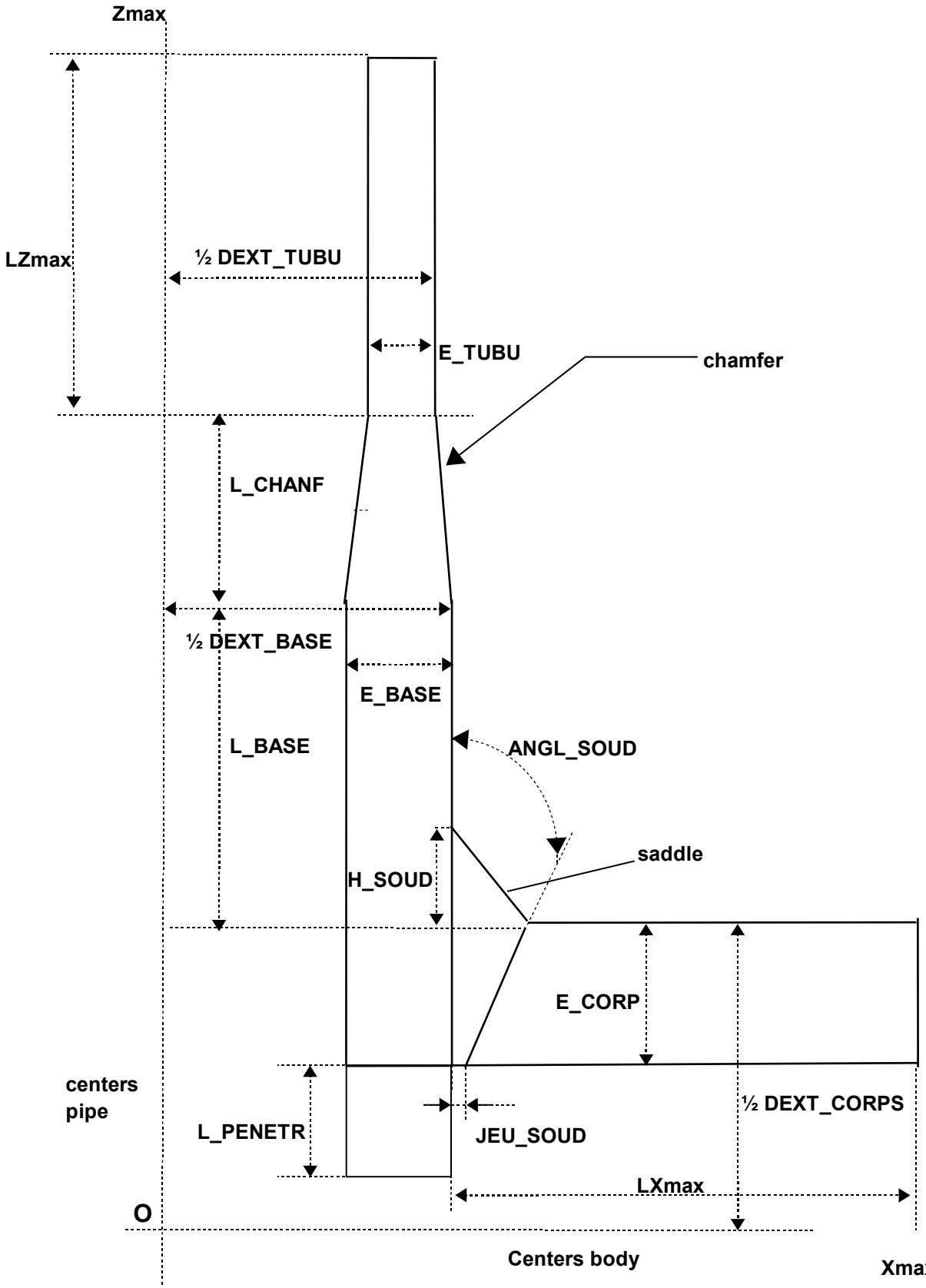
The maximum dimensions of the body (X_{max}) and the pipe (Z_{max}) are calculated starting from the maximum of two damping lengths $max\left(\frac{3}{2}\sqrt{\frac{R_m^3}{e}}, 3\sqrt{R_m.e}\right)$ noted respectively LX_{max} and LZ_{max}.

These damping lengths are counted starting from the foot of weld (according to X) and with the top of the chamfer (according to Z).

In the pipe, one will take for LZ_{max} the maximum of maximum calculated with R_m and e the corresponding respectively at the base of the pipe or the current part of the pipe, with the top of the chamfer.

One thus obtains:

$$X_{max} = LX_{max} + 1/2\,\text{DEXT\_BASE}$$
$$Z_{max} = LZ_{max} + 1/2\,\text{DEXT\_CORP} + \text{L\_BASE} + \text{L\_CHANF}$$



i Descr ption

of the various geometrical parameters of the bypass with a weld of the type 1

♦TYPE=/ "TYPE_1", [Txm]
/"TYPE_2",

the position of weld, cf [U4.PC.10] Defines.
/"TYPE_1" the bevel of weld is located in the body
/"TYPE_2" the bevel of weld is located in the pipe

3.13 Key word TRANSLATION

Attention

One can combine this functionality with ROTATION , but these operations are not commutative. The translation is always carried out before rotation.
One cannot combine this functionality with SYMETRIE .

