Macro order MACR_ASPIC_CALC

1 Goal

To carry out a preset calculation of healthy or fissured prickings, as well as the post - associated treatments. **Lengths of the grid produced by** MACR_ASPIC_MAIL **are in millimetres**, it is necessary to take of it account in the units of the characteristics material and the loading.

The principal stages of the macro order are:

- assignment of the models mechanical and thermal by the order AFFE_MODELE,
- assignment of materials by the order AFFE_MATERIAU,
- assignment of the characteristics of the discrete elements by the order AFFE_CARA_ELEM (worthless rigidities),
- definition of the boundary conditions of embedding of type beam with the connection 3D-beam by the order AFFE_CHAR_MECA,
- definition of the mechanical loading (pressure, basic effect, torque of effort, thermal deformation of origin) by the order AFFE_CHAR_MECA,
- definition of the thermal loading (temperature of fluid, coefficient of exchange) by the order AFFE_CHAR_THER_F,
- realization of linear thermal calculation and linear mechanical calculation or not linear by the orders THER_LINEAIRE and STAT_NON_LINE, then calculation of options by CALC_CHAMP,
- realization of the post treatment by the orders POST_RELEVE_T, or DEFI_FOND_FISS, CALC_THETA, CALC_G and POST_RCCM,
- impression of postprocessing by the orders IMPR_RESU and IMPR_TABLE.

2 Syntax

```
resu [evol_noli] = MACR_ASPIC_CALC      (

    ♦  TYPE_MAILLAGE=      /   'SAIN_FIN',                      [TXM]
                           /   'SAIN_GROS',                     [TXM]
                           /   'FISS_COUR_DEB',                 [TXM]
                           /   'FISS_COUR_NONDEB',              [TXM]
                           /   'FISS_LONG_DEB',                 [TXM]
                           /   'FISS_LONG_NONDEB',              [TXM]
                           /   'FISS_AXIS_DEB',                 [TXM]
                           /   'FISS_AXIS_NONDEB',              [TXM]

    ♦  PIPE       =_F (
                  ♦  TYPE   =  /   'TYPE_1',                    [TXM]
                               /   'TYPE_2',
                    ),

    ♦  GRID       =  nom_maillage,                          [grid]

    ◊  MODEL          = CO   ("modmec"),                        [TXM]

    ◊  CHAM_MATER     = CO   ("chmat"),                         [TXM]

    ◊  CARA_ELEM      = CO   ("carael"),                        [TXM]

    ◊  FOND_FISS_1    = CO   ("fonfiss1"),                      [TXM]

    ◊  FOND_FISS_2    = CO   ("fonfiss2"),                      [TXM]

    ◊  RESU_THER      = CO   ("resuth"),                        [TXM]

    ♦  AFFE_MATERIAU= _F ( ♦  /  ALL    =  'YES',
                           /  GROUP_MA  =  / 'TUBU',
                                           / 'BODY',
                                           / 'SOUD',
                                           / 'SOUDTUBU',
                                           / 'SOUDCORP',
                              ♦  MATER        =  material,       [to subdue]
                              ◊  TEMP_REF     =  / 0. ,          [DEFECT]
                                                 / tref ,        [R]
                              ♦  RCCM         =  / 'YES',        [TXM]
                                                 / 'NOT',
                         ),

    ♦  BALANCE        = _F ( ♦  NODE         =  / 'P1_CORPS',
                                                 / 'P2_CORPS',
                         ),

    ♦  PRES_REP       = _F ( ♦  NEAR         =  near,           [R]
