Operator MECA_STATIQUE

1 Drank

To solve a problem of static mechanics linear.

This operator allows to solve is:

- a linear static mechanical problem with superposition of various boundary conditions and various loadings,
- a thermo-mechanical analysis for a given list of times.
  - in this case the mechanical characteristics of the materials can depend on the temperature: the concept of the cham_mater type must then be defined from functions (cf operator DEFI_MATERIAU [U4.43.01] operand ELAS_FO),
  - the loading of thermal expansion can be given only if one defined the coefficient of thermal expansion and the reference temperature (cf operators DEFI_MATERIAU [U4.43.01] and AFFE_MATERIAU [U4.43.03]).

The product concept by this operator is of evol_elas type containing one or more fields of displacements at various times of computation.

In the case of the static mechanical analysis, one assigns sequence number 0 (time 0) to the field solution.

2 Syntax

```
mestat  [evol_elas] = MECA_STATIQUE  ,    reuse = mestat,
              (  ♦MODELE    =mo                 ,                 [model]
                 ♦   |   CHAM_MATER =chmat          ,             [cham_mater]
                     |   CARA_ELEM =carac          ,             [cara_elem]
                 ♦EXCIT  = (_F (  ♦CHARGE    = tank   ,       /   [char_meca]
                                                            /   [char_cine_meca]
                                  ◊FONC_MULT=    fmult ,    /   [function]
                                                            /   [formula]
                               ),)
                 ◊/INST     =/tps                  ,              [R]
                                        /0 .   ,                [DEFAULT]
                    /LIST_INST    =/litps             ,           [listr8]
                       ◊INST_FIN  = tf,
                 ◊SOLVEUR   = ( … to see [U4.50.01]  ),
                 ◊OPTION    =      "SIEF_ELGA",         [DEFAULT]
                              /   "SANS",
                 ◊INFO   =/1          ,                          [DEFAULT]
                              /2 ,
                 ◊TITER  =titer   ,                           [l_K80]
               )
```

3 Operands

3.1 Operands MODELS / CHAM_MATER / CARA_ELEM

One provides the arguments making it possible to calculate the stiffness matrix (and the second member):

♦MODELE =mo ,

Name of the model whose elements are the object of mechanical computation.

♦CHAM_MATER =chmat ,

Name of the material field.

◊CARA_ELEM =carac ,

Name of the characteristics of the structural elements (beam, shell, discrete,…) if they are used in the model.

3.2 Key word EXCIT and operands INST / LIST_INST

One defines the boundary conditions here and the loadings.

♦EXCIT =

This key word factor makes it possible to define several concepts of the type charges, one by occurrence; the solution is calculated by **superimposing** the effects of the various loads applied.

3.2.1 Operands CHARGE / FONC_MULT

♦CHARGE = tank,

Name of a concept of the char_meca type produces by AFFE_CHAR_MECA or AFFE_CHAR_MECA_F [U4.44.01] starting from the model Mo.

One can also give the name of a "kinematical load" (standard char_cine_meca) result of operators AFFE_CHAR_CINE and AFFE_CHAR_CINE_F [U4.44.03].

◊FONC_MULT = fmult,

Name of a concept of type function (or formulates) which makes it possible to define for each time of computation a multiplying coefficient applied to the load tank.

fmult is a function of time: by default it is a constant function which is worth 1.

3.2.2 Operands INST / LIST_INST

◊/INST = tps,

Key word used to carry out computation at only one time tps with the temperature corresponding to this time.

/LIST_INST = litps,

◊INST_FIN = tf,

the list litps produced by DEFI_LIST_REEL [U4.34.01] defines times for which one asks for the computation of a thermomechanical evolution.
Key word INST_FIN makes it possible to calculate only times former or equal to tf.
This key word (INST_FIN) combined with the key word "reuse" (réentrante orders) makes it possible to split a long thermomechanical transient.

One will make for example:

```
resu = MECA_STATIQUE (…     LIST_INST = linst, INST_FIN = 10. ,…)
MECA_STATIQUE (reuse = resu,   LIST_INST = linst, INST_FIN = 20. ,…)
```

```
MECA_STATIQUE (reuse = resu,   LIST_INST = linst, INST_FIN = 30. ,…)
```

3.3 Key word factor **solver**

See [U4.50.01].

3.4 Operand **OPTION**

```
◊OPTION    =/"SANS"    /"SIEF_ELGA"
```

By default command MECA_STATIQUE calculates the stresses with Gauss points (or forces generalized for the structural elements).
The other options of postprocessing will be calculated a posteriori by the command CALC_CHAMP [U4.81.04].
If the user indicates OPTION = "SANS", these stresses will not be calculated and the produced data structure will be less bulky.

3.5 Operand **INFO**

```
◊INFO  = 1,
```

Prints the principal characteristics of the linear systems to solve: number of unknowns, size of the matrix.

3.6 Operand **TITER**

```
◊TITER = titr,
```

Title which one wants to give to result [U4.03.01].

4 Examples of computations

4.1 static Computation with superposition of 2 mest1

```
loading cases = MECA_STATIQUE (     MODELS = Mo,  CHAM_MATER = chmat,
                 CARA_ELEM = carac,
                 EXCIT = (_F (CHARGE = ch1, FONC_MULT = COS),
                           _F (CHARGE = ch2),),  )
```

4.2 thermoelastic Computation at various times

```
chmat = AFFE_MATERIAU (    …, AFFE_VARC=_F (… EVOL=evoth…) );

mest2 = MECA_STATIQUE (    MODELS = Mo, CHAM_MATER = chmat,
                           EXCIT = _F (CHARGE = bloq),
                           LIST_INST = litps)
```

5 Notices

For certain studies in linear elasticity for which the characteristics of stiffness of structure are independent of the thermal history and the kinematical boundary conditions independent of the other loads, one can by means of determine the deformed shapes for several cases of loading MACRO_ELAS_MULT [U4.51.02].