Macro-command CALC_EUROPLEXUS

1 Drank

This operator makes it possible to control the execution of a Europlexus study since a command file *Code_Aster*.

Macro-command CALC_EUROPLEXUS makes it possible to define and carry out a Europlexus study while remaining entirely in the environment Aster. The resolution is done in background by Europlexus, without the user not having to worry about the input files Europlexus. More precisely, all the setting in data is possibly done by Aster commands (since an assistant Salomé), and the resolution is done by the macro-command Aster taking care of the control of Europlexus. This one takes in arguments the Aster concepts, built the command file Europlexus, controls the execution of Europlexus, then rebuilt, on the one hand result a total Aster which can be used then with Aster in postprocessing (with Stanley for example), and on the other hand a series of curves generated by Europlexus.

The macro-command produces a data structure of the evol_noli type and possibly an array containing the evolution of certain quantities in certain times.

Notice

It is necessary to specify key word DEBUG=_F (HIST_ETAPE=' OUI') in debut to use this macro-command.

2 Syntax

```
evol = CALC_EUROPLEXUS  (

        ♦/MODELE=mo                    ,                          [model]
          CARA_ELEM=carac              ,                       [cara_elem]
          CHAM_MATER=chmat       ,                          [cham_mater]

          /ETAT_INIT    =_F       (
            ♦RESULTAT=              evolno                    [evol_noli]
            ◊CONTRAINTE=           /  "NON"                  [DEFAULT]
                                   /  " OUI'                [TXM]
            # so FORCED = "NON":
                ◊ NITER=           /1                        [DEFAULT]
                                   /niter                    [I]
            ◊EQUILIBRE=               /  "OUI'                  [DEFAULT]
                                   /  "NON"                  [TXM]
                    ),
        ♦COMP_INCR    =_F       (
            ♦RELATION=              "ELAS"                    [DEFAULT]
                                 = "GLRC_DAMAGE"             [TMX]
            ♦GROUP_MA=                 l_grma
        [l_gr_GROUP_MA]

        ◊LOGICIEL       =
            /  "/home/europlex/EPXD/bin/europlexus"  [DEFAULT]
            /chemin   ,                                [TXM]

        ◊LANCEMENT=               /  "OUI'                     [DEFAULT]
                               /  "NON"                     [TXM]

        ◊FONC_PARASOL =_F       (
            |     ♦NFKT=            nfkt                 [fonction_sdaster]
            |     ♦NFKR=            nfkr                 [fonction_sdaster]
            |     ♦NFAT=            nfat                 [fonction_sdaster]
                  ♦NFAR=            nfar                  [fonction_sdaster]
             ◊GROUP_MA=          gma                       [l_gr_GROUP_MA]
                              ),

        ♦EXCIT=_F                  (
            ♦CHARGE=cho                ,                  [char_meca]
            ♦FONC_MULT=fi          ,
    [function/formula]
                              ),

        ◊DIME=_F                   (
          ◊   |     UNITE_DIME=i  ,                     [I]
              |  Q4GS=q4gs         ,                     [I]
              |  FORCE=force          ,                     [I]
              |  PT6L=pt6l         ,                     [I]
              |  ZONE=zone         ,                     [I]
              |  POUT=pout         ,                     [I]
              |  ECRO=ecro                               [I]
              |  APPU=appu         ,                     [I]
              |  BLOQ=bloq         ,                     [I]
              |  PRESS=press          ,                     [I]
              |  PMAT=pmat          ,                     [I]
              |  DKT3=dkt3          ,                     [I]
```

```
                |  DEPL=depl            ,                [I]
                |  FNOM=fnom            ,                [I]
                |  TABLE=table             ,                 [I]
                |  FTAB=ftable             ,                [I]
                |  MTTI=mtti            ,                [I]
                |  NEPE=nepe            ,                [I]
                |  LIAI=liai            ,                [I]
                            ),


♦CALCUL=_F                  (
                    ♦/TYPE_DISCRETIZATION=' AUTO',        [DEFAULT]
                  ♦CSTAB=/0.3                        ,       [DEFAULT]
                                          /cstab ,       [R]

                  /TYPE_DISCRETISATION    =  ' UTIL',     [TXM]