                              ◊  NODE         =  / 'P1_CORPS',
                                                 / 'P2_CORPS',
                              ◊  EFFE_FOND    =  / 'YES',        [DEFECT]
                                                 / 'NOT',
                              ◊  PRES_LEVRE   =  / 'YES',
                                                 / 'NOT',        [DEFECT]
                              ◊  FONC_MULT    =  fmult1,      /  [function]
                                                              /  [formula]
                         ),

    ◊  EXCHANGE       = _F ( ♦  COEF_H_TUBU  =  htubu,       /  [function]
                                                              /  [formula]
```

```
                          ♦  COEF_H_CORP  =  hcorp,        /  [function]
                                                           /  [formula]
                          ♦  TEMP_EXT     =  chtex,        /  [function]
                                                           /  [formula]
                       ),

    ◊  TORS_CORP    =_F (  ♦   NODE        =  /  'P1_CORPS',
                                              /  'P2_CORPS',
                          ♦  |  FX          =  fx,              [R]
                             |  FY          =  fy,              [R]
                             |  FZ          =  fz,              [R]
                             |  MX          =  MX,              [R]
                             |  MY          =  my,              [R]
                             |  MZ          =  mz,              [R]
                          ◊  FONC_MULT    =  fmult2 ,      /  [function]
                                                           /  [formula]
                       ),

    ◊  TORS_TUBU    = _F (  ♦  |  FX          =  fx,              [R]
                             |  FY          =  fy,              [R]
                             |  FZ          =  fz,              [R]
                             |  MX          =  MX,              [R]
                             |  MY          =  my,              [R]
                             |  MZ          =  mz,              [R]
                          ◊  FONC_MULT    =  fmult3,       /  [function]
                                                           /  [formula]
                       ),

    ♦  BEHAVIOR  = _F (  ♦  RELATION     =  / 'ELAS',
                                            / 'ELAS_VMIS_TRAC',
                       ),

    ◊  THETA_3D     = _F (  ♦  R_INF        =  r_inf  ,         [R]
                          ♦  R_SUP        =  r_sup  ,         [R]
                       ),

    ◊  OPTION       =  /  'CALC_G_MAX',
                       /  'CALC_G_MAX_LOCAL',

# If OPTION = CALC_G_MAX or CALC_G_MAX_LOCAL
    ◊  TERMINALS       = _F (
                          ♦   NUME_ORDRE  =  num    ,         [I]
                          ♦   VALE_MIN    =  qmin   ,         [R]
                          ♦   VALE_MAX    =  qmax   ,         [R]
                       ),
# Finsi

    ◊  SOLVEUR      =  (see the document [U4.50.01])

    ◊  CONVERGENCE  =  (see the document [U4.51.03])

    ◊  NEWTON       =  (see the document [U4.51.03])

    ◊  RECH_LINEAIRE=  (see the document [U4.51.03])

    ♦  INCREMENT    =  (see the document [U4.51.03])

    ◊  ENERGY    = _F ()

    ◊  PAS_AZIMUT   =     /  1,                             [DEFECT]
                          /  not,                           [I]
```

```
    ◊  IMPRESSION    = _F ( ◊  /  FORMAT     =  /  'RESULT', [DEFECT]
