Operator MODI_REPERE

1 Goal

This operator allows to modify the reference mark in which fields carried of the elements of continuous medium are expressed and of the elements of structure (hulls, plates, beams,…).

The call to MODI_REPERE product generally a new concept result :

```
RESUOUT = MODI_REPERE (RESULT = RESUIN…)
```

The concep result EN left is DU even standard that the concept as starter. For changes of reference mark COQUE_INTR_UTIL , COQUE_UTIL_INTR ET USER for the beams, IL is possible (though disadvised) to use the same concept result EN entered and at exit. In all the other cases, it operation is prohibited .
It is strongly recommended not to use it concept produced by MODI_REPERE as starter of another ordering of calculation.
It is of more necessary to take care to comply with well the rules of the paragraph [§4].

2 Syntax

```
resuout [*] = MODI_REPERE(
  ◊ reuse = resuout,
  / ♦ RESULT = resuin,    /     [evol_elas]
                          /     [evol_noli]
                          /     [evol_ther]
                          /     [mode_flamb]
                          /     [dyna_trans]
                          /     [dyna_harmo]
                          /     [mode_meca]
                          /     [mult_elas]
                          /     [base_modale]
    ♦ CHAM_GD = CHIN,        [field]
    # if RESULT
      ◊ # Selection of the sequence numbers
       /  TOUT_ORDRE     = 'YES',                          [DEFECT]
       /  NUME_ORDRE     = l_nuor,                         [l_I]
       /  LIST_ORDRE     = l_nuor,                         [listis]
        / NUME_MODE      = l_numo,                         [l_I]
        / NOEUD_CMP      = l_nomo,                         [l_K16]
       /  NOM_CAS        = nocas,                          [K16]
        /  ♦ /INST       = l_inst,                         [l_R]
            /FREQ       = l_freq,                        [l_R]
            /LISTE_INST  = l_inst,                        [listr8]
            /LISTE_FREQ  = l_freq,                        [listr8]
       ◊  /   ♦  CRITERION      =/'RELATIVE',             [DEFECT]
           ♦  PRECISION    =/prec,                       [R]
                             / 1.0D-6,                   [DEFECT]
        / ♦ CRITERION      = 'ABSOLUTE',
          ♦ PRECISION    = prec,                         [R]

      ♦  MODI_CHAM = _F (
         ♦   NOM_CHAM    = nomch,                        [K16]
         ♦   NOM_CMP     = l_cmp,                        [l_K8]
         ♦   TYPE_CHAM   =/'VECT_2D',
                          / 'VECT_3D',
                          / 'TENS_2D',
                          / 'TENS_3D',
                          / 'COQUE_GENE'
      )

      ♦  REFERENCE MARK =/'USER',
                 / 'CYLINDRICAL',
                 / 'HULL',
                 / 'COQUE_INTR_UTIL',
                 / 'COQUE_UTIL_INTR',
                 / 'COQUE_UTIL_CYL',
```

```
        ♦  AFFE = _F (
             # if REFERENCE MARK = 'USER'
           / ♦ ANGL_NAUT = (alpha, beta, gamma)                    [l_R]
           / ♦ VECT_X    = (vx1, vx2, vx3)                        [l_R]
             ♦ VECT_Y    = (vy1, vy2, vy3)                        [l_R]
             # if REFERENCE MARK = ' CYLINDRIQUE' or 'COQUE_UTIL_CYL'
             ♦ ORIGIN    = (X, there, Z)                              [l_R]
             ◊ AXE_Z     = (oz1 oz2 oz3)                          [l_R]
             # if REFERENCE MARK = 'HULL'
           / ♦ ANGL_REP  = ( α,β )                                 [l_R]
           / ♦ VECTOR    = (X, there, Z)                             [l_R]
           ♦ / ALL       = 'OUI',                                 [l_gr_maille]
             / GROUP_MA  = l_grma,                                [l_gr_maille]
             / GROUP_NO  = l_grno,                                [l_gr_noeud]
        )

     # if CHAM_GD
        ♦ REFERENCE MARK    = 'GLOBAL_UTIL'
   [DEFECT]
        ♦  CARE_ELEM = carelem
   [cara_elem]

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

3 Operands

3.1 Operands RESULT and CHAM_GD

/♦ RESULT = resuin
Name of the structure of data result. This argument must be different from that used for the concept produced by the operator. The option reuse is authorized (though disadvised) only when REPERE=' COQUE_UTIL_INTR' or REPERE=' COQUE_INTR_UTIL'.

♦ CHAM_GD = chin
Name of the field as starter. This field is very particular and it can be produced only by the order PROJ_CHAMP with the method under-points applied to a stress field 3D. The order PROJ_CHAMP project this field on all the points of the family RIGI finite elements supporting of the under-points. See the operands REFERENCE MARK and CARA_ELEM of this order, as well as the documentation of the order PROJ_CHAMP.

3.2 Selection of the sequence numbers and the moments

3.2.1 Operands TOUT_ORDRE/NUME_ORDRE/LIST_ORDRE/

♦ / TOUT_ORDRE = 'YES' (value by default)
This keyword indicates that one applies the change of reference mark for all the sequence numbers of the concept result
Example: every moment for a result of the type evol_*.

/ NUME_ORDRE = l_nume
The change of reference mark will be done for the values of sequence number l_nume provided.

/ TOUT_INST = 'YES'
This keyword indicates that one wants to change the reference mark for every moment.

