# Operator DEFI_BASE_MODALE

## 1 Goal

The goal of the operator is to define:
– the base of a dynamic under-structuring, when one cut out the complete structure in substructures;
– or bases it of a modal recombination, when the complete structure directly is treated.

The modal base obtained by this operator is of the type: 'CLASSICAL' if the modal base is made up of dynamic clean modes and of the static deformations calculated by the operator starting from a concept of the type interf_dyna_clas product by DEFI_INTERF_DYNA [U4.64.01]. The option DIAG_MASS allows to recompute a classification for the static modes so that the matrix of mass is diagonal.
The base is of type RITZ in the other cases.

The operator produces a concept of the type mode_meca.

# Contents

# 2 Syntax

```
bamo [mode_meca] = DEFI_BASE_MODALE (

♦  /  CLASSIC = _F (  ♦  INTERF_DYNA= intdyn,          [interf_dyna_clas]
                      ♦  MODE_MECA  = modes,          [l_mode_meca]
                      ◊  NMAX_MODE  = nbmodes,        [l_I]
                      ),

   /  RITZ      =  _F (  ♦  /  MODE_MECA  = modes       [l_mode_meca]
                         /  MODE_INTF  = modeintf,  / [mode_meca]
                                                    / [mult_elas]
                         /  BASE_MODALE= bamo,       [mode_meca]

                      ◊  NMAX_MODE =     nbmodes,     [l_I]
                      )
   /  DIAG_MASS  = _F (  ♦  MODE_MECA  = modes,          [l_mode_meca]
                      ♦  MODE_STAT  = modesta,        [mode_meca]
                      ),
   /  ORTHO_BASE = _F (  ♦  BASE  = modes,             / [mode_meca]
                                                   / [mult_elas]
                      ♦  MATRIX  = matrix,            [matr_asse_*]
                      ),


◊  INTERF_DYNA  =  intdyn,                            [interf_dyna_clas]

◊  NUME_REF     =  numddl,                            [nume_ddl]

◊  LIST_AMOR    =  listamor,                          [l_R8]

◊  ORTHO        =  / 'YES'
                   / 'NOT'                            [DEFECT]
   ♦  MATRIX  = matrix,                               [matr_asse_*]

◊  SOLVEUR =_F(see document [U4.50.01])

◊  TITLE = title,                                     [l_Kn]

◊  INFORMATION =   /  1,                                    [DEFECT]
                   /  2,

)
```

# 3 Operands

## 3.1 Keyword factor CLASSIC

♦ / CLASSIC = _F (
Keyword factor for the definition of a modal base of type 'CLASSICAL', when one carries out a calculation by dynamic under-structuring.

### 3.1.1 Operand INTERF_DYNA

♦ INTERF_DYNA = intdyn

Name of the concept of the type interf_dyna_clas product by DEFI_INTERF_DYNA [U4.64.01].

The operator calculates the static deformations corresponding to the various defined interfaces, while being based on the classification used for the calculation of the clean modes.

### 3.1.2 Operands MODE_MECA/NMAX_MODE

◊ MODE_MECA = modes

List of the concepts of the type mode_meca containing the clean modes of the structure.

◊ NMAX_MODE = nbmodes

List of entireties giving, for each concept mode_meca, the maximum number of modes suitable to retain. From $I^{ème}$ base modal list modes, one retains the modes then corresponding to nbmodes [I] the lowest frequencies.

In general, the length of the list of entireties, well informed under the keyword NMAX_MODE, must correspond to that of the list of the modal bases (keyword MODE_MECA). The only exception to this rule is when a single value is given in NMAX_MODE. In this case, the value of NMAX_MODE is used for each modal base.

If NMAX_MODE is not well informed, one takes to by default all the modes of each one of modal bases given under the keyword MODE_MECA.

## 3.2 Keyword factor RITZ

♦ / RITZ = _F (

Keyword allowing factor:
– in the case of a calculation by under-structuring, to build a modal base of substructure of the type 'RITZ';
– in the case of a calculation directly with the complete structure, to build an enriched modal base (for example: clean modes of vibration, which one enriches by static modes associated with external forces).

The base is made up starting from 2 occurrences of the keyword RITZ (one with the keyword MODE_MECA or BASE_MODALE, one other with the keyword MODE_INTF).

### 3.2.1 Keyword MODE_MECA

Name of the concept of the type mode_meca containing the clean modes of vibration of the structure, or substructure in the case of a calculation by under-structuring.

One can give a list of mode_meca obtained for the same structure (with boundary conditions different for example).

### 3.2.2 Keyword MODE_INTF

Name of the concept of the type mode_meca (produced by CALC_MODES [U4.52.02] or by MODE_STATIQUE [U4.52.14]) or mult_elas (produced by MACRO_ELAS_MULT [U4.51.02]) container:
– in the case of a calculation by under-structuring: the modes which one wants to use as modes of interface of under - structure;
– in the case of a calculation directly on the complete structure: modes which enrich the base by clean modes of vibration given under the keyword MODE_MECA precedent. That can for example be static deformations associated with external forces (known imposed force; force of shock associated with an obstacle; etc).