                                                /  'ASTER',      [TXM]
                                                /  'CASTEM',     [TXM]
                                                /  'IDEAS',      [TXM]


# If FORMAT = 'IDEAS' or 'CASTEM'
          ◊  NOM_CHAM     =  | 'DEPL',                          [TXM]
                             | 'SIEQ_ELNO',
                             | 'TEMP',
          ◊  TOUT_ORDRE   =  'YES' ,                            [TXM]
          ◊  NUME_ORDRE   =  lordre ,                           [l_I]
          ◊  INST         =  linst  ,                           [l_R]
# Finsi


# If FORMAT = 'CASTEM'
                                  ◊  NIVE_GIBI =  / 3,
                                                  / 10   ,      [DEFECT]

# If FORMAT = 'IDEAS'
                                  ◊  VERSION   =  / 4,
                                                  / 5,          [DEFECT]
                        ),

    ◊  TITLE        =  nom_titre                                [l_Kn]

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

3 Operands

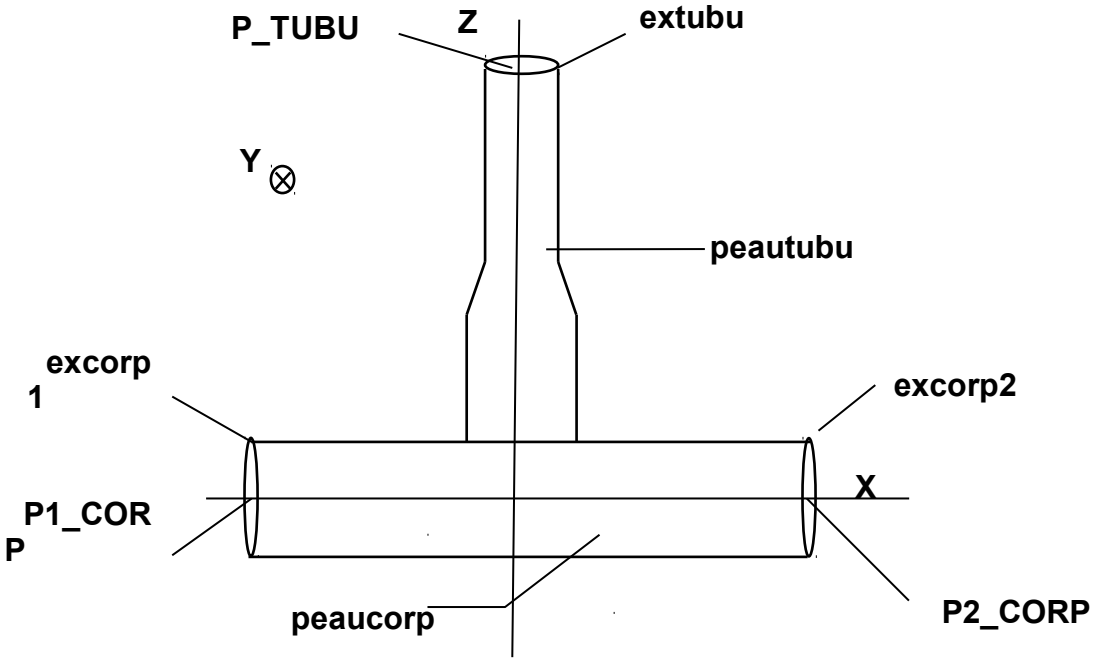

Figure 3-a: Grid obtained

One notes:

- peautubu : the skin interns pipe,
- peaucorp : the skin interns body,
- excorp1 : the extreme section of the body, located at the dimension X = - Xmax,
- excorp2 : the extreme section of the body, located at the dimension X = +Xmax,
- P1_CORP : the node located at the center of excorp1,
- P2_CORP : the node located at the center of excorp2,
- extubu : the extreme section of the pipe, located at the dimension Z = Zmax,
- P_TUBU : the node located at the center of extubu.

Notice 3-1:

Groups of meshs TUBU , BODY and SOUD are present only in the case of healthy pricking. They are replaced by TUBU and SOUDCORP or by SOUDTUBU and BODY, according to the type of welding (1 or 2) and the position of the crack (right or tilted) (see [§3.11.1]).

3.1 Keyword TYPE_MAILLAGE

♦ TYPE_MAILLAGE =

/ 'SAIN_GROS'	calculation is carried out on a healthy pricking built with the option RAFF_MAIL = 'LARGE' in MACR_ASPIC_MAIL.
/ 'SAIN_FIN'	calculation is carried out on a healthy pricking built with the option RAFF_MAIL = 'FINE' in MACR_ASPIC_MAIL.
/ 'FISS_COUR_DEB'	calculation is carried out on a pricking fissured (breaking process) with an emerging short crack.
/ 'FISS_COUR_NONDEB'	calculation is carried out on a pricking fissured (breaking process) with a short crack not emerging.
/ 'FISS_LONG_DEB'	calculation is carried out on a pricking fissured (breaking process) with an emerging long crack.
/ 'FISS_LONG_NONDEB'	calculation is carried out on a pricking fissured (breaking process) with a long crack not emerging.
/ 'FISS_AXIS_DEB'	calculation is carried out on a pricking fissured (breaking process) with an emerging axisymmetric crack.
/ 'FISS_AXIS_NONDEB'	calculation is carried out on a pricking fissured (breaking process) with an axisymmetric crack not emerging.

Information already given by the user in the macro-order of grid MACR_ASPIC_MAIL must be repeated here to determine the type of calculation and postprocessing to be made.

The table below recapitulates the configuration of the bottom of crack, and the treatment carried out for each position of crack in the square, in the case of a pricking with crack.

One will refer to the note of use of the operators of breaking process [U2.05.01] or to the various reference documents [R7.02.01; R7.02.03; R7.02.04; R7.02.05; R7.02.07] for more detail on calculation of the G-room.