                        ♦PASFIX=pasfix                ,       [R]
               ♦INST_INIT=tini                ,                [R]
               ♦INST_FIN=tfin                 ,                [R]
               ◊NMAX=nmax                     ,                [R]
                            ),

                  ◊OBSERVATION        =_F     (
                  ♦SUIVI_DDL=/                "OUI'             [DEFAULT]
                                        /  "NON"
                        ◊NOM_CHAM=/                "DEPL"        [DEFAULT]
                                              /  "QUICKLY"        [TXM]
                                              /  "ACCE"         [TXM]
                                              /  "SIEF_ELGA"    [TXM]
                                              /  "EPSI_ELGA"    [TXM]
                                              /  "VARI_ELGA"    [TXM]

                        ♦/PAS_INST=pas_inst                     [R]
                           /PAS_NBRE     =pas_nbre            [I]

                        ◊/GROUP_NO=grno                       [l_gr_noeud]
                           /TOUT_GROUP_NO       =  ' OUI'        [TXM]

                        ◊/GROUP_MA=grma                       [l_gr_GROUP_MA]
                           /TOUT_GROUP_MA       =  ' OUI'        [TXM]

                              ),

♦ARCHIVAGE=_F           (
                  ♦/PAS_INST=pinst                          [R]
                     /PAS_NBRE     =pnbre                   [I]

                  ♦CONT_GENER=/       "OUI'                [DEFAULT]
                                      /"NON"               [TXM]
                            )

◊COURBE=_F              (
                  ◊UNITE_ALIT=ualit                         [I]
                  ◊NOM_CHAM=ncham                           [TXM]
                  ◊NOM_CMP=ncmp                            [TXM]
                  ◊/GROUP_NO=noeud                           [l_gr_noeud]
                     /GROUP_MA     =grma                    [l_gr_maille]
                        ◊NUM_GAUSS=       N                 [I]
                  ♦/PAS_INST_COURBE=picourbe                  [R]
```

```
                /PAS_NBRE_COURBE       =pncourbe            [I]
            ◊TABLE_COURBE=CO        ("array")            [tabl_*]
                  ),

◊DOMAINES=_F            (
            ◊GROUP_MA=dom_gma                            [l_gr_maille]
            ◊IDENTIFIANT=dom_id                          [I]
                      ),
◊   INTERFACES=_F     (
                ◊GROUP_MA_1=int_gma1                     [l_gr_maille]
                ◊GROUP_MA_2=int_gma2                     [l_gr_maille]
                ◊TOLE=tole                               [R]
                ◊IDENT_DOMAINE_1=int_dom1                [I]
                ◊IDENT_DOMAINE_2=int_dom2                [I]
                          ),

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

3 Operands

3.1 Operand MODELS/CHAM_MATER/CARA_ELEM

♦ /MODELE = Mo,
CARA_ELEM = carac,
CHAM_MATER = chmat,

These key words make it possible to inform:

- the name of the (mo) model whose elements are the object of mechanical computation. Only mechanical computations are authorized, and for modelizations Q4GG, BAR (section GENERALE in AFFE_CARA_ELEM), POU_D_E (section rectangular in AFFE_CARA_ELEM) and DIS_TR (relates to just the characteristics M_T_D_N defined in AFFE_CARA_ELEM
- the name of the material field (chmat) affected on the mesh. Attention, all meshes of the model must be associated with a material (if not fatal error with not very explicit message). For the moment, only the elastic characteristics are taken into account.
- the name of the characteristics (carac) of the shell elements, beam, pipe, bar, cable, and discrete elements affected on the model Mo .

3.2 Key word ETAT_INIT

♦ /ETAT_INIT = _F (
♦ RESULTAT = resu,
◊CONTRAINTE
◊ NITER
◊ EQUILIBRE

This key word makes it possible Europlexus to begin computation from an initial state resulting from a result concept of Code_Aster. The fields provided to Europlexus are those corresponding to the last moment of computation of the result concept given.

Note: One recovers the model, the material field and the characteristic elementary of the result concept.

3.2.1 Operand RESULTAT

♦ RESULTAT

Result concept providing the mesh and the fields of displacements and stresses which will be used as initial state in Europlexus.

3.2.2 FORCED operand

◊ FORCED

So FORCED = ' OUI' , stress field SIEF_ELGA is part of the initial state, if not only the field of displacement is given, the initial stresses are then calculated starting from displacements by Europlexus.

Only the modelizations BARS and Q4GG are compatible with STRESS = ' OUI'.

