Macro order MACRO_ELAS_MULT

1 Goal

The role of the order is to calculate linear static answers for various loading cases or modes of Fourier.

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

The structure of data produced is of type mult_elas in the case of load multiple or fourier_elas for calculations of Fourier.

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2 Syntax

```
resu = MACRO_ELAS_MULT     (

   ◊  reuse         =  resu,

   ♦  MODEL         =  Mo,                                  [model]

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

   ◊  NUME_DDL      =  naked,                                  [nume_ddl]

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

   ♦  CAS_CHARGE=_F(

                  ♦  /  NOM_CAS       =  moncas,          [KN]
                     /  MODE_FOURIER  =  mode,            [I]
                        TYPE_MODE     =  /  'SYME',       [DEFECT]
                                         /  'ANTI',
                                         /  'ALL',
                  ♦  /  CHAR_MECA     =  lcharm,          [l_char_meca]
                     /  VECT_ASSE     =  chdep,           [cham_no_depl_r]

                  ◊  OPTION           =  /  'WITHOUT',
                                         /  'SIEF_ELGA', [DEFECT]
                  ◊  SOUS_TITRE       =  soustitre,       [l_Kn]
                   )

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

   ◊  TITLE =   title,                                     [l_Kn]


                           )
```

`resu` is a structure of data `RESULT` of type:

- `mult_elas` if the keyword `NOM_CAS` is present,
- `fourier_elas` if the keyword `MODE_FOURIER` is present.

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3 Operands

MACRO_ELAS_MULT is a macro order which calls elementary operators likely to create temporarily concepts on the total basis, it is thus possible that the file associated with the latter contains superfluous destroyed marked recordings. To reduce the size final of the file, when one wishes to preserve it, one will be able to use the procedure **END** and the keyword **RETASSAGE=' OUI'** in the command set.

3.1 Operands MODEL / CHAM_MATER / CARA_ELEM

One provides the arguments allowing to calculate the matrix of rigidity (and second members).

♦ MODEL = Mo,

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

◊ CHAM_MATER = chmat,

Name of the material field.

◊ CARA_ELEM = carac,

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

3.2 Operand NUME_DDL

◊ NUME_DDL = naked,

Keyword 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,

Keyword defining the boundary conditions mechanical of blocking of the 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 = 'YES',

This keyword is simply used to say that there are not mechanical conditions or kinematics of blocking of the structure.

3.4 Keyword CAS_CHARGE

Keyword factor allowing to define a loading case.

For each occurrence of the keyword 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 the structure of data result.

Note:

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

3.4.2 Operands MODE_FOURIER / TYPE_MODE

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◊ MODE_FOURIER = mode,

Positive or null entirety indicating the harmonic of FOURIER on whom one calculates the elementary matrix of rigidity and the elementary vector.

◊ TYPE_MODE = type,

The type of the harmonic will be symmetrical ('SYME'), or antisymmetric ('ANTI') or symmetrical and antisymmetric ('ALL') (cf the note of Utilisation Fourier [U2.01.07]).

3.4.3 Operands CHAR_MECA / VECT_ASSE

◊ CHAR_MECA = lcharm,

List of concepts of the type char_meca product 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 dilation":
- the taking into account of thermal dilation 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 "worthless" (for example a worthless nodal force on a node).

◊ VECT_ASSE = chdep,

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

3.4.4 Operands OPTION

◊ OPTION = / 'WITHOUT',
/ 'SIEF_ELGA', [DEFECT]

By default the order MACRO_ELAS_MULT calculate the constraints at the points of Gauss (or efforts generalized for the elements of structure).
The other options of postprocessing will be calculated a posteriori by the order CALC_CHAMP [U4.81.04].
If the user indicates OPTION = 'WITHOUT', these constraints will not be calculated and the structure of data produced will be less bulky.

3.4.5 Operand SOUS_TITRE

♦ SOUS_TITRE = soustitre,

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

3.5 Keyword SOLVEUR [U4.50.01]

This keyword 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 TITLE

See [U4.03.01].

4 Examples

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

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```
# definition of the boundary conditions of blocking
 bloqu =  AFFE_CHAR_MECA ( Model MODELE=,
                          DDL_IMPO= (_F (TOUT=' OUI',   DZ=0.  ),
                                     _F (GROUP_NO= ('WITH', '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         )  )

statics   =  MACRO_ELAS_MULT  (  MODEL               = 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            = model,
                                  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,
                            ),),
                            )
```

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