Emerging cracks or not	Type fissures	Configuration melts of crack	Calculation of G_Local
Cracks emerging	short	**one** bottom of crack **not closed**	Legendre-Legendre
	long	**one** bottom of crack **not closed**	Legendre-Legendre
	axisymmetric	**one** bottom of crack **closed**	Lagrange-Lagrange
Cracks not emerging	short	**one** bottom of crack **closed**	Lagrange-Lagrange
	long	**two** funds of crack **not closed**	Legendre-Legendre
	axisymmetric	**two** funds of crack **closed**	Lagrange-Lagrange

Table 3.1-1: Various configurations of the bottom of crack

Notice 3-2:

As soon as a crack is defined in the model, a checking of the interpenetration of the lips is carried out for all the steps of time. If an interpenetration is detected, a message of alarm is transmitted to announce it. It is pointed out that the contact is not taken into account in calculation. rate of

refund of energy G is thus positive including where the crack tends to be closed, which can lead to results too much penalizing.

Notice 3-3:

In the case of long cracks not emerging, two funds of crack are netted because the connection at each end is not with a grid.

For healthy prickings, one calculates in postprocessing the constraints according to the modes of opening IF, software firm and SIII:

	IF	Software firm	SIII
standard welding 1 right interface (cylindrical reference mark)	siXX	siXY	siXZ
standard welding 1 tilted interface (local reference mark)	siYY	siXY	– siYZ
standard welding 2 right interface (local reference mark)	siYY	siXY	– siYZ
standard welding 2 tilted interface (local reference mark)	siYY	siXY	– siYZ

Table 3.1-2: Constraints according to the modes of opening

Notice 3-4:

The sign – obtained on SIII in the local reference mark is explained by the difference between the local reference mark chosen by the SEPTEN and that of Code_Aster.

3.2 Keyword factor PIPE

♦ PIPE = / 'TYPE_1', [DEFECT]
/ 'TYPE_2', [TXM]

Point out the type of welding defined in MACR_ASPIC_MAIL to define the reference marks of examination of postprocessings.

3.3 Keyword GRID

♦ GRID = grid

Here the grid used is specified. This grid is resulting from MACR_ASPIC_MAIL.

3.4 Keyword MODEL

◊ MODEL = CO ("modmec")

This keyword makes it possible to possibly name the mechanical model in order to re-use it, for example to do another calculation (not using MACR_ASPIC_CALC) or of postprocessing.

3.5 Keyword CHAM_MATER

◊ CHAM_MATER = CO ("chmat")

This keyword makes it possible to possibly name the field material corresponding to the mechanical model in order to re-use it, for example to do another calculation (not using MACR_ASPIC_CALC) or of postprocessing.

If it is about a thermomechanical calculation, the field of temperature calculated is associated with the field material (variable of order, cf [U4.43.03]). Thermal dilation due to the field of temperature is thus taken into account if one re-uses in another calculation this field material.

3.6 Keyword CARA_ELEM

◊ CARA_ELEM = CO ("carael")

This keyword makes it possible to possibly name the concept of the type cara_elem (order AFFE_CARA_ELEM) in order to re-use it, for example to do another calculation (not using MACR_ASPIC_CALC).

3.7 Keyword FOND_FISS_1

◊ FOND_FISS1 = CO ("fonfiss1")

This keyword makes it possible to possibly name the concept fond_fiss (order DEFI_FOND_FISS) in order to re-use it, for example to do another calculation (not using MACR_ASPIC_CALC) or of postprocessing.

3.8 Keyword FOND_FISS_2

◊ FOND_FISS2 = CO ("fonfiss2")

This keyword makes it possible to possibly name the concept fond_fiss (order DEFI_FOND_FISS) in order to re-use it, for example to do another calculation (not using MACR_ASPIC_CALC) or of postprocessing. One uses it if the crack comprises two funds of crack, (see [§3.1]).

3.9 Keyword RESU_THER

◊ RESU_THER = CO ("resuth")

This keyword makes it possible to possibly name the result of thermal calculation, for example to do another calculation (not using MACR_ASPIC_CALC) or of postprocessing.

