POST_T_Q Operator

1 Goalkeeper

To compute Tstress in 2D and 3D models.

This operator allows computation of T-stress in 2D (modelling 'D_PLAN', 'C_PLAN' and 'AXIS') and 3D ('3D') by extrapolation of displacement one the ace lips, cf [R7.02.08]. This method is appropriate only for homogeneous and isotropic materials.

This operator is only available for has meshed plane ace (method FEM).

Product has concept of standard table_sd_aster .

2 Syntax

```
tk [table_sdaster] = POST_T_Q (

      ♦ MODELING =        / '3D',
                          / 'AXIS',
                          / 'D_PLAN',
                          / 'C_PLAN',

      ♦   RESULTAT=         =  resu,                  /  [evol_elas]
                                                      /  [evol_noli]
                                                      /  [mode_meca]

       ◊  NB_NOEUD_COUPE   =/  5 ,
                           /  NR,                        [I]

# 1) FOND_FISS is indicated for ace
       ♦ /  FOND_FISS       =found ,                     [fond_fiss]

      ◊  ABSC_CURV_MAXI     =dmax,                       [R]

      ◊  /   ALL           = 'YES',
            |GROUP_NO      = gr_noeu,                  [l_gr_noeud]
            |SANS_GROUP_NO = gr_noeu,                  [l_gr_noeud]

      # Yew modelization is 3D
      ♦  TYPE_MAILLAGE     =   / 'FREE',
                               / 'RULE',             [DEFECT]

       ◊  EVOL_THER             = evol ,                              [
evol_ther ]

# 2) FISOUR is indicated for ace

      ♦  /  CRACK       =f ound ,                       [fond_fiss]

      ◊  ABSC_CURV_MAXI     =dmax,                      [R]
      ◊  NUME_FOND          =  /digital,                   [R]
                               /1.
      ◊  NB_POINT_FOND      =  /nbpoint,                [I]

 # Common options

      ♦ MATER= chechmate,
   [material]

      ◊   PREC_VIS_A_VIS    =/  1.E-1,                  [DEFECT]
                            /  epsi,

      ◊  /  TOUT_ORDRE      =  'YES',
         /   NUME_ORDRE     =  lnuor,                   [L_I]
         /  LISTE_ORDRE     =  lnuor,                   [listis]

         /  TOUT_MODE       =  'YES',
         /  NUME_ORDRE      =  lnuor,                  [L_I]
         /  LISTE_MODE      =  lnuor,                   [listis]
```

```
                / FREQ            =  l_freq,                    [l_R]
               /  LISTE_FREQ      =  l_freq,                   [listr8]
                  ◊  CRITERE      =  /  'RELATIVE',            [DEFECT]
                                     ◊   PRECISION =prec,
                                                   / 1.E-6 ,   [DEFECT]
                                     /   'ABSOLUTE',
                                      ♦  PRECISION =prec        [R]
                / INST            =  [l_R]                     [l_R]
               /  LIST_INST       =  [l_R]                    [listr8]
                  ◊  CRITERE      =  /  'RELATIVE',            [DEFECT]
                                     ◊   PRECISION =prec,
                                                   / 1.E-6 ,   [DEFECT]
                                     /   'ABSOLUTE',
                                      ♦  PRECISION =prec        [R]

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

3 Keywords

3.1 Keyword MODELING

```
♦ MODELING =        / '3D',
                      / 'AXIS',
                      / 'D_PLAN',
                      / 'C_PLAN',
```

This option has llows defin I tion of the computation type in 2 D gold 3 D. Th E mode L option must coherent Be with the model used for the computation of displacements.

3.2 Keyword MATER

```
♦ MATER = chechmate,                                    [material]
```

The material definition containS the elastic characteristics of the material. It must Be homogeneous, isotropic and linear elastic. This material must Be **constant** (compulsory uses of DEFI_MATERIAU/ELAS). The only tolerated variability is has dependence one **temperature** . Yew material properties depends one temperature (keyword ELAS_FO of DEFI_MATERIAU), the approch is different according to the standard of modelization:

• IF EVOL_THER keyword is not given, then the characteristic materials are obtained with reference temperature TEMP_DEF_ALPHA of DEFI_MATERIAU ;

• IF EVOL_THER operator is indicated, then the characteristic materials are calculated from the temperature of the ace tip nodes.

3.3 Keyword FOND_FISS

