Macro command MACRO_ELAS_MULT

1 Drank

the role of the command is to calculate linear static responses for various loading cases or modes of Fourier.

It is supposed that the kinematical conditions (blockings of structure) and the characteristic of the materials are invariant for all the loading cases, which makes it possible to have the same stiffness matrix.

The produced data structure is of type mult_elas for the multiple loading case or fourier_elas for computations of Fourier.

2 Syntax

```
resu = MACRO_ELAS_MULT      (

   ◊reuse=resu                ,

   ♦  MODELE=mo               ,                                  [model]

   ◊  CHAM_MATER=chmat        ,                                  [cham_mater]
   ◊  CARA_ELEM=carac             ,                              [cara_elem]

   ◊  NUME_DDL=nu             ,                                  [nume_ddl]

   ♦  /CHAR_MECA_GLOBAL           =lchmg    ,
[l_char_meca]
      /LIAISON_DISCRET         =   ' OUI',

   ♦CAS_CHARGE=_F        (

                    ♦/NOM_CAS=moncas                 ,        [kN]
                       /MODE_FOURIER     =mode ,               [I]
                          TYPE_MODE=/              "SYME",     [DEFAULT]
                                   /   "ANTI",
                                   /   "TOUS",
                    ♦/CHAR_MECA=lcharm                  ,      [l_char_meca]
                       /VECT_ASSE            =chdep    ,
[cham_no_depl_r]

                    ◊OPTION=/                        "SANS",
                                   /   "SIEF_ELGA",   [DEFAULT]
                    ◊SOUS_TITER=soustitre               ,     [l_Kn]
                     )

    ◊ solver =_F     (  ) ,   [U4.50.01]

   ◊TITER  =titer   ,                                         [l_Kn]


                           )
```

resu is a data structure RESULTAT of the type:

- mult_elas if key word NOM_CAS is present,
- fourier_elas if key word MODE_FOURIER is present.

3 Operands

MACRO_ELAS_MULT is a macro command which calls elementary operators likely to temporarily create concepts on the global database, it is thus possible that the file associated with the latter contains superfluous destroyed marked records. To reduce the size final of the file, when one wishes to preserve it, one will be able to use the procedure FIN and key word RETASSAGE=' OUI' in the command set.

3.1 Operands MODELS / CHAM_MATER / CARA_ELEM

One provides the arguments making it possible to calculate the stiffness matrix (and the second members).

♦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 Operand NUME_DDL

◊NUMÉRIQUE_DDL=nu ,

Key word used to name classification for a later use or to use an existing classification. If no name is provided, a classification is created temporarily for each call to MACRO_ELAS_MULT.

3.3 Operands CHAR_MECA_GLOBAL / LIAISON_DISCRET

♦ /CHAR_MECA_GLOBAL =lchmg ,

Key word defining the mechanical boundary conditions of blocking of structure.
These conditions are the same ones for all the loading cases. They are defined by AFFE_CHAR_MECA or AFFE_CHAR_MECA_F [U4.44.01].

/LIAISON_DISCRET = "OUI',

This key word is simply used to say that there are no mechanical or kinematical conditions of blocking of structure.

3.4 Key word CAS_CHARGE

Key word factor allowing to define a loading case.

For each occurrence of the key word factor, one builds a second member (except if one uses VECT_ASSE (in which case the second member is already assembled)) and one résoud the linear system.

3.4.1 Operand NOM_CAS

♦NOM_CAS=moncas ,

Character string, is used as variable of access to data structure result.

Note:

Each case is named by the user and the notion of sequence number does not exist.

3.4.2 Operands MODE_FOURIER / TYPE_MODE

◊MODE_FOURIER=mode ,

positive or null Integer indicating the harmonic of FOURIER on whom one calculates the elementary matrix of stiffness and the elementary vector.

◊TYPE_MODE=type ,

the type of the harmonic will be symmetric ("SYME"), or skew-symmetric ("ANTI") or symmetric and skew-symmetric ("TOUS") (cf the note of use Fourier [U2.01.07]).