3.10 Keyword factor AFFE_MATERIAU

♦ AFFE_MATERIAU = F (

Keyword factor allowing to affect various materials on parts of the grid.

3.10.1 Operands ALL, GROUP_MA

♦
```
/ ALL = 'YES' ,
/ GROUP_MA = / 'TUBU' ,
             / 'BODY' ,
             / 'SOUD' ,
             / 'SOUDTUBU' ,
             / 'SOUDCORP' ,
```

These keywords make it possible to affect material on all the meshs of the grid (ALL), or on part of the grid (GROUP_MA).

For 'healthy' prickings, one can affect:
'TUBU' : the pipe,
'BODY' : the body,
'SOUD' : the welding.

For prickings with right crack if the welding is of type 1 or with tilted crack if the welding is of type 2, one can affect:
'TUBU' : the pipe,
'SOUDCORP' : the unit welding - body.

For prickings with tilted crack if the welding is of type 1 or with right crack if the welding is of type 2, one can affect:
'BODY' : the body,
'SOUDTUBU' : the unit welding - pipe.

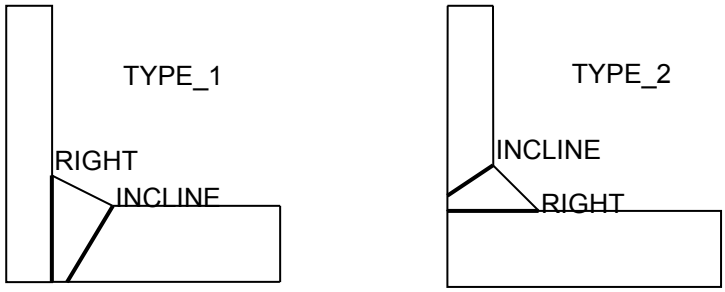

Figure 3.11.1-a: Definition of the position of a crack according to the type of the welding

3.10.2 Operand MATER

♦ MATER

Name of the material which one wants to affect.

3.10.3 Operand RCCM

♦
```
RCCM = / 'YES',
       / 'NOT',
```

Is used to specify if one wants to make a postprocessing of the type POST_RCCM. **Caution** if the characteristics material necessary to POST_RCCM are not defined in an order DEFI_MATERIAU precedent MACR_ASPIC_CALC (keywords factor RCCM or RCCM_FO,) calculation will stop in **FATAL ERROR** at the time of carrying out POST_RCCM.

3.10.4 Operand TEMP_REF

◊ TEMP_REF

Temperature of reference for which there is no thermal deformation (cf orders AFFE_MATERIAU).

3.11 Keyword factor BALANCE

♦ BALANCE

One defines an embedding of type beam in the one of the two ends (P1_CORP or P2_CORP). The 6 degrees of freedom of the discrete point are thus blocked.

Note:

There exists a connection 3D-beam between the discrete nodes P1_CORP , P2_CORP and P_TUBU and respectively excorp1 , excorp2 and extubu who are the sections ends of the body and the pipe.

3.11.1 Operand NODE

♦ NODE = / 'P1_CORPS',
/ 'P2_CORPS',

Node of application of embedding.

3.12 Keyword factor PRES_REP

3.12.1 Operands NEAR

♦ NEAR = near

One indicates here the value of the pressure which applies to the internal skin.

3.12.2 Operands NODE / EFFE_FOND

◊ NOEUD= / 'P1_CORPS',
/ 'P2_CORPS',

Determine the face of application of the basic effect on the body.
An operand is obligatory in the event of taking into account of the basic effect.

Note:

If balance is applied to the node P1_CORP then the basic effect will be applied to the face associated with P2_CORP , and reciprocally. The macro-order checks that the position chosen for balance is different from the position of the basic effect on the body.

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

Indicator of taking into account of the basic effect.

The basic effect is applied to the face associated with the node P_TUBU and with the one of the two faces ends of the body (partner to the node P1_CORP or P2_CORP). It is calculated in an automatic way according to the pressure exerted on the internal wall, according to the formula and is applied below with PRES_REP.

$$Tfond = pres * \frac{R_i^2}{R_e^2 - R_i^2}$$

Note:

For the pipe, one will take the rays corresponding to the part located at the top of the chamfer.