```
◊   FOND_FISS=fond,                              [fond_fiss]
```

It correspond to computation of has meshed ace, defined for post-processing with operator DEFI_FOND_FISS . By defect, this is computed automatically for all the nodes of the ace tip.

3.4 Keywords PREC_VIS_A_VIS/GROUP_NO/SANS_GROUP_NO/ALL

```
◊  PREC_VIS_A_VIS          =  /  1.D-1,     [DEFECT]
                              /  epsi,      [R]
◊  /  ALL              =  'YES',
      □  GROUP_NO      =  gr_noeu,      [l_gr_noeud]
       □  SANS_GROUP_NO  =  gr_noeu,      [l_gr_noeud]
```

FOND_FISS keyword makes it possible to input has fond_fiss object (created by the command DEFI_FOND_FISS) in which the necessary information are stored with the automatic search of the nodes of the two lips located one segments normal to the ace tip. It must Be noted that the object fond_fiss must Be necessarily defined such ace the lips of ace are initially stuck (CONFIGURATION_INIT=' COLLEE' in DEFI_FOND_FISS [U4.82.01]).

In 3D, by defect, the computation of T-stress is calculated one the nodes tips. The to use has the following options:

- to select nap nodes of ace tipS (keyword GROUP_NO);
- to exclude nap nodes of the ace tip (keyword SANS_GROUP_NO);
- to compute one all the nodes of the ace tip (keyword ALL).

◊ ABSC_CURV_MAXI = dmax [R]

has maximum distance for computation of T-stress starting from the ace tip. In practice, the accuracy of the results is less accurate IF it is located very far from the ace tip [R7.02.08]. It is thus advised to choose $dmax$ the smallest possible ace (about 4 to 5 elements, gold about the radius of the radiant mesh, yew necessary). Yew in does not have N of the ace tip, this distance is higher than the distance from the ace tip At this not At the edge of the lips, the been worth of T-stress At not N constant are obtained by prolongation. The selected been worth is the not of the ace tip nearest and for which the computation will Be out carried.

WithBSC_CURV_MAXI Operator is optional. When this option is not indicated, the been worth of ABSC_CURV_MAXI automatically computed is starting from the maximum size h of the meshes connected to the nodes of the ace tip. Thesis size of meshes in each node of the bottom are computed in the DEFI_FOND_FISS command and present are in the concept fond_fiss [D4.10.01]. It was chosen to take ABSC_CURV_MAXI equal to $4h$.

Yew one chooses the been worth automatically calculated for ABSC_CURV_MAXI which is advisable, however, needs to make sour that its been worth (displayed in the file .mess) is coherent with dimensions of the structure.

In automatic search for each node of the ace tip, the operator select the nodes with the following conditions:

- distance R compared to the ace tip: R < ABSC_CURV_MAXI,
- Distance L compared to its opposite one the other lip:
  L < epsi.ABSC_CURV_MAXI,
- and in 3D outdistances D from has node of the lips to the line perpendicular to the ace tip: D < epsi_fond. d , where d is the minimal outdistances between two successive nodes of the ace tip, and where epsi is the been worth of the provided accuracy (keyword PREC_VIS_A_VIS) and epsi_fond the been worth of the accuracy provided in keyword PREC_NORM of DEFI_FOND_FISS.

By defect epsi is equal to 0.1 . Increasing the been worth of PREC_VIS_A_VIS (and/or PREC_NORM in DEFI_FOND_FISS) is equivalent to increase the number of potential nodes selected for the computation.

3.5 Keyword RESULT

♦ RESULT = resu,

resu has standard concept of evol_elas however evol_noli containing the displacement field one all the model.

3.6 Keyword TYPE_MAILLAGE

♦ TYPE_MAILLAGE = / 'FREE',
/ 'RULE', [DEFECT]

Judicious This keyword makes only in 3D for meshed aces defined by FOND_FISS. The Principle of computation is then ace follows:

1. determination of the normal directions At the ace face for each node localized At the ace face,
2. definition one each one of thesis directions of NB_NOEUD_COUPE points equally DistributeD between the ace face and the distance ABSC_CURV_MAXI,

