Operator MODE_ITER_CYCL

1 Drank

Compute the eigen modes of a structure with cyclic symmetry.

One calculates the generalized components of the eigen modes of whole structure, by a method of substructuring cyclic, from the modal base of a sector of reference (cf [R4.06.03]). The axis of symmetry is axis OZ. The modal base of the sector must be of type CLASSIQUE. Interfaces RIGHT, GAUCHE and possibly AXE must be in the same way standard. The sides right and left are defined by the trigonometrical meaning in plane OXY.

Product a data structure of the mode_cycl type.

2 Syntax

```
mocy [mode_cycl] = MODE_ITER_CYCL (

   ♦BASE_MODALE=bamo          ,
[mode_meca]

   ◊NB_MODE=/nbmo                ,                                    [I]
                        /999
[DEFAULT]

    ♦NB_SECTEUR=nbsec         ,                                      [I]

   ♦LIAISON=_F             (              ♦DROITE=' nom_int',         [kN]

                                        ♦GAUCHE=' nom_int',          [kN]

                                           ◊AXE=' nom_int',          [kN]
                           ),

   ♦CALCUL=_F                   ( ♦/TOUT_DIAM       =  ' OUI',
                                  /NB_DIAM     =li ,                [l_I]
                                ◊OPTION        =  /"PLUS_PETITE",   [DEFAULT]
                                                  /"CENTER",
                                                  /"TAPE",

                                If OPTION = "CENTER":
                                ♦FREQ=lifreq              ,          [R]

                                If OPTION = "TAPE":
                                ♦FREQ=lifreq              ,          [2xR]

                                ◊NMAX_FREQ=/nbfreq                ,     [I]
                                                  /10 ,              [DEFAULT]
                                ◊PREC_SEPARE=/pre_sep             ,     [R]
                                                  /1.E    +2,
[DEFAULT]
                                ◊PREC_AJUSTE=/pre_ajus            ,     [R]
                                                  /1.E-6 ,           [DEFAULT]
                                ◊NMAX_ITER=/niter                 ,      [I]
                                                  /50 ,              [DEFAULT]
                                ),
   ◊VERI_CYCL=_F                 ( ◊PRECISION=/prec          ,          [R]
                                                  /1.D-3 ,           [DEFAULT]
                                          ◊CRITERE=' RELATIF',
[DEFAULT]

                                ◊DIST_REFE=dist_ref       ,          [R]
                                ),

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

3 Operands

3.1 Operand BASE_MODALE

♦BASE_MODALE = bamo

Name of the modal base of the sector built by DEFI_BASE_MODALE [U4.64.02].

3.2 Operand NB_MODE

◊NB_MODE = nbmo

Many eigen modes of the sector to be used for cyclic computation. By defaults, if the key word does not appear, all the eigen modes of modal base are used.

3.3 Operand NB_SECTEUR

♦NB_SECTEUR = nbsec

Many basic sectors necessary to the construction of total structure.