3.2.3 So FORCED

operand NITER = ' NON', this operand indicates to Europlexus in how much stages (time step) to recompute the stresses starting from displacement. During this computation initial displacement given

is regarded as an imposed displacement. At the stage $i=1,...,niter$, imposed displacement is multiplied par. $\frac{i}{niter}$

3.2.4 Operand BALANCES

◊ EQUILIBRE

When result is transferred from a computer code to another, it often arrives that a state balanced in the first code is not it completely any more in the second. To avoid that, Europlexus has a functionality to balance perfectly an initial state by adding what it is necessary for the external forces. This functionality will be activated if EQUILIBRE='OUI' (value by default) is given.

3.3 Key word COMP_INCR

```
♦COMP_INCR     =_F        (
                  ♦RELATION=                "ELAS"                    [DEFAULT]
                                          = "GLRC_DAMAGE"          [TMX]
                  ♦    GROUP_MA         =    l_grma
            [l_gr_GROUP_MA]
```

On the model of the operators such as STAT_NON_LINE and DYNA_NON_LINE , key word COMP_INCR makes it possible to assign a behavior to the mesh groups modelled in computation.

The two only behaviors available are "ELAS" and "GLRC_DAMAGE" . They are indicated by the key word RELATION .

3.4 Key word LOGICIEL

◊ LOGICIEL

Site of the Europlexus program. Allows to specify the path towards the script of Europlexus launching.

3.5 Key word LANCEMENT

◊ LANCEMENT

Makes it possible to stop (LANCEMENT=' NON') after the generation of the data files of Europlexus (command file and mesh). All the Europlexus files are recoverable in a directory defined by REPE in mode result (R) in profile ASTK.

3.6 Key word FONC_PARASOL

♦ FONC_PARASOL

This key word makes it possible to define the functions of stiffness, and damping, translation and rotation of the elastic supports defined in the key word factor RIGI_PARASOL of the command AFFE_CARA_ELEM.

It is possible to combine at the same time a carpet of springs of soil with a carpet of dampers (standard dashpots). In this frame, one can mix descriptions: for example K_TR_D_N to couple springs with 6 components, of which stiffness of rotation, with dampers of the type A_T_D_N . In Europlexus, the damping coefficients in rotation are worth then implicitly 0.

Of course, homogeneous descriptions on the level of the degrees of freedom, type K_TR_D_N with A_TR_D_N or K_T_D_N with A_T_D_N are also authorized. In all the cases, the arguments which

follow (NFKT , NFKR , NFAT and NFAR) must be specified in coherence with the degrees of freedom of stiffness and damping.

3.6.1 Operand NFKT

♦ NFKT

Makes it possible to define the function of translation of the stiffness following the total axes.

3.6.2 Operand NFKR

♦ NFKR

Makes it possible to define the function of rotation of the stiffness following the total axes.

3.6.3 Operand NFAT

♦ NFAT

Makes it possible to define the function of translation of following depreciation the total axes.

3.6.4 Operand NFAR

♦ NFAR

Makes it possible to define the function of rotation of following depreciation the total axes.

3.6.5 Operand GROUP_MA

♦ GOUPE_MA

Makes it possible to inform the mesh groups about which the discrete ones are already affected (standard computation step parasol for them, on the other hand their stiffness is affected functions nfkt and nfkr as for the discrete ones calculated by methodology parasol).

3.7 Key word EXCIT

♦ EXCIT

This key word factor makes it possible to define a load for each occurrence. These loads result from operator AFFE_CHAR_MECA.

3.7.1 Operand CHARGE

♦ CHARGE

the types of loads taken into account by CALC_EUROPLEXUS are the following ones:
• DDL_IMPO : although envisaged to declare displacements imposed, this key word is usable with CALC_EUROPLEXUS only to define blockings (that is to say for the displacements imposed on zero),
• PRES_REP : pressure on a shell, one must obligatorily associate with this kind of load with a multiplying coefficient (key word FONC_MULT),
• RELA_CINE_BP : kinematic relations resulting from macro-command DEFI_CABLE_BP, defines connections between degrees of freedom of concrete and cables.

3.7.2 Operand FONC_MULT

◊ FONC_MULT

multiplying Function of the time of the loading defined by the current occurrence of the key word factor EXCIT.