3.12.3 Operand PRES_LEVRE

◊ PRES_LEVRE

Allows to activate or not the application of the pressure, evoked with [§3.13.1] of this document, on the lips of the crack when this one emerges in internal skin. By default PRES_LEVRE is worth 'NOT'.
Caution not to use PRES_LEVRE = 'YES' that for the cracks which emerge in internal skin.

3.12.4 Operand FONC_MULT

◊ FONC_MULT = fmult1

Multiplying function of the time of the loading of pressure. By default: fmult1 = 1.

3.13 Keyword factor EXCHANGE

◊ EXCHANGE = F (

This keyword factor makes it possible to apply conditions of exchange to the internal skin of pricking (cf orders AFFE_CHAR_THER_F) and to carry out a linear thermal calculation (with THER_LINEAIRE) precondition to mechanical calculation. For thermics, one uses the solvor by default, the value of parm_theta by default and the initial temperature temp_init is calculated starting from a stationary calculation and is worth the temperature of the fluid at the initial moment (TEMP_EXT).

3.13.1 Operands COEF_H_TUBU and COEF_H_CORP

♦ COEF_H_TUBU = htubu,
♦ COEF_H_CORP = hcorp,

Value of the coefficient of exchange on the skin interns pipe (PEAUTUBU) and of the body (PEAUCORP), given in the form of function.

3.13.2 Operand TEMP_EXT

♦ TEMP_EXT = chtex

Value of the temperature of the fluid inside pricking, data in the form of function.

3.14 Keyword factor TORS_CORP

◊ TORS_CORP

This keyword is used to take into account the torque of efforts on the body.

3.14.1 Operand NODE

♦ NODE = / 'P1_CORPS',
/ 'P2_CORPS',

The position of the torque here is indicated. If balance is given for P1_CORP (keyword BALANCE) then the torque will be applied to P2_CORP. The macro-order checks that the position chosen for balance is different from the position of the torque of effort on the body.

3.14.2 Operands FX, FY, FZ, MX, MY, MZ

♦ | FX = fx , [R]
| FY = fy , [R]
| FZ = fz , [R]
| MX = MX , [R]
| MY = my , [R]
| MZ = mz , [R]

The torque of efforts here is informed. The components must be provided in the reference mark of the grid. At least one of the components must be indicated.

3.14.3 Operand FONC_MULT

◊ FONC_MULT = fmult2

Multiplying function of the time of the loading TORS_CORP. By default: fmult2 = 1.

3.15 Keyword factor TORS_TUBU

◊ TORS_TUBU

This keyword is used to take into account the torque of effort on the pipe. It is applied at the end of the pipe to the node P_TUBU.

3.15.1 Operands FX, FY, FZ, MX, MY, MZ

♦ | FX = fx , [R]
| FY = fy , [R]
| FZ = fz , [R]
| MX = MX , [R]
| MY = my , [R]
| MZ = mz , [R]

The torque of efforts here is informed. The components must be provided in the reference mark of the grid. At least one of the components must be indicated.

3.15.2 Operand FONC_MULT

◊ FONC_MULT = fmult3

Multiplying function of the time of the loading TORS_TUBU. By default: fmult3 = 1.

3.16 Keyword factor BEHAVIOR

♦ RELATION =

Type of elastic relation of behavior used to carry out mechanical calculation with STAT_NON_LINE :

/ 'ELAS' Linear elastic behavior.
/ 'ELAS_VMIS_TRAC' Nonlinear elastic behavior of Von Mises with nonlinear isotropic work hardening.

3.17 Operand THETA_3D

◊ THETA_3D

For postprocessing in breaking process, this keyword defines the rays of the crowns surrounding the bottom of crack and used in the method theta. This keyword is répétable as many times as one wants. The choice of several couples of rays makes it possible to check the stability of the method.

The contact is not taken into account in calculation, but a message of alarm is transmitted if the two lips of the crack interpenetrate. In this case, the rate of refund of energy G will remain positive including where the crack tends to be closed, which can lead to results too much penalizing.

