

## Operator PROJ\_SPEC\_BASE

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### 1 Goal

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To project one or more spectra of turbulence on one (or several) bases (S) modal (S). The spectra are defined by the operator `DEFI_SPEC_TURB` [U4.44.31]. (Or them) bases (S) modal (S) can or (can) to be defined by:

- a concept of the type `melasflu` product by the operator `CALC_FLUI_STRU` [U4.66.02],
- a concept of the type `mode_meca` product by the operator `CALC_MODES` [U4.52.02],
- a list of concepts of the type `cham_no_depl_r` corresponding to the deformations.

Allows to calculate for each definite modal base a matrix interspectrale of generalized excitations. An option makes it possible if necessary to calculate only the autospectres.

The produced concept is of type `interspectre`.

## 2 Syntax

```
tinsp [interspectre] = PROJ_SPEC_BASE

(
  ◆ SPEC_TURB          =      l_spec,          [l_spectre]

  ◆ / BASE_ELAS_FLUI  =      baseflui,        [melasflu]
    ◆ VITE_FLUI       =      vitefl          [R]
    ◇ PRECISION       = / 1.E-3              [DEFECT]
                          / prec              [R]
  / MODE_MECA         =      basemeca,        [mode_meca]
  / CHAM_NO           =      l_cham ,         [l_cham_no_DEPL_R]

  ◇ MODELE_INTERFACE =      model ,          [model]

  ◆ / GROUP_MA        =      grma,           [gr_maille]
  / ALL               =      'YES',

  ◇ VECT_X            =      l_cmpx,          [l_R]
  ◇ VECT_Y            =      l_cmpy,          [l_R]
  ◇ ORIG_AXE         =      l_coor,          [l_R]

  ◆ FREQ_INIT         =      fi,              [R]
  ◆ FREQ_FIN          =      FF,              [R]
  ◆ NB_POIN          =      Np,              [I]

  ◇ TOUT_CMP          = / 'YES'              [DEFECT]
                          / 'NOT',

  ◇ OPTION            = / 'ALL'              [DEFECT]
                          / 'DIAG',

  ◇ TITLE             =      title,          [TXM]

)
```

## 3 Operands

### 3.1 Operand SPEC\_TURB

◆ SPEC\_TURB = l\_spec

List of concepts of the type spectrum products by the operator DEFI\_SPEC\_TURB [U4.44.31] defining several spectra of turbulent excitation.

**Note:**

- 1) *The operand SPEC\_TURB the taking into account of several spectra of turbulent excitation allows. The interspectres of generalized excitations are calculated for each provided physical spectrum then are added.*
- 2) *The spectra of turbulence of type "length of correlation" apply only to the tubes of steam generators. It is possible simultaneously to project several spectra of turbulence of type "length of correlation", but the zones of excitation of each spectrum must be strictly disjointed from/to each other. The zones to which these excitations apply are defined for each spectrum, with the order DEFI\_SPEC\_TURB [U4.44.31].*
- 3) *The spectra of turbulence of type "length of correlation" cannot be combined with spectra of another type.*
- 4) *In the case of a spectrum of the type SPEC\_CORR\_CONV\_3, double projection is very consuming resources, because it is necessary to buckle on the directions, the meshes, their points of gauss and the modes (double loop), and each time to evaluate the analytical function having defined the spectrum. One advises to use this kind of spectrum on the reduced grids (less than 1000 degrees of freedom), while starting with a small number of points of frequential discretization to evaluate the computing time.*

### 3.2 Operand BASE\_ELAS\_FLUI

The operand BASE\_ELAS\_FLUI is employed when one wishes to carry out the projection of a spectrum defined by one of the keywords factors SPEC\_LONG\_COR\_n, SPEC\_FONC\_FORME or SPEC\_EXCI\_POINT of the operator DEFI\_SPEC\_TURB [U4.44.31]. In this case, one must inform the speed of the fluid vitefl.

◆ / BASE\_ELAS\_FLUI = baseflui

Concept of the type melasflu product by the operator CALC\_FLUI\_STRU [U4.66.02], which defines one or a set of modal bases on which or (which) the spectra are projected, as well as the discretization of speed.

The operator calculates a matrix of interspectres of generalized excitations  $S_{fif}^k(\omega)$  corresponding at the speed of the fluid vitefl that one must inform.

The concept melasflu provides moreover the name of the concept type\_flui\_stru product at the beginning of study by the order DEFI\_FLUI\_STRU [U4.25.01]. The concept type\_flui\_stru contains all information characteristic of the studied configuration: one finds there inter alia the data necessary to the dimensionnalisation of the projected excitation.

### 3.3 Keyword VITE\_FLUI

The operand VITE\_FLUI must be well informed if a base of the type is used melasflu.