3.4 Key word LIAISON

♦LIAISON

Key word factor for the definition of connections between the sectors.

3.4.1 Operands STRAIGHT LINES / GAUCHE / AXE

See [Figure 3.6-a].

♦DROITE=' nom_int'

Name of the right interface of the sector.

♦GAUCHE=' nom_int'

Name of the left interface of the sector.

◊AXE=' nom_int'

Name of the interface of the axis of the sector.
They are common points with all the sectors.

3.5 Key word CALCUL

♦CALCUL

Key word factor to define the mode of search of the eigen modes.

3.5.1 Operands TOUT_DIAM / NB_DIAM

◊TOUT_DIAM=' OUI'

the modes associated with all the numbers of nodal diameters will be calculated.

◊NB_DIAM=li

List of the numbers of nodal diameters to calculating. By defaults, all the numbers of nodal diameters possible are studied.

3.5.2 Operand OPTION

◊OPTION =

"PLUS_PETITE" : to calculate by an opposite iteration method the eigen modes the corresponding to smallest frequencies for each number of diameters requested.

"CENTER" : to calculate the eigen modes centered around a frequency requested by key word LIST_FREQ.

"TAPE" : to calculate the eigen modes between two frequencies given by the user by key word LIST_FREQ.
The eigenfrequencies are separated by dichotomy then the eigen modes calculated by inverse iterations centered on the frequencies resulting from the stage of separation.

3.5.3 Operands FREQ / NMAX_FREQ

◊FREQ=lifreq

List of the frequencies of which the use depends on the selected option:

OPTION=' BANDE'

One expects 2 values $\left(f_1 \leq f_2 \right)$ which define the tape.

OPTION=' CENTER'

One expects 1 value which is the center frequency of the interval.

OPTION=' PLUS_PETITE'

One calculates the smallest eigenfrequencies of structure. By default, one calculates the 10 first. Key word FREQ then does not have a meaning in this case, it does not have to be indicated.

◊NMAX_FREQ=nbfreq

Many frequencies to calculating for each number of nodal diameters asked. If this key word does not appear, one calculates as many frequencies, for each nodal diameter, that there are eigen modes used in modal base (key word NB_MODE).

3.5.4 Operands PREC_SEPARE / PREC_AJUSTE / NMAX_ITER

◊PREC_SEPARE=pre_sep

Accuracy of separation of the frequencies for option "BANDAGES".

◊PREC_AJUSTE=pre_ajus

Accuracy used for the computation of the modes (all OPTIONS).

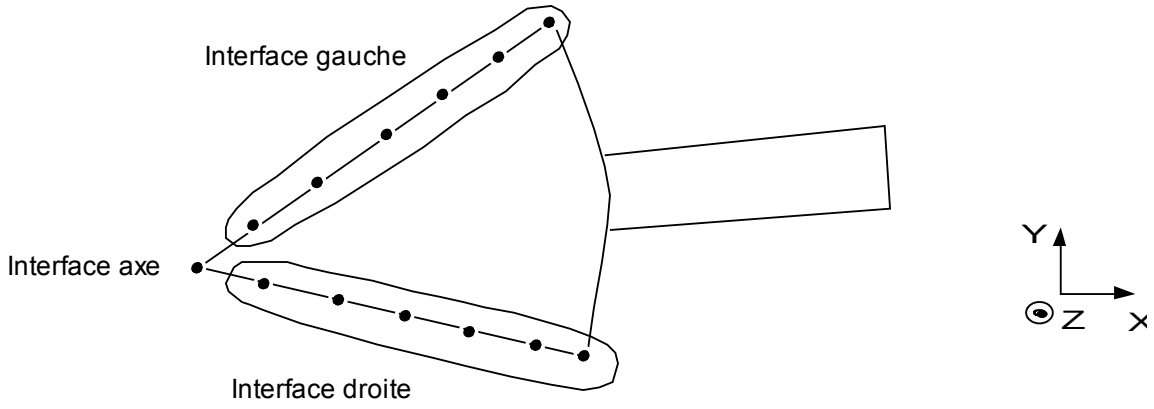
◊NMAX_ITER=niter

maximum Number of inverse iterations (all OPTIONS).

3.6 Key word VERI_CYCL

♦VERI_CYCL

Key word for checking of the coherence of the interfaces given in cyclic term of repetitivity.



Appear 3.6-a

3.6.1 Operands accuracy / DIST_REFE

◊PRECISION=prec
◊DIST_REFE=dist_ref

the test of coherence between 2 contiguous sectors will be determined by the product prec*dist_ref. If DIST_REFE is not indicated, it will be automatically calculated proportionally with prec and a maximum value of coordinate of a sector.

3.7 Operand INFO

◊INFO=

Level of printing

1 step from printing,
2 writing of the frequencies and generalized parameters obtained and the relative participations of the various modes of the base.

4 Cyclic substructuring example