3. projection of the displacement of each lip one thesis nodes.

3.7 Keyword NB_NOEUD_COUPE

◊ NB_NOEUD_COUPE= / 5, [DEFECT]
/ NR, [I]

Possible It makes it to define the number of nodes corresponding to the projection of the lips displacement one each normal direction. The projection of nodes is equal to distribute between the ace tip and distance ABSC_CURV_MAXI.

3.8 Keywords LIST_INST, INST , FREQ, LIST_FREQ, TOUT_ORDRE, NUME_ORDRE, LIST_ORDRE, TOUT_MODE, NUME_MODE, LIST_MODE

For specific information, refer to [U4.71.00].

3.9 Keyword INFORMATION

◊ INFORMATION = / 1, [DEFECT]
/ 2,

Level of messages in the message slips by: yew INFORMATION is equal to 2, one gives the list of all the computed been worth for all the nodes that cuts been treated.

3.10 Keyword TITR E

◊ TITRE = tit,

Title to name the result.

4 Precautions and uses advices

4.1 Assumptions relating to the materials used for the computation of displacements

For computation of T-stress by displacement extrapolation method the material needs to Be homogeneous and isotropic linear elastic.

This material edge Be **constant** (of uses DEFI_MATERIAU/ELAS) however **function** (of uses DEFI_MATERIAU/ELAS_FO). Only the command variables being whitebait to Be used for the computation of T-stress in the box of has material function are **"TEMP"** (temperature). These variable must Be affected (necessarily in AFFE_MATERIAU/AFFE_VARC) starting from nodal fields (cham_no).

In the box of has material function, the elastic parameters are evaluated At the points of the ace tip. Thesis points are the nodes of the ace tip.

4.2 Count produced

Command POST_T_Q produces concept has of type table_sd_aster. The counts edge Be printed by IMPR_TABLE [U4.91.03]. It contains for each node of the ace tip the been worth of T-stress: T .

4.3 Additional printings

Yew INFORMATION is equal to 2, all intermediate computations are displayed in the message slips by. It is announced that column entitled SAUT_DX (resp. SAUT_DY and SAUT_DZ) in the arrayS displayed in the message spins corresponDing to the displacement step allong axis X1 (resp. X2 and X3), multiplied by has material coefficient, all squared [R7.02.08].

4.4 Precautions and advice

The assumptions necessary to the validity of this method are:

1) the ace must Be sufficiently regular (either the ace and the lips must not present has geometric singularity);
2) the material behavior must Be elastic, linear, homogeneous and isotropic;
3) the structure must Be isothermal (but, the temperature gradients one the lips should Be negligable in the area of interpolation).

Computation of interpolation displacement requires having At least 6 nodes one the normal direction of ace tip. Yew the number of nodes is not sufficient, year alarm is emitted and the lines corresponding to this node of the bottom are set to 0 in the result table. Then the Computation continuous, yew necessary, for the node of the ace tip. IN this box one of the following messages are seen:

- either increase the curvilinear maximum X-coordinate ABSC_CURV_MAXI in order to compute nodes further away from the ace tip;
- either Increase the parameter PREC_VIS_A_VIS (and possibly PREC_NORM in DEFI_FOND_FISS), which IS less complicated in the selection of nodes for the computation.

Computations are inefficient in time and memory yew there are too many points one the ace tip. The uses of Key Word NB_POINT_FOND makes it possible to limit the post-processing to has some number of points equal ly distribute D along the ace face (for example twenty points is often sufficient).

5 Example

Circular ace in 3D cubic bodystocking subject to pure tension is presented (testbox SSLV324). Young stag to cal POST_T_Q we need to uses:

```
TABT= POST_T_Q (MODELISATION=' 3D',
                RESULTAT=CHAMDEPL,
                FOND_FISS=FISS,
                MATER=MAT,
                 NFO=2,
                TYPE_MAILLAGE=' LIBRE',
                NB_NOEUD_COUPE=18,
          )
```