◆ VITE\_FLUI = vitefl

Rate of flow of the fluid for the calculation of answer.

### 3.4 Keyword PRECISION

◇ PRECISION = prec

Precision on the rate of flow of the fluid (by default 1.E-3).

## 3.5 Operands MODE\_MECA or CHAM\_NO

Operands `MODE_MECA` or `CHAM_NO` are employed when one wishes to carry out the projection of a spectrum of pressure defined by one of the keywords factors `SPEC_CORR_CONV_n` of the operator `DEFI_SPEC_TURB` [U4.44.31].

/ `MODE_MECA = basemeca`

Concept of the type `mode_meca` product by the operator `CALC_MODES` [U4.52.02], which defines the modal base on which the spectra are projected. This modal base was possibly calculated by taking account of an effect of added mass fluid, by recourse to the operator `CALC_MATR_AJOU` [U4.66.01] or `MACRO_MATR_AJOU` [U4.66.11].

/ `CHAM_NO = l_cham`

List of concepts of the type `cham_no_depl_r`, which defines the deformations of the modal base on which the spectra are projected.

This manner of defining the modal base makes it possible to impose on the structure a particular type of movement; a similar approach is adopted in the operator `CALC_MATR_AJOU` [U4.66.01], where figure also the operand `CHAM_NO`.

### Note:

*The operator determines the matrix of mutual acceptance connecting the spectrum of pressure to the matrix interspectrale of generalized excitations acting on the structure:*

$$S_{fij}(\omega) = S_p(\omega) \times J_{Aij}(\omega)$$

where

- $S_p(\omega)$  is the spectral concentration of power of pressure,
- $J_{Aij}(\omega)$  is the matrix of mutual acceptance,
- $S_{fij}(\omega)$  is the matrix of the interspectres of generalized excitations.

### Note:

- If the modal base is defined by a list of the fields in the nodes (keyword `CHAM_NO`), it is imperative to inform the mechanical model associated with the elements to which the projection of the spectrum must apply (by the keyword `MODELE_INTERFACE`).
- If a modal base of type `mode_meca` is given and if the structure is modelled in thin hulls of type `DKT`, it is not obligatory to inform the keyword `MODELE_INTERFACE`.

The theoretical precise details are given in internal report HP-51/97/027/B.

## 3.6 Operand MODELE\_INTERFACE

The operand `MODELE_INTERFACE` is employed when one wishes to carry out the projection of a spectrum of pressure defined by one of the keywords factors `SPEC_CORR_CONV_n` of the operator `DEFI_SPEC_TURB` [U4.44.31].

◇ `MODELE_INTERFACE = model`

Concept of the type `model` product by the operator `AFFE_MODELE` [U4.41.01], defining:

1. That is to say the model (thermal) of interface enters the structure and the fluid used beforehand for calculation of the matrices added by `CALC_MATR_AJOU` [U4.66.01] or `MACRO_MATR_AJOU` [U4.66.11].
2. That is to say the mechanical model of the structure if this one is modelled by elements of thin hull (`DKT`).

**Note:**

*If a thermal model of interface is defined, the calculation of the coefficients of acceptance is carried out using this model, which characterizes the wet surface of the structure, by making the assumption of a homogeneous turbulence on all the interface fluid-structure.*

*If the model given is mechanical, the coefficients of acceptance can be calculated on the structure, provided that this one is modelled in thin hulls of type `DKT`.*

*If the keyword `MODELE_INTERFACE` is not informed, the mechanical model used is that which is associated with the matrix of rigidity, referred in the modal base of projection.*

**Note:**

*If the spectrum were defined analytically with the option `SPEC_CORR_CONV_3`, the model of interface must obligatorily be indicated, because projection is done by using the functions of form carried by the elements of the model.*

## 3.7 Operand `GROUP_MA/TOUT`

The operand `GROUP_MA` is employed when one wishes to carry out the projection of a spectrum of pressure defined by one of the keywords factors `SPEC_CORR_CONV_n` of the operator `DEFI_SPEC_TURB` [U4.44.31].

◆ `GROUP_MA/TOUT`

List of groups of meshes or totality of the grid, on which projection will be carried out. The groups of meshes must be part of the grid associated with the model (thermal or mechanical) used for calculation with the coefficient with acceptance.

## 3.8 Operand VECT\_X

The operand `VECT_X` is employed when one wishes to carry out the projection of a spectrum of pressure defined by one of the keywords factors `SPEC_CORR_CONV_n` of the operator `DEFI_SPEC_TURB` [U4.44.31], if correlations of `CORCOS` or of `AU YANG` are used.