3.17.1 Operands R_INF/R_SUP

◊ R_INF= r_inf [R8]
◊ R_SUP= r_sup [R8]

r_inf and r_sup are respectively the lower and higher rays crowns defining the field theta, cf [U4.82.03].

3.18 Operand OPTION

◊ OPTION = / 'CALC_G_MAX' ,
/ 'CALC_G_MAX_LOCAL' ,

This option relates to only the maximization of G (total or local) under constraints terminals [R7.02.01]. One then needs also fournir the value of the constraints terminals behind the keyword factor TERMINALS. Attention, this option does not make it possible to distinguish the loadings leading to an opening or a closing from the crack.
The fields theta and G (S) are defined with a smoothing of Type Lagrange (cf [U4.82.03]).

3.19 Keyword factor TERMINALS

◊ TERMINALS =_F (
♦ NUME_ORDRE = num , [I]
♦ VALE_MIN = qmin , [R]
♦ VALE_MAX = qmax , [R]
)

This keyword factor is obligatory if the option is used 'CALC_G_MAX' or the option 'CALC_G_MAX_LOCAL'. The syntax of this keyword is described in the document [U4.82.03], with in particular an example of maximization of G in the presence of signed and not signed constraints.

3.20 Operand SOLVEUR

One defines the solvor retained for mechanical calculation. The syntax of this keyword is described in the document [U4.50.01]. It is used only for mechanical calculation.

3.21 Operand CONVERGENCE

Specify the convergence criteria of mechanical calculation. The syntax of this keyword is described in the document [U4.51.03]. It is used only for mechanical calculation.

3.22 Operand NEWTON

Specify the characteristics of the method of resolution of the nonlinear incremental mechanical problem. The syntax of this keyword is described in the document [U4.51.03]. It is used only for mechanical calculation.

3.23 Operand RECH_LINEAIRE

Specify the linear mode of research of the solvor. The syntax of this keyword is described in the document [U4.51.03]. It is used only for mechanical calculation.

3.24 Operand INCREMENT

Defines the time intervals taken in the incremental method during a linear or mechanical calculation thermal nonlinear. The steps of times used for calculations thermics and mechanics are identical. The syntax of this keyword is described in the document [U4.51.03].

3.25 Keyword ENERGY

This keyword makes it possible to activate the calculation of the assessment of energy and its posting during mechanical calculation (see the document [R4.09.01]). This assessment is stored in the table of name PARA_CALC from where it can be extracted using the order RECU_TABLE [U4.71.02].

3.26 Keyword PAS_AZIMUT

```
◊  PAS_AZIMUT       =  /  1   ,                          [DEFECT]
                       /  not ,                          [I]
```

This keyword allows to limit the examinations in the case of healthy prickings.
In the case of the refinement of coarse/fine grid: one strips by default on 40 azimuts/48 azimuths with the 2 interfaces right-hand side and tilted.

3.27 Operand IMPRESSION

```
◊  IMPRESSION   =_F (  ◊  /  FORMAT =  /  'RESULT'  ,  [DEFECT]
                                      /  'ASTER'    ,  [TXM]
                                      /  'CASTEM'   ,  [TXM]
                                      /  'IDEAS'    ,  [TXM]

# If FORMAT = 'IDEAS' or 'CASTEM'
          ◊  NOM_CHAM     =  | 'DEPL'          ,          [TXM]
                             | 'SIEQ_ELNO',
                             | 'TEMP'          ,
          ◊  TOUT_ORDRE   =  'YES'  ,                      [TXM]
          ◊  NUME_ORDRE   =  lordre ,                      [l_I]
          ◊  INST         =  linst  ,                      [l_R]
# Finsi

# If FORMAT = 'CASTEM'
                                ◊  NIVE_GIBI =  / 3,
                                                / 10,      [DEFECT]

# If FORMAT = 'IDEAS'
                                ◊  VERSION   =  / 4,
                                                / 5,       [DEFECT]
                          )
```

Allows to define a format for the impression of the results, 'RESULT', 'ASTER', 'CASTEM' or 'IDEAS', (see the user's documentation of the order IMPR_RESU).