◊TRANSLATION = (n1, N2, [n3]), [l_R]

simple Key word for the translation of a mesh following a vector.

3.14 Key word ROTATION

Attention

One can combine this functionality with TRANSLATION , but these operations are not commutative. On the other hand, it is not authorized to use ROTATION , MODI_BASE and SYMETRIE at the same time. The translation is always carried out before rotation.

◊ROTATION =

Key word factor for the unspecified rotation of axis of a mesh.

♦POIN_1= (nor, N2, [n3]), [l_R]

Coordinated first point to define the rotational axis.

♦/POIN_2= (neither, N2, [n3]), [l_R]
/DIR = (nor, N2, [n3]), [l_R]

Coordinated second point or direction to define the rotational axis completely.

♦ANGLE=a , [R]

Angle swing expressed in degrees.

Rotation is done in the direct meaning, compared to its directed axis. This axis passes by point POIN_1 and its directional sense is given, either by vector DIR, or by the vector of origin POIN_1 and end POIN_2.

Rotation is defined by:

That is to say $\mathbf{M}(x, y, z)$ a point of space, one imposes a rotation of angle to him α (in radians) whose axis passes by $\mathbf{P}(px, py, pz)$ and has as a direction $\mathbf{D}(dx, dy, dz)$. Then $\mathbf{M}$ becomes $\mathbf{M}'$ after rotation:

$$\mathbf{M'} = \mathbf{P} + \cos\alpha . \mathbf{PM} + (1 - \cos\alpha).(\mathbf{PM} . \mathbf{D}). \mathbf{D} + \sin\alpha(\mathbf{D} \wedge \mathbf{PM})$$

3.15 Key word ECHELLE

Attention

This functionality is usable with TRANSLATION and ROTATION . The scaling, when she is asked, is always made after TRANSLATION and ROTATION.
One cannot combine this functionality with SYMETRIE.

◊ECHELLE = n1, [R]

simple Key word for the setting at the level of a mesh according to a reality.

That is to say $\mathbf{M}(x, y, z)$ a point of the mesh,
it will become, by this transformation of ratio $n1$: $\mathbf{M}'(n1 \cdot x, n1 \cdot y, n1 \cdot z)$.

3.16 Key word MODI_BASE

Attention

This functionality is not authorized with ROTATION and SYMETRIE.

◊MODI_BASE =

Key word factor for the basic change in which one expresses the coordinates of a mesh. The change of reference always takes place between 2 orthonormal bases.

♦VECT_X = (n1, N2, [n3]), [l_R]

Coordinated first vector of the new base, unspecified norm.

◊VECT_Y = (n1, N2, [n3]), [l_R]

Coordinated second vector of the new base (not used in 2D), also of unspecified norm.

In 2D, it is enough to give axis VECT_X, and *Code_Aster* automatically builds the second vector to define a direct orthogonal base. A test checks if VECT_X is of non-zero norm.

In 3D, it is checked that VECT_X and VECT_Y are of non-zero norm and it is checked that they are orthogonal. The third vector which supplements the base is built as being the cross product of VECT_X with VECT_Y. One thus makes sure construction of a direct orthogonal base.

Then, in all the cases (2D and 3D), the vectors of the base are normalized to 1, the user does not have thus to be concerned with it. There is thus finally a direct orthonormal base.

In 3D, one thus expects the data of **VECT_X** and **VECT_Y**, the first two vectors of the new base. Then the basic change is defined as:

3.17 Key word SYMETRIE

Attention

One cannot combine this functionality with TRANSLATION , ROTATION , ECHELLE and MODI_BASE .

♦POINT= (n1, N2, [n3]) [l_R]
Punctual coordinate pertaining to the right in 2D or the plane in 3D.

♦AXE_1= (n1, N2, [n3]) [l_R]
directing Vector of the right in 2D or 1st vector allowing to describe the plane.

◊AXE_2= (n1, N2, n3) [l_R]
2nd vector allowing to describe the plane.

In 2D, symmetry is done compared to a line, which is in the plane OXY. To define this line it is necessary to give the directing vector of the right (AXE_1) and a point (POINT) pertaining on this line.
In 3D, symmetry is done compared to a plane. To define this plane, it is necessary to give 2 vectors of the plane (AXE_1, AXE_2) and a point (POINT) pertaining to this plane.

In all the cases (2D or 3D), symmetry is carried out compared to a plane. In 2D, the second vector necessary to the definition of the plane is fixed at AXE_2 = (0.0, 0.0,-1.0).

The algebraic distance δ between a point $\mathbf{M}(x,y,z)$ and a plane passing by the point $\mathbf{Mo}(xo,yo,zo)$ with for perpendicular vector $\mathbf{V}=\mathrm{AXE\_1}\wedge\mathrm{AXE\_2}=(a,b,c)$ is:

$$\delta=\frac{a(x-x_0)+b(y-y_0)+c(z-z_0)}{\sqrt{a^2+b^2+c^2}}$$

The coordinates of the symmetric $\mathbf{M}'$ point of the point $\mathbf{M}$ compared to the plane are given by:

$$OM'=-2\,\delta\,.\frac{V}{\|V\|}+OM$$