3.8 Key word DIME

◊ DIME

This key word factor is used to define a certain number of parameters of design of the Europlexus study. These parameters affect directly the size of tables FORTRAN used as starter in Europlexus. The values can be provided in a file to Europlexus syntax (see UNITE_DIME) or be specified directly by simple key words under this key word DIME. So values are defined in the file and in key word DIME, then it is the value in the macro one which is used.

3.8.1 Operand UNITE_DIME

◊ UNITE_DIME

This key word indicates the logical unit of the file where some all (or) the parameters are defined. The parameters which miss will be directly defined using the key words quoted hereafter.

3.8.2 Operand Q4GS

◊ Q4GS

Informs the number of elements Q4GS.

3.8.3 Operand FORCE

◊ FORCE

Informs the number of imposed forces.

3.8.4 Operand PT6L

◊ PT6L

Informs the number of elements PT6L (points with 6 d.o.f.).

3.8.5 Operand ZONE

◊ ZONE

Informs the number of geometrical zones of elements. Each zone can contain one type of element. If this operand is not indicated, Europlexus considers that there is only one geometrical zone.

3.8.6 Operand POUT

◊ POUT

Informs the number of elements POUT .

3.8.7 Operand ECRO

◊ ECRO

Informs the number of variables of hardening.

3.8.8 Operand APPU

◊ APPU

Informs the number of elements APPU.

3.8.9 Operand BLOQ

◊ BLOQ

Informs the number of blocked displacements.

3.8.10 Operand PRESS

◊ PRESS

Informs the number of imposed pressures.

3.8.11 Operand PMAT

◊ PMAT

Informs the number of elements PMAT.

3.8.12 Operand DKT3

◊ DKT3

Informs the number of elements DKT3.

3.8.13 Operand DEPL

◊ DEPL

Informs the number of imposed displacements.

3.8.14 Operand FNOM

◊ FNOM

Informs the number of functions.

3.8.15 Operand COUNTS

◊ ARRAY

Informs the number of arrays.

3.8.16 Operand FTAB

◊ FTAB

Informs the number of points per array.

3.8.17 Operand MTTI

◊ MTTI

Informs the maximum number of records as a display or storage.

3.8.18 Operand NEPE

◊ NEPE

Cuts memory reserved for the vector NEPEDI which is built by Europlexus. By default, the code calculates this length automatically but it can be overloaded by a advanced user.

3.8.19 Operand LIAI

◊ LIAI

Informs the number of coefficients in connections.

3.9 Key word CALCUL

♦ CALCUL

This key word factor makes it possible to choose the parameters of computation to be used.

3.9.1 Operand TYPE_DISCRETISATION

♦TYPE_DISCRETIZATION :

Allows to choose between an automatic discretization in time ("AUTO", it is necessary then to specify CSTAB) and a discretization imposed by the user ("UTIL", it is then necessary to specify PASFIX). INST_INI and INST_FIN specify initial and final time computation.

3.9.2 Operand CSTAB

Coefficient safety taken during time step of stability estimated (i.e. critical) for each element. The value by default is of $0,8$.

3.9.3 Operand PASFIX

This parameter is a short cut making it possible to assign time step a fixed user. In conjunction of TYPE_DISCRETISATION must be used = UTIL.

3.9.4 Initial operand

INST_INI Urgent of computation. In the case of a computation of recovery, this parameter is ignored (it can however be left), because the new value of initial time is read in the file of recovery.

3.9.5 Operand INST_FIN

Final moment of computation.

3.9.6 Maximum operand

NMAX Number of computation steps. The value not default is: 1000000 .

3.10 Key word OBSERVATION

Makes it possible to define the places and the urgent where one wants to follow the evolution of certain quantities. Rather useful for the layout of curve.

3.10.1 Key word SUIVI_DDL

♦ SUIVI_DDL

to activate or not the follow-up of computations through points of observation.

3.10.1.1 Operand NOM_CHAM

◊ NOM_CHAM

Informs the name of the fields to be written in the listing.