/ LIST_ORDRE = l_ord
This keyword indicates that one wants to modify the reference mark with the sequence numbers described in the concept l_ord of type listis.

/ NUME_MODE = l_numo
This keyword indicates that one wants to modify the reference mark of the modes indicated by their numbers of mode in the list l_numo.

/ NOEUD_CMP = l_nomo
This keyword indicates that one wants to modify the reference mark of the static modes indicated by their DDL in the list l_nomo.

/ NOM_CAS = nocas
This keyword indicates that one wants to modify the reference mark of a static result indicated by the name of his loading case nocas.

3.2.2 Operands INST/LIST_INST/FREQ/LIST_FREQ

◊ / INST = l_inst
This keyword indicates that one wants to modify the reference mark at the moments l_inst.

/ LIST_NST = li_inst
This keyword indicates that one wants to modify the reference mark at the moments described in the concept li_inst of type listr8.

/ FREQ = l_freq
This keyword indicates that one wants to modify the reference mark at the frequencies l_freq.

/ LIST_FREQ = li_freq
This keyword indicates that one wants to modify the reference mark at the frequencies described in the concept li_freq of type listr8.

3.3 Keyword factor MODI_CHAM

This keyword factor makes it possible to define the fields and the components to be calculated. It can moreover be repeated several times. One can treat several fields at the same time.

3.3.1 Operand NOM_CHAM

Reference symbol of the field to be treated.

3.3.2 Operand NOM_CMP

Names of the components which one wants to treat (see [U2.01.04]). See also the paragraph [§4].

3.3.3 Operand TYPE_CHAM

This operand **obligatory** allows to specify the type of field to be treated. The various types are the following:

/ 'VECT_2D' mean that one treats a field of vectors in dimension 2,
/ 'VECT_3D' mean that one treats a field of vectors in dimension 3. This field of vectors can have 3 components (translation) or 6 components (translation and rotation).
/ 'TENS_2D' mean that one treats a field of symmetrical tensors in dimension 2,
/ 'TENS_3D' mean that one treats a field of symmetrical tensors in dimension 3,
/ 'COQUE_GENE' mean that one treats a field of quantities generalized in dimension 3 (deformations or efforts). This type is valid only for the reference mark 'HULL'.

See also the paragraph §4.1.

3.4 Simple keyword REFERENCE MARK

This keyword makes it possible to select a kind of reference mark among those listed below. To define the reference mark chosen, the keyword factor should be used AFFE.

- reference mark 'UTILISATEUR' : for the elements of continuous medium and elements of structure.
- reference mark 'CYLINDRIQUE' : for the elements of continuous medium.
- reference mark 'COQUE' : a reference mark user defines on the elements hull.
- reference mark 'COQUE_UTIL_INTR' : allows to pass from the reference mark user to the intrinsic reference mark on the elements • hull.
- reference mark 'COQUE_INTR_UTIL' : allows to pass from the intrinsic reference mark to the reference mark user on the elements • hull.
- Reference mark 'COQUE_UTIL_CYL' : allows to pass from the reference mark user on the elements hull to a cylindrical total reference mark.

Note:

- *If the user specified that the concept is D-entering (by the reserved word reuse), them only possible choices for the wordkey simple REFERENCE MARK are 'COQUE_UTIL_INTR' or 'COQUE_INTR_UTIL'. The fields where the transformation is relevant are transformed, while the other fields are kept in the state;*
- *For a hull, the reference mark being defined by element, change of reference mark 'HULL' applies only to the fields by element (cham_elem).*

The intrinsic reference mark is a reference mark specific to a finite element of plate or hull, where are carried out elementary calculations and which is used as intermediary with the reference mark user in which are expressed the deformation and stress fields. It is defined in the following way:

- For a triangle (*cf.* Figure 3.4-1) whose tops are numbered of s_1 with s_3 : it is the reference mark formed by $x=s_1s_2$, $y=z\wedge x$, $z=s_1s_2\wedge s_1s_3$
- For a quadrangle (*cf.* Figure 3.4-2) whose tops are numbered of s_1 with s_4 and whose mediums on the sides are numbered of m_1 (medium of s_1s_2) with m_4 (medium of s_4s_1): it is the reference mark formed by $x=m_4m_2$, $y=z\wedge x$, $z=m_4m_2\wedge m_1m_3$

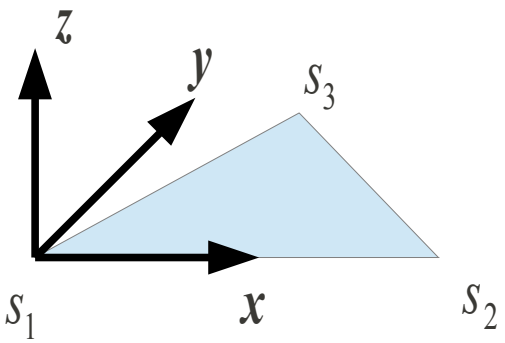

Figure 3.4-1: Intrinsic reference mark for a mesh of the type TRIA3

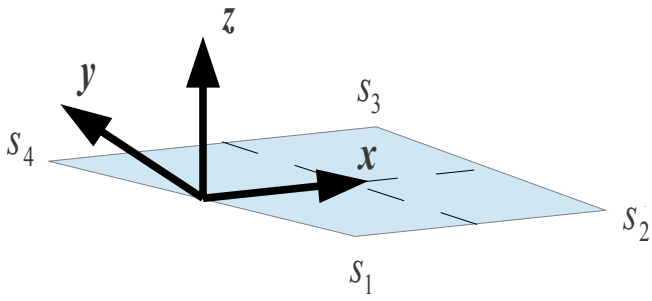

Figure 3.4-2: Intrinsic reference mark for a mesh of the type QUAD4

3.5 Keyword factor AFFE

This keyword factor defines the reference mark previously selected:

- reference mark 'UTILISATEUR' :
  - that is to say defined by the data of 3 nautical angles (in degrees),
    ANGL_NAUT = (alpha, beta, gamma)
  - maybe in 3D by data of 2 basic vectors with VECT_X and VECT_Y from which 3 nautical angles are built such as:

for alpha $\begin{cases} si\ VECT_X(1)=0\ alors\ alpha=0 \\ sinon\ alpha=\arctan(VECT_X(2)/VECT_X(1)) \end{cases}$

for beta $\begin{cases} si\ \sqrt{VECT_X(1)^2+VECT_X(2)^2}=0\ alors\ beta=0 \\ sinon\ beta=-\arctan(VECT_X(3)/\sqrt{VECT_X(1)^2+VECT_X(2)^2}) \end{cases}$

