Opérateur MECA_STATIQUE

1 Drank

Résoudre 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 starting from functions (Cf. operator `DEFI_MATERIAU` [U4.43.01] operand `ELAS_FO)`,
  - the loading of dilation 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 =          /  time   ,              [R]
                                        /0 .   ,               [DEFAUT]
                     /LIST_INST    =     /  litps  ,           [listr8]
                        ◊INST_FIN  = tf,
                 ◊SOLVEUR   = ( … see [U4.50.01]  ),
                 ◊OPTION    = /  "SIEF_ELGA",          [DEFECT]
                            /  "SANS",
                 ◊INFO  =     /  1,                          [DEFAUT]
                            /2  ,
                 ◊TITRE  =titre   ,                           [l_K80]
              )
```

3 Opérandes

3.1 Opérandes MODELE / CHAM_MATER / CARA_ELEM

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

♦MODELE =mo ,

Nom of the model whose elements are the subject of mechanical computation.

♦CHAM_MATER =chmat ,

Nom of the material field.

◊CARA_ELEM =carac ,

Nom 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 here the boundary conditions and the loadings.

♦EXCIT =

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

3.2.1 Operands CHARGES / FONC_MULT

♦CHARGE = tank,

Nom 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,

Nom 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 = time,

Key word used to carry out computation at only one time `time` 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 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

Voir [U4.50.01].

3.4 Operand OPTION

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

Par defect command MECA_STATIQUE calculates the stresses at the Gauss points (or forces generalized for the structural elements).
The other options of postprocessing will be computed a posteriori by 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,
```

Imprime main characteristics of the linear systems to solve: number of unknown factors, size of the matrix.

3.6 Operand TITRATES

```
◊TITRE  = titr,
```

Titre which one wants to give to the result [U4.03.01].

4 Examples of computations

4.1 static Computation with superposition of 2 mest1

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

4.2 thermoelastic Computation at various times

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

mest2 = MECA_STATIQUE (    MODELE = Mo, CHAM_MATER = chmat,
                           EXCIT = _F (LOAD = bloq),
                           LIST_INST = litps)
```

5 Remarque

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