### 3.2.3 Keyword BASE_MODALE

Name of concept of the type mode_meca product by a preceding call of the operator of DEFI_BASE_MODALE [U4.64.02]. It can be entered only at the time of the first occurrence of the keyword RITZ. Second occurrence of the keyword RITZ obligatorily the keyword will contain then MODE_INTF. The name of concept mode_meca result of the operator can be different from this one or identical (it is then réentrant).

### 3.2.4 Operand NMAX_MODE

Many modes to be retained in the dynamic modes (or statics) given by one of the preceding keywords under the occurrence of the keyword RITZ . If one informs a list of mode_meca , it is necessary to give either a list of the same size for the numbers of modes to retain, or a single value (in this case, this value is applied to all the concepts mode_meca ).

If NMAX_MODE is not informed, one takes to by default all the modes.

### 3.2.5 Operand INTERF_DYNA

Dynamic interface of the substructure (to be informed if required and only if the keyword factor is used 'RITZ').

### 3.2.6 Operand NUME_REF

Classification of reference on which all fields of displacement (dynamic modes and statics) constituting the base of 'RITZ' will be reordered.

### 3.2.7 Operand LIST_AMOR

List of modal depreciation that the user can provide to enrich the modes declare under the keyword MODE_MECA. That amounts adding the depreciation reduced for these same modes if in the beginning they are real modes. This option is useful to simulate experimental results.

### 3.2.8 Operand ORTHO

Operand allowing to make a orthonormalisation of the base of Ritz (be informed if this D-orthonormalisation is wished and only if the keyword factor is used 'RITZ'). This orthonormalisation is made with an algorithm of iterative the Graam-Schmidt type (IGS) according to the version of Kahan-Parlett.

### 3.2.9 Keyword MATRIX

Name of the concept of the type matr_asse_* who will be taken into account for the scalar products at the time of the reorthonormalisation of the base of RITZ. It is an obligatory keyword if ORTHO='OUI'.

## 3.3 Keyword factor DIAG_MASS

♦ / DIAG_MASS = _F (

Keyword allowing to recompute the static modes by eliminating the dynamic contribution and while proceeding to a orthogonalisation of Graam-Schmidt.

### 3.3.1 Keyword MODE_MECA

Name of the concept of the type mode_meca containing the dynamic clean modes of the treated substructure.

### 3.3.2 Keyword MODE_STAT

Name of the concept of the type mode_meca product by the operator MODE_STATIQUE [U4.52.14] which contains the static modes.

## 3.4 Keyword factor ORTHO_BASE

♦ / ORTHO_BASE = _F (

Allowing keyword of orthonormaliser the modes of a base This orthonormalisation is made with an algorithm of iterative the Graam-Schmidt type (IGS) according to the version of Kahan-Parlett.

### 3.4.1 Keyword BASE

Name of the concept of the type mode_meca or mult_ elas containing dynamic clean modes.

### 3.4.2 Keyword MATRIX

Name of the concept of the type matr_asse_* who contains will be taken into account for the scalar products at the time of the reorthogonalisation.

## 3.5 Keyword factor SOLVEUR

◊ SOLVEUR = _F (...)

This keyword factor is optional: it makes it possible to choose another solvor of resolution of system. In the case of this order, the syntax of the keyword is restricted with two methods: one can choose between the method by default, MULT_FRONT, and methods LDLT or MUMPS. Syntax being common to several orders, please consult the handbook [U4.50.01].

## 3.6 Operand TITLE

◊ TITLE = title

Title of the concept created.

## 3.7 Operand INFORMATION

◊ INFORMATION =

Level of the furnished information in the file MESSAGE :

1 pas d' impression;
2 writing of the general information (concepts upstream, basic standard).

# 4 Examples

## 4.1 dynamic Under-structuring

Various modelings of CAS-test SDLS106 present implementation the complete of a calculation by under-structuring, with various methods (Craig-Bampton, Mc Neal, compatible grids or not, etc).

## 4.2 Enrichment of a base of clean modes with static modes

```
# calculation of the assembled matrices and the classification of the DDL
…

# calculation of the clean modes of vibration
modesvib = CALC_MODES (MATR_RIGI=K_ASSE,
                       MATR_MASS=M_ASSE,
                       CALC_FREQ=_F (NMAX_FREQ = nb_freq),
                      );

# application of an external force
force = AFFE_CHAR_MECA (MODELE=modele,
                        FORCE_NODALE=_F (NODE = 'N11',
                                         FX=800., FY = -1000.)) ;

# calculation of the static deformation associated with this external force
modestat = MODE_STATIQUE (MATR_RIGI=K_ASSE,
                          MATR_MASS=M_ASSE,
                          FORCE_NODALE=_F (NOEUD=' N11',
                                           AVEC_CMP= ('DX', 'DY')),
                         );

# construction of the enriched modal base
basemode = DEFI_BASE_MODALE (RITZ = (_F (MODE_MECA=modesvib),
                                     _F (MODE_INTF=modestat),
                                     ),
                             NUME_REF=NUMDDL,
                            );
```

The SDNL104c CAS-test presents implementation the complete of this technique.

Another example is given by the SDNL301a CAS-test, where the static deformations which enrich the base by the clean modes, are those related to external forces generated by shocks.