for gamma $\begin{cases} si\ VECT_Y(2)=0\ alors\ gamma=0 \\ sinon\ gamma=\arctan(VECT_Y(3)/VECT_Y(2)) \end{cases}$

- reference mark 'CYLINDRIQUE' or 'COQUE_UTIL_CYL' : defined by the data of the origin of the reference mark and the axis Oz

ORIGIN = (X, there, Z) coordinates of the origin O reference mark
AXE_Z = (oz1 , oz2 , oz3) coordinates of a vector defining the axis oz (axis of the cylinder).

This reference mark can be defined only once.

Note: in 2D, if AXE_Z is not well informed, one takes total axis Z.

- reference mark ' COQUE' : it is defined is by the data of two angles in degrees (keyword ANGL_ REFERENCE MARK) or using the keyword VECTOR. *Cf.* keyword HULL in AFFE_CARA_ELEM [U4.42.01].
  In the case ANGL_REFERENCE MARK, the angles are used to define the preceding vector which, project as regards the hull, will give the axis Ox new reference mark. Knowing the normal in any point with the hull, one from of easily deduced the new reference mark.

Note:
- One can define a variable reference mark by using several occurrences of the keyword AFFE and by giving for example nautical angles different on various groups from nodes or meshs. This possibility is • reserved for the changes of bearing reference mark on elements of continuous mediums ('USER' and 'CYLINDRICAL');
- For the changes of reference mark on elements of structure ('HULL' , 'COQUE_UTIL_INTR' , 'COQUE_INTR_UTIL' , 'COQUE_UTIL_CYL'), the reference mark cannot be variable, and only one occurrence of the keyword AFFE is authorized.

3.5.1 Operands ALL, GROUP_MA, GROUP_NO

Allow to apply to all the grid or to restrict the change of reference mark to certain meshs or certain nodes, or to define the reference mark in a different way on certain meshs or certain nodes.
Attention, for the fields by element, GROUP_NO beT prohibited.

3.6 Operand REFERENCE MARK

This operand is obligatory as soon as CHAM_GD is well informed. It makes it possible to change the reference mark of the field as starter. Currently only one possibility exists: passage of the total reference mark to the local reference mark of the element of hull REPERE=' GLOBAL_UTIL'. It is thus supposed that the field given under CHAM_GD is defined in the reference mark **total**.

3.7 Operand CARA_ELEM

This operand is obligatory as soon as CHAM_GD is well informed. It makes it possible to give the local reference mark of the elements of structure and thus to make the passage of the total reference mark of definition of the starting field in the local reference mark of the elements.

3.8 Operand INFORMATION

This operand makes it possible to display the structure of the concept result (resuout).

3.9 Operand TITLE

See [U4.03.01].

4 Notes of use

4.1 Definitions and precautions of use

A concept produced by MODI_REPERE does not have to be used any more then to do calculations, Code_Aster not memorizing the reference mark in which the fields appear. Only impressions or layouts are licit.

According to each type of field, it is necessary to specify well afterwards NOM_CMP the exact number of components and in the following order:

- in the case of vectors in dimension 2 or 3 (2 or 3 components): $X , Y , (Z)$,
- in the case of a tensor in dimension 2 (4 components): XX , YY , ZZ , XY ,
- in the case of a tensor in dimension 3 (6 components): $XX , YY , ZZ , XY , XZ , YZ$
- in the case of a quantity generalized in dimension 3 (8 components: two tensors in dimension 2, a vector in dimension 2): $XX , YY , XY , XX , YY , XY , X , Y$
- in the case of vectors in dimension 3 (6 components): $N , VY , VZ , MT , MFY , MFZ$,

Note:

- *When a node N grid is on the axis Oz (cylindrical reference mark), one seeks the average node of the geometrical centers of the meshs containing the node N for the calculation of the matrix of passage in cylindrical reference mark. If this average node is also on the axis Oz, calculation stops in fatal error.*
- *When all the components of a node are not present in the field to treat, one writes nothing in the field transformed for this node. This meets for example with the elements of modeling COQUE_3D for which the nodes located in the middle of the faces do not have a degree of freedom of translation. The field of displacement resulting from MODI_REPERE is thus not calculated for these nodes mediums of faces.*
- *This list of components is exhaustive. It is not licit to carry out a change of having reference mark on fields of other components. For example, a thermal field of deformation (of type EPVC_NOEUD) is certainly a tensor of dimension 3 but its components are not $XX , YY , ZZ , XY , XZ , YZ$ but $EPTHER\_L$, $EPTHER\_T$, $EPTHER\_N$, $EPSECH$, $EPHYDR$, $EPTOT$. These components not corresponding to a reference mark, that would not have a direction to change them of reference mark.*
- *In the case of VECT_3D with 6 components only fieldS EFGE_ELNO ET SIEF_ELNO are licitS.*

4.2 Cylindrical correspondences

For the expression of the constraints in cylindrical reference mark one makes the following correspondences (by simplification one notes $T = \theta$):

Constraints in Cartesian reference mark		Constraints in cylindrical reference mark
vector	X	R
	Y	Z
	Z	T
tensor	XX	RR
	YY	ZZ
	ZZ	TT
	XY	RZ
	XZ	RT
	YZ	ZT

5 Examples

5.1 Calculation of the constraints in cylindrical reference mark