```
       PLATES ANNULAR CLAMPED ON a HUB - METHODE OF CRAIG-BAMPTON

sector = LIRE_MAILLAGE      ( )
model  = AFFE_MODELE          (  MAILLAGE= sector,
                                 AFFE  =_F (     TOUT=' OUI',
                                             PHENOMENE = ' MECANIQUE',
                                             MODELISATION=' DKT')       )
to subdue   = DEFI_MATERIAU      (ELAS =_F (E=2.E11, NU=0.3, RHO=7800.0)
   )
chammat = AFFE_MATERIAU     (MAILLAGE= sector,
                            AFFE  =_F (TOUT = ' OUI',  MATER= MATER)     )
chamcar = AFFE_CARA_ELEM    (MODELS  = model,
                            COQUE   = (TOUT = ' OUI', EPAIS= 0.001)   )
charge  = AFFE_CHAR_MECA    (=  model DDL_IMPO=
                            MODELS (TOUT=' OUI', DX=0., DY=0., DRZ=0.),
                            DDL_IMPO= (GROUP_NO=' AXE', DZ=0., DRX=0.,
DRY=0.),
                            DDL_IMPO= (GROUP_NO=' DROIT', DZ=0., DRX=0.,
DRY=0.),
                            DDL_IMPO= (GROUP_NO=' GAUCH', DZ=0., DRX=0.,
DRY=0.))
#
#      CONSTRUCTION OF the STIFFNESS MATRIXES AND MASSE OF Basic SECTEUR
#
rigiele = CALC_MATR_ELEM   (MODELS    = models,   CHARGE    = load,
                            CHAM_MATER= chammat,   CARA_ELEM = chamcar,
                            OPTION    =   "RIGI_MECA"    )
massele = CALC_MATR_ELEM   (MODELS    = model,  CHARGE    = load,
                             CHAM_MATER= chammat,   CARA_ELEM = chamcar,
                             OPTION    = "MASS_MECA"      )
numerot = NUME_DDL         (MATR_RIGI = rigiele          )
matrigi = ASSE_MATRICE     (MATR_ELEM = rigiele,  NUME_DDL = numerot     )
matmass = ASSE_MATRICE     (MATR_ELEM = massele,  NUME_DDL = numerot     )
#
#               CALCUL OF the MODES DYNAMICS OF Basic SECTEUR
#
modes    = MODE_ITER_SIMULT    (MATR_RIGI = matrigi, MATR_MASS = matmass,
                               CALC_FREQ= _F(NMAX_FREQ= 15)              )
#
#      DEFINITION OF the INTERFACES AND the MODES STATICS ASSOCIATE
#
lint     = DEFI_INTERF_DYNA    (NUME_DDL = numerot,   IMPR= 2,
                               INTERFACE= _F (NOM=' DROITE', TYPE=' CRAIGB',
                                             GROUP_NO= "DROIT",
                               MASQUE= ("DX", "DY", "DRZ"),          ),
                               INTERFACE= _F (NOM=' GAUCHE', TYPE=' CRAIGB',
                                             GROUP_NO= "GAUCH",
                               MASQUE= ("DX", "DY", "DRZ")         )  )
#
#      CALCUL OF Projection base = RECOVERY OF the MODES DYNAMICS
#                                       AND CALCUL OF the MODES STATICS
bamo     = DEFI_BASE_MODALE    (CLASSIQUE= _F (INTERF_DYNA= lint,   IMPR= 2,
                                              MODE_MECA  = modes,
                                              NMAX_MODE= 15 )  )
#
#                           CALCUL OF CYCLIC MODES
```

```
#
modcyc    = MODE_ITER_CYCL  (BASE_MODALE= bamo,  NB_MODE=15,  NB_SECTEUR=18,
                             LIAISON=_F ("RIGHT" DROITE=, GAUCHE= "GAUCHE"),
                             CALCUL =_F (NB_DIAM= (0, 1,2,3), NMAX_FREQ=2))
```