◇ `VECT_X = l_cmpx`

List of three components of an unit vector  $x$  defining:

- direction of the flow on the surface of the plane structure, in the case of a correlation of `CORCOS`,
- direction of the axis of revolution of the cylindrical structure of circular section, in the case of a correlation of `AU YANG`.  
(see diagrams hereafter)

## 3.9 Operand VECT\_Y

The operand `VECT_Y` is employed when one wishes to carry out the projection of a spectrum of pressure defined by one of the keywords factors `SPEC_CORR_CONV_n` of the operator `DEFI_SPEC_TURB` [U4.44.31], if the correlation of `CORCOS` is used.

◇ `VECT_Y = l_cmpy`

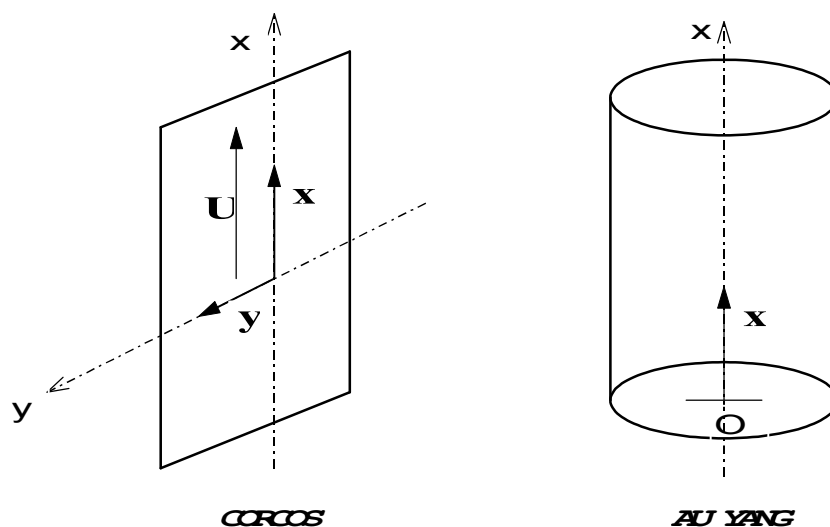
List of the three components of an unit vector  $y$  defining the orthogonal direction in the direction of the flow on the surface of the plane structure (see diagrams hereafter).

## 3.10 Operand ORIG\_AXE

The operand `ORIG_AXE` is employed when one wishes to carry out the projection of a spectrum of pressure defined by one of the keywords factors `SPEC_CORR_CONV_n` of the operator `DEFI_SPEC_TURB` [U4.44.31], if the correlation of `AU YANG` is used.

◇ `ORIG_AXE = l_coor`

List of the three coordinates defining the position of an origin  $O$  on the axis of revolution of the cylindrical structure of circular section (see diagrams hereafter).



## 3.11 Operands `FREQ_INIT`, `FREQ_FIN` and `NB_POIN`

- ◆ `FREQ_INIT` = `fi`
- ◆ `FREQ_FIN` = `FF`
- ◆ `NB_POIN` = `Np`

These operands define the waveband and the number of points of frequential discretization of the interspectres to be calculated. The number of points of discretization must be equal to a power of 2, in order to allow postprocessings of type FFT (Fast Fourier Transform). It is recommended to calculate these three elements according to the following method.

If  $(f_1^k, \dots, f_N^k)$  the frequencies of the modes indicate of  $k^{\text{ème}}$  base structure then:

$$\text{FREQ\_INIT} = \min_k \left( \frac{f_1^k}{2} \right) \quad \text{FREQ\_FIN} = \max_k \left( f_N^k + \frac{f_1^k}{2} \right)$$

The number of points of discretization can then be deduced from the minimum step in frequency defined by:

$$df = \min_{i,k} (2 \times \pi \times \mu_i^k \times f_i^k)$$

where  $\mu_i^k$  indicate the reduced damping of  $i^{\text{ème}}$  mode of  $k^{\text{ème}}$  base modal.

## 3.12 Operand `TOUT_CMP`

- ◇ `TOUT_CMP` = `'YES'` or `'NOT'`

Indicator of the components of the modal deformations which one adopts to calculate them inter - spectra of excitation on modal basis:

- `'YES'` one uses the three components in translation,
- `'NOT'` one uses only the component in translation which was defined prior to the assistance of the operator `DEFI_FLUI_STRU`.

## 3.13 Operand `OPTION`

- ◇ `OPTION` = `'ALL'` or `'DIAG'`

Indicator of the choice of calculation to be realized:

- `'ALL'` if one wishes to calculate all the interspectres of generalized excitations (option by default),
- `'DIAG'` if one wishes to calculate only the autospectres of generalized excitations.

## 3.14 Operand `TITLE`

- ◇ `TITLE` = `title`

Argument of type text defining the title attached to the concept `interspectre` at exit.