Operator MODE_ITER_CYCL

1 Goal

To calculate the clean modes of a structure with cyclic symmetry.

One calculates the generalized components of the clean modes of the whole structure, by a method of under-structuring cyclic, starting from the modal base of a sector of reference (cf [R4.06.03]). The axis of symmetry is the axis OZ. The modal base of the sector must be of type CLASSIC. Interfaces RIGHT-HAND SIDE, LEFT and possibly AXIS must be in the same way standard. The sides right and left are defined by the trigonometrical direction in the plan OXY.

Product a structure of data of the type mode_cycl.

2 Syntax

```
mocy [mode_cycl] = MODE_ITER_CYCL (

    ♦  BASE_MODALE   =  bamo,                                  [mode_meca]

    ◊  NB_MODE       =  nbmo,                                  [I]

    ♦  NB_SECTEUR    =  nbsec,                                 [I]

    ♦  CONNECTION       =  _F(♦  RIGHT-HAND SIDE     =  'nom_int',
    [KN]

                            ♦  LEFT      =  'nom_int',        [KN]

                            ◊  AXIS      =  'nom_int',           [KN]
                           ),

    ♦  CALCULATION      =  _F(♦  /  TOUT_DIAM =  'YES',
                              /  NB_DIAM  =  Li,              [l_I]
                            ◊  OPTION     =  / 'PLUS_PETITE', [DEFECT]
                                             / 'CENTER',
                                             / 'BAND',

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

                            If OPTION = 'BAND':
                            ♦  FREQ       =  lifreq,        [2xR]

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

                            ◊  DIST_REFE =  dist_ref,      [R]
                           ),

    ◊  INFORMATION      =  /  1,
    [DEFECT]
                         /  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 modes clean of the sector to be used for cyclic calculation. By defaults, if the keyword does not appear, all the clean modes of the modal base are used.

3.3 Operand NB_SECTEUR

♦ NB_SECTEUR = nbsec

Many basic sectors necessary to the construction of the total structure.

3.4 Keyword CONNECTION

♦ CONNECTION

Keyword factor for the definition of the connections between the sectors.

3.4.1 Operands RIGHT-HAND SIDE / LEFT / AXIS

See [Figure 3.6-a].

♦ RIGHT-HAND SIDE = 'nom_int'

Name of the right interface of the sector.

♦ LEFT = 'nom_int'

Name of the left interface of the sector.

◊ AXIS = 'nom_int'

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

3.5 Keyword CALCULATION

♦ CALCULATION

Keyword factor to define the mode of research of the clean modes.

3.5.1 Operands TOUT_DIAM / NB_DIAM

◊ TOUT_DIAM = 'YES'

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

◊ NB_DIAM = Li

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

3.5.2 Operand OPTION

◊ OPTION =

'PLUS_PETITE' : to calculate by a method of iteration reverses the clean modes the corresponding to smallest frequencies for each number of required diameters.

'CENTER' : to calculate the clean modes centered around a frequency requested by the keyword LIST_FREQ.

'BAND' : to calculate the clean modes between two frequencies given by the user by the keyword LIST_FREQ.
The Eigen frequencies are separated by dichotomy then the clean modes calculated by iterations opposite 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 = 'BAND'

2 values are expected $\left(f_1 \leq f_2 \right)$ who define the band.

OPTION = 'CENTER'

1 is expected value which is the centre frequency of the interval.

OPTION = 'PLUS_PETITE'

One calculates the smallest Eigen frequencies of the structure. By default, one calculates the 10 first. The keyword FREQ then does not have direction in this case, it does not have to be indicated.

◊ NMAX_FREQ = nbfreq

Many frequencies to be calculated for each number of nodal diameters asked. If this keyword does not appear, one calculates as many frequencies, for each nodal diameter, that there are clean modes used in the modal base (keyword NB_MODE).

3.5.4 Operands PREC_SEPARE / PREC_AJUSTE / NMAX_ITER

◊ PREC_SEPARE = pre_sep

Precision of separation of the frequencies for option 'BAND'.

◊ PREC_AJUSTE = pre_ajus

Precision used for the calculation of the modes (all OPTIONS).

◊ NMAX_ITER = niter

Maximum number of iterations opposite (all OPTIONS).

3.6 Keyword VERI_CYCL

♦ VERI_CYCL

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

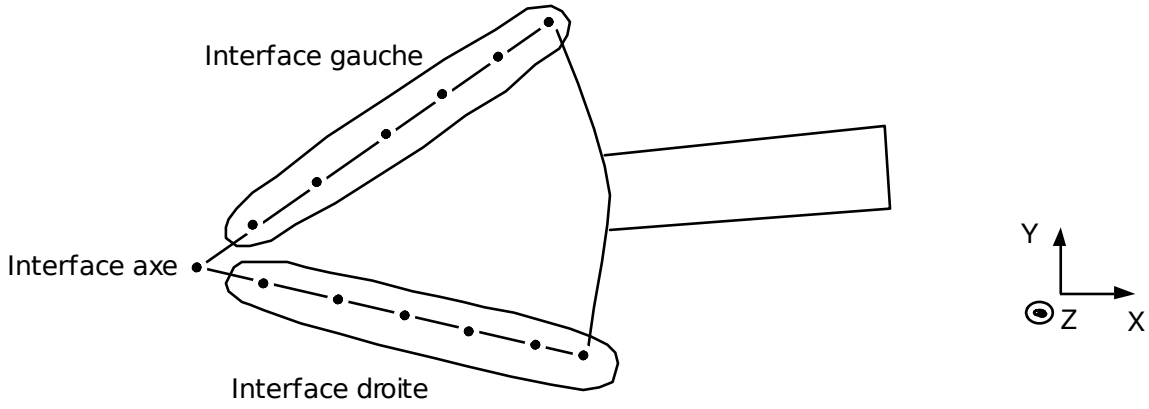

Figure 3.6-a

3.6.1 Operands PRECISION / 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 informed, it will be automatically calculated proportionally with prec and with a maximum value of coordinate of a sector.

3.7 Operand INFORMATION

◊ INFORMATION =

Level of impression

1 pas d' impression,
2 writing of the frequencies and generalized parameters obtained and the relative participations of the various modes of the base.

4 Cyclic under-structuring example