3.10.1.2 Operand PAS_INST/PAS_NBRE

◊/ PAS_INST
/ PAS_NBRE

Determines the list of times for which one wishes the display:
- by frequency defined by the time interval: PAS_INST
- or, by number of time step: PAS_NBRE

3.10.1.3 Operand GROUP_NO/TOUT_GROUP_NO

◊ / GROUP_NO
/ TOUT_GROUP_NO

Determines the nodes for which one wishes to visualize information:
- A some nodes, through the list defined in a group: GROUP_NO
- For all the nodes groups of mesh: TOUT_GROUP_NO

3.10.1.4 Operand GROUP_MA/TOUT_GROUP_MA

◊/ GROUP_MA
/ TOUT_GROUP_MAILLE

Determines meshes for which one wishes to visualize information:
- On some meshes, through the list defined in a group: GROUP_MA
- For all the mesh groups of mesh: TOUT_GROUP_MA

3.10.1.5 Operand SUIVI_DDL

◊ SUIVI_DDL

Makes it possible to activate or not the possibility of following the evolution of the results to the points of observation.

3.11 Key word ARCHIVAGE

Makes it possible to define on the one hand the frequency of archivage of the results. Rather useful for layouts of isovaleurs or a poursuite of computation.

3.11.1.1 Operand PAS_INST/PAS_NBRE

◊/PAS_INST
/PAS_NBRE

Determines the list of times for which one wishes the display:
- by frequency defined by the time interval: PAS_INST
- or, by number of time step: PAS_NBRE

3.11.2 Key word CONT_GENER

♦CONT_GENER

If "OUI', the stresses are translated into generalized stresses, so "NON" in fact the rough stresses resulting from Europlexus are extracted from computations.

3.12 Key word COURBE

Makes it possible to define what will be stored in the array of the variables of archivage.

3.12.1 Key word UNITE_ALIT

◊UNITE_ALIT

Number of the logical unit in which Europlexus writes its results.

3.12.2 Key word NOM_CHAM/NOM_CMP

◊NOM_CHAM
◊NOM_CMP

refers to the fields and components which are extracted and filed in the array.

3.12.3 Operand GROUP_NO

◊GROUP_NO

Nodes where the results are taken.

3.12.4 Operand GROUP_MA (NUM_GAUSS)

◊GROUP_MA
◊ NUM_GAUSS

Gauss points and the mesh groups where the results are taken.

3.12.5 Operand PAS_INST_COURBE/PAS_NBRE_COURBE

♦/PAS_INST_COURBE
/PAS_NBRE_COURBE

times of archivage are defined by PAS_INST_COURBE/PAS_NBRE_COURBE (even logical that PAS_INST or PAS_NBRE under key word OBSERVATION.
All the filed values divide the same list of time of archivage)

3.12.6 Key word TABLE_COURBE

◊ TABLE_COURBE

the array where the values are stored.

3.13 Key word DOMAINES

Defines under fields for the studies multi-fields.

3.13.1 Key word GROUP_MA

◊ GROUP_MA

For each under field it is necessary to have a group of mesh GROUP_MA.

3.13.2 Key word IDENTIFIANT

◊ IDENTIFIANT

Each under field defines by its mesh group, must also have an identifier.

3.13.3 Key word INTERFACES

◊ INTERFACES

Defines the interfaces between under fields previously definite.

3.13.3.1 Key word GROUPE_MA_1/GROUPE_MA_2

◊ GROUPE_MA_1
◊ GROUPE_MA_2

These two mesh groups define edges of the two pennies fields in contact between them.

3.13.3.2 Key word TOLE

◊ TOLE

Specifies the tolerance used to pair the nodes of edges GROUP_MA_1 and GROUP_MA_2.

3.13.3.3 Key word IDENT_DOMAINE_1/IDENT_DOMAINE_2

◊ IDENT_DOMAINE_1
◊ IDENT_DOMAINE_2

These two keys refer to the respective identifiers of under fields, already specified.

3.14 Key word INFO

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

Makes it possible to control the level of message of the macro-command.

Note:

•If key word IMPR_MACRO=' OUI' is present in the command debut , then all the commands of macro-command CALC_EUROPLEXUS will be printed in the file of messages
•key word INFO is transmitted to all the commands used in the macro-command. INFO = 2 can thus print much information
•In all the cases, the command file Europlexus is printed in the file of messages