Note:

In the cases of a fissured or healthy grid, following postprocessings are carried out:

1/ Fissured grid

- Impression in the file RESULT of the field of temperature in bottom of crack for each step of calculated time, (if it were calculated and if there is only one bottom of crack, cf [§ 3.1]);
- Impression in the file RESULT of the table of the total rate of refund of energy in bottom of crack (option CALC_G_GLOB of CALC_G) and, if asked, of the maximum rate of refund of energy under constraints terminals;
- Impression, at the request of the user, format CASTEM or IDEAS of the grid and the following fields:

'DEPL'
'SIEQ_ELNO'
'TEMP'

2/ Healthy grid

- Impression in the file RESULT of the principal stress fields IF, software firm, SIII (SIEQ_ELNO) for all the steps of time and all the lines of examination requested by the user;
- Impression in the file RESULT of the field of temperature (if it were calculated) for all the steps of time and all the lines of examination requested by the user;
- Impression in the file RESULT of the stress fields Pm and Pm+Pb (POST_RCCM) for all the lines of examination requested by the user;
- Impression in the file RESULT of the parameters characterizing the distribution of temperature (if it were calculated) in the thickness of the ligament for all the steps of time and all the lines of examination requested by the user (POST_RELEVE_T, OPERATION = 'AVERAGE').

3.28 Operand TITLE

Title of the structure of data result [U4.03.01].

3.29 Operand INFORMATION

◊ INFORMATION =

Indicate the level of impression of the results of the operator:

1: no impression,
2: impression of relative information to the grid.

To have the detail of the operators called by the macro-order in the file message, it is necessary to specify IMPR_MACRO=' OUI' in the order BEGINNING.

4 Examples

Besides the example of thermomechanical calculation elastic describes here, one will be able to consult the command files (file .comm) cases tests. The latter are in the /aster/STA9/astest repertoire and bear the names aspic*.

```
RESU=MACR_ASPIC_CALC (TYPE_MAILLAGE=' FISS_AXIS_DEB',
                      TUBULURE=_F (TYPE=' TYPE_1',),
                      MAILLAGE=MA,
                      MODELE=CO ("MOMEC"),
                      CHAM_MATER=CO ("CHMAT"),
                      CARA_ELEM=CO ("CARAEL"),
                      FOND_FISS_1=CO ("FD_FISS"),
                      CHARGE=CO ("CHMETH"),
                      RESU_THER=CO ("RESUTH"),
                      AFFE_MATERIAU=_F (TOUT=' OUI',
                                        MATER=TU42C,
                                        RCCM=' NON',
                                        TEMP_REF=220.0,),
                      EQUILIBRE=_F (NOEUD=' P1_CORPS',),
                      PRES_REP=_F (PRES=7.45,
                                   NOEUD=' P2_CORPS',
                                   EFFE_FOND=' OUI',),
                      ECHANGE=_F (COEF_H_TUBU=COEFHTUB,
                                  COEF_H_CORP=COEFHCOR,
                                  TEMP_EXT=VARTEMP,),
                      TORS_CORP=_F (NOEUD=' P2_CORPS',
                                    FX=-1789.0,
                                    FY=120.0,
                                    FZ=480.0,
                                    MX=-7.3E5,
                                    MY=7.01E5,
                                    MZ=3.25E5,
                                    FONC_MULT=VARP,),
                      TORS_TUBU=_F (FX=3.5450E4,
                                    FY=5984.0,
                                    FZ=-9496.0,
                                    MX=8.985E6,
                                    MY=-2.3797E7,
                                    MZ=-1.699E7,
                                    FONC_MULT=VARP,),
                      COMPORTEMENT=_F (RELATION=' ELAS',),
                      THETA_3D= (_F (R_INF=0.2,
                                     R_SUP=1.0,),
                                 _F (R_INF=0.5,
                                     R_SUP=1.5,),),
                      NEWTON=_F (REAC_INCR=50,
                                 MATRICE=' ELASTIQUE',
                                 REAC_ITER=10,),
                      INCREMENT=_F (LIST_INST=LISTE,),
                      IMPRESSION=_F (FORMAT = 'CASTEM',
                                     NOM_CHAM = ('DEPL', 'SIEQ_ELNO',
                                                 'TEMP'),
                                     INST = (1.0, 20.0),),)
```