```
       ANNULAR PLATE ENCASTREE ON A HUB - METHOD OF CRAIG-BAMPTON

sector = LIRE_MAILLAGE     (  )
model  = AFFE_MODELE          (  MAILLAGE= sector,
                                 AFFE  =_F (  ALL= ' OUI',
                                              PHENOMENON = ' 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 (ALL = ' OUI',  MATER= MATER)      )
chamcar = AFFE_CARA_ELEM   (MODEL  = model,
                            HULL   = (ALL = ' OUI', EPAIS= 0,001)  )
load  = AFFE_CHAR_MECA (MODEL  = model
                            DDL_IMPO= (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 MATRICES OF RIGIDITY AND MASS OF THE BASIC SECTOR
#
rigiele = CALC_MATR_ELEM   (MODEL    = model,  LOAD    = load,
                            CHAM_MATER= chammat,  CARA_ELEM = chamcar,
                            OPTION    =   'RIGI_MECA'    )
massele = CALC_MATR_ELEM   (MODEL    = model,  LOAD    = 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     )
#
#               CALCULATION OF THE DYNAMIC MODES OF THE BASIC SECTOR
#
modes    = CALC_MODES (MATR_RIGI = matrigi,
                       MATR_MASS = matmass,
                       CALC_FREQ= _F (NMAX_FREQ= 15) )
#
#      DEFINITION OF THE INTERFACES AND THE STATIC MODES ASSOCIATE
#
lint     = DEFI_INTERF_DYNA   (NUME_DDL = numerot,   IMPR= 2,
                               INTERFACE= _F (NOM=' DROITE', TYPE=' CRAIGB',
                                             'RIGHT' GROUP_NO=,
                               MASQUE= ('DX', 'DY', 'DRZ'),          ),
                               INTERFACE= _F (NOM=' GAUCHE', TYPE=' CRAIGB',
                                             GROUP_NO= 'GAUCH',
                               MASQUE= ('DX', 'DY', 'DRZ')          )  )
#
#      CALCULATION OF THE BASE OF PROJECTION = RECOVERY OF THE DYNAMIC MODES
#                                          AND CALCULATION OF THE STATIC MODES
bamo     = DEFI_BASE_MODALE   (CLASSIQUE= _F (INTERF_DYNA= lint,   IMPR= 2,
                                              MODE_MECA  = modes,
                                              NMAX_MODE= 15)  )
#
```

```
#                          CALCULATION OF THE CYCLIC MODES
#
modcyc   = MODE_ITER_CYCL  (BASE_MODALE= bamo,  NB_MODE=15,  NB_SECTEUR=18,
                            LIAISON=_F ('RIGHT' DROITE=,'LEFT' GAUCHE=),
                            CALCULATION =_F (NB_DIAM= (0, 1,2,3),
NMAX_FREQ=2))
```