3.4.3 Operands CHAR_MECA / VECT_ASSE

◊ CHAR_MECA=lcharm ,

List of concepts of the char_meca type produces by AFFE_CHAR_MECA [U4.44.01] or AFFE_CHAR_MECA_F [U4.44.01] starting from the model Mo.

Notice to only define a loading case of "thermal thermal expansion":

- the taking into account of thermal thermal expansion in a loading case is systematic if the material field "contains" temperature (AFFE_VARC/NOM_VARC=' TEMP').
- so that this loading is only taken into account, it is necessary that lcharm contains a mechanical load "null" (for example a nodal force null on a node).

◊VECT_ASSE=chdep ,

Concept of the cham_no_depl_r type representing the second member of the linear system to solve.

3.4.4 Operands OPTION

◊OPTION = "SANS",
/ "SIEF_ELGA", [DEFAULT]

By default command MACRO_ELAS_MULT 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.

3.4.5 Operand SOUS_TITRE

♦SOUS_TITER=soustitre ,

Under title which one wants result to give to the field displacement.

3.5 Key word solver [U4.50.01]

This key word makes it possible to choose the method of resolution of the linear systems. Let us recall that, in the case of the multiple loading case, only one factorization is made for each call to MACRO_ELAS_MULT and a resolution for each loading case.

3.6 Operand TITER

See [U4.03.01].

4 Examples

One will be able to refer to test SSLL14 A [V3.01.014].

```
# definition of the boundary conditions of blocking
 bloqu=AFFE_CHAR_MECA       ( model MODELE=,
                           DDL_IMPO= (_F (TOUT=' OUI',    DZ=0. ),
                                      _F (GROUP_NO= ("A", "B"), DX=0.,
DY=0.,),))

# definition of 4 loadings
charg1=AFFE_CHAR_MECA          ( model MODELE=,
                        FORCE_POUTRE=_F (GROUP_MA= "D2", FY= P         )  )

charg2=AFFE_CHAR_MECA          ( model MODELE=,
                        FORCE_NODALE=_F (GROUP_NO= "It,  FY= F1        )  )

charg3=AFFE_CHAR_MECA          ( model MODELE=,
                        FORCE_NODALE=_F (GROUP_NO= "Of,  FX= F2        )  )

charg4=AFFE_CHAR_MECA          ( model MODELE=,
                        FORCE_NODALE=_F (GROUP_NO= "Of,  MZ= M         )  )

statique=MACRO_ELAS_MULT          ( MODELE=                 model,
                                  CHAM_MATER=          ch_mater,
                                  CARA_ELEM=              cara_ele,
                                  CHAR_MECA_GLOBAL=       bloqu,

# one gives a name in order to recover concept NUME_DDL
                                NUME_DDL  = nu_ddl,
             CAS_CHARGE=_F  ( NOM_CAS   = "load number 1",
                                CHAR_MECA = charg1,
                                OPTION    = "SIEF_ELGA",
                                SOUS_TITRE=' charges set out again vertical on
DC',
                            ),
                            )

# second series of loading case

statique=MACRO_ELAS_MULT       (     reuse=           static,
                                  model            MODELE=,
                                  CHAM_MATER=      ch_mater,
                                  CARA_ELEM=          cara_ele,
                                  CHAR_MECA_GLOBAL=    bloqu,

# one gives concept NUME_DDL calculated previously
                                 NUME_DDL  = nu_ddl,
             CAS_CHARGE= (_F (   NOM_CAS   = "load number 2",
                                 CHAR_MECA = charg2,
                                OPTION    = ("SIEF_ELGA", "REAC_NODA"),
                                SOUS_TITRE= "forces specific vertical in It,
                            ),

                        _F  ( NOM_CAS   = ' load number 3 ',
                                 CHAR_MECA =charg3,
                                OPTION    = ("SIEF_ELGA", "REAC_NODA"),
                                SOUS_TITRE=' forces specific horizontal in It,
                            ),
                        _F  ( NOM_CAS   = "load number 4",
                                 CHAR_MECA = charg4,
                                OPTION    = ("SIEF_ELGA", "REAC_NODA"),
                                SOUS_TITRE= "moment in It,
                            ),),
```

)