```
RESU1=MODI_REPERE (
                RESULT      = RESU,
                NUME_ORDRE  = 1,
                MODI_CHAM      =  (
                   _F (  NOM_CHAM    = 'SIGM_ELNO',
                      NOM_CMP     = ('SIXX', 'SIYY', 'SIZZ', 'SIXY',),
                      TYPE_CHAM      = 'TENS_2D',),),
                REFERENCE MARK       = 'CYLINDRICAL',
                AFFE = _F (ORIGIN = (0.0, 0.0,0.0,),
                         AXE_Z    = (0.0, 0.0,1.0,),   ),
      )
```

5.2 Calculation of the constraints and efforts generalized on hulls in a variable reference mark defined by the user

```
RESU2=MODI_REPERE (
                RESULT      = RESU,
                NUME_ORDRE  = 1,
                MODI_CHAM      = (
                   _F (  NOM_CHAM = 'SIGM_ELNO',
                      NOM_CMP  = (   'SIXX', 'SIYY', 'SIZZ',
                                  'SIXY', 'SIXY', 'SIXY',),
                      TYPE_CHAM   = 'TENS_3D',),
                   _F (  NOM_CHAM = 'EFGE_ELNO',
                      NOM_CMP  = ('NXX', 'NYY', 'NXY',
                                  'MXX', 'MYY', 'MXY', 'QX', 'QY',),
                      TYPE_CHAM = 'COQUE_GENE',),
                ),
                REFERENCE MARK = 'HULL',
                AFFE = (
                   _F (ANGL_REP = (30.0, 30.0,),GROUP_MA= 'GRMA1 ',),
                   _F (ANGL_REP = (45.0, 45.0,), GROUP_MA=' GRMA2',),
                ),
      )
```