Operator **DEFI_INTE_SPEC**

### 1 Goal

To define a matrix of spectral concentration (one also says: matrix interspectrale). The terms of the matrix are defined by:

- constants (white vibration),
- existing complex functions,
- the analytical formula of KANAI-TAJIMI.

Product a structure of data of the type *interspectre*.
2 Syntax

```plaintext
intsp [interspectre] = DEFI_INTE_SPEC

◊ DIMENSION = / 1 [DEFECT]
     / N [I]

◊ PAR_FONCTION = F {
     ◆ / NUME_ORDRE_I = I [I]
        NUME_ORDRE_J = J [I]
     / NOEUD_I = nd_i [node]
        NOEUD_J = nd_j [node]
     / NOM_CMP_I = ncmp_i [KN]
        NOM_CMP_J = ncmp_j [KN]
     ◆ FUNCTION = fonction [fonction_c]
}

◊ KANAI_TAJIMI = F {
     ◆ / NUME_ORDRE_I = I [I]
        NUME_ORDRE_J = J [I]
     / NOEUD_I = nd_i [node]
        NOEUD_J = nd_j [node]
     / NOM_CMP_I = ncmp_i [KN]
        NOM_CMP_J = ncmp_j [KN]
     ◆ FREQ_MIN = / 0. [DEFECT]
        / fmin [R]
     ◆ FREQ_MAX = / 100. [DEFECT]
        / fmax [R]
     ◆ NOT = / 1. [DEFECT]
        / not [R]
     ◆ / VALE_R = valr [R]
        / VALE_C = valc [C]
     ◆ AMOR_REDUIT= / 0.60 [DEFECT]
        / amor [R]
     ◆ FREQ_MOY = / 5. [DEFECT]
        / fmoy [R]
     ◆ Interpol = | 'FLAX' [DEFECT]
        | 'LOG'
     ◆ PROL_GAUCHE= / 'EXCLUDED' [DEFECT]
        / 'CONSTANT'
        / 'LINEAR'
     ◆ PROL_DROITE= / 'EXCLUDED' [DEFECT]
        / 'CONSTANT'
        / 'LINEAR'
}
```

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◊ CONSTANT = _F (  
  ◊ / NUME_ORDRE_I = I [I]  
  ◊ NUME_ORDRE_J = J [I]  
  ◊ / NOEUD_I = nd_i [node]  
  ◊ NOEUD_J = nd_j [node]  
  ◊ / NOM_CMP_I = ncmp_i [KN]  
  ◊ NOM_CMP_J = ncmp_j [KN]  
  ◊ / FREQ_MIN = / 0. [DEFECT]  
  ◊ / fmin [R]  
  ◊ / FREQ_MAX = / 100. [DEFECT]  
  ◊ / fmax [R]  
  ◊ / NOT = / 1. [DEFECT]  
  ◊ / not [R]  
  ◊ / VALE_R = / 1. [DEFECT]  
  ◊ / valr [R]  
  ◊ VALE_C = valc [C]  
  ◊ Interpol = | 'FLAX' [DEFECT]  
  ◊ | 'LOG'  
  ◊ / PROL_GAUCE = / 'EXCLUDED' [DEFECT]  
  ◊ / 'CONSTANT'  
  ◊ / 'LINEAR'  
  ◊ / PROL_DROITE = / 'EXCLUDED' [DEFECT]  
  ◊ / 'CONSTANT'  
  ◊ / 'LINEAR'  
  )  
  ◊ TITLE = title [l_Kn]  
  ◊ INFORMATION = / 1 [DEFECT]  
  ◊ / 2  
)
3 Operands

3.1 Operand DIMENSION

◊ DIMENSION = N

Dimension of the matrix of spectral concentration, stored in a table of interspectres (tabl_intsp).

3.2 Keyword PAR_FONCTION

◊ ~ PAR_FONCTION =

Keyword factor, makes it possible to define a term (i, j) matrix interspectrale starting from concepts of the type function_c already definite.

3.2.1 Operands NUME_ORDRE_I, NUME_ORDRE_J

NUME_ORDRE_I = I
NUME_ORDRE_J = J

Couples indices (line, column) of the matrix on which one will affect a function.

These operands are excluded with the operands NOEUD_I NOEUD_J NOM_CMP_I NOM_CMP_J.

3.2.2 Operands NOEUD_I, NOEUD_J, NOM_CMP_I, NOM_CMP_J

NOEUD_I = nd_i [node]
NOEUD_J = nd_j [node]
NOM_CMP_I = ncmp_i [KN]
NOM_CMP_J = ncmp_j [KN]

These operands correspond to the names of the nodes and the components (line, column) of the matrix where one will affect a function.

These operands are excluded with the operands NUME_ORDRE_I NUME_ORDRE_J.

3.2.3 Operand FUNCTION

◊ FUNCTION: fonct

fonct is a concept of the type function_c.

3.3 Keyword KANAI_KAJIMI

◊ ~ KANAI_TAJIMI =

Keyword factor, makes it possible to define a function spectral concentration by using the model of Kanai and Tajimi. This function of spectral concentration corresponds to that of a filtered white vibration [bib2].

One gives the three parameters of the spectral concentration of the model of KANAI_TAJIMI: damping, frequency and level.

3.3.1 Operands NUME_ORDRE_I, NUME_ORDRE_J

NUME_ORDRE_I = I
NUME_ORDRE_J = J
Couples indices (line, column) of the matrix interspectrale. Not having model of spectral coherence, the model of Kanai-Tajimi only makes it possible to create auto-spectra. It is thus necessary to choose \( I = J \) (in general, one will choose \( n=1 \) and \( i=j=1 \) here). These operands are excluded with the operands \( \text{NOEUD}_I \text{ NOEUD}_J \text{ NOM_CMP}_I \text{ NOM_CMP}_J \).

\[ \text{NOEUD}_I = nd_i \quad \text{[node]} \]
\[ \text{NOEUD}_J = nd_j \quad \text{[node]} \]
\[ \text{NOM_CMP}_I = ncmp_i \quad \text{[KN]} \]
\[ \text{NOM_CMP}_J = ncmp_j \quad \text{[KN]} \]

These operands correspond to the names of the nodes and the components (line, column) of the matrix where one will affect a function. In the case of the model of Kanai-Tajimi, one chooses \( \text{NOEUD}_I = \text{NOEUD}_J \) and \( \text{NOM_CMP}_I = \text{NOM_CMP}_J \).

These operands are excluded with the operands \( \text{NUME_ORDRE}_I \text{ NUME_ORDRE}_J \).

\[ \text{AMOR_REDUIT} = \text{amor} \]
\[ \text{FREQ_MOY} = \text{fmoy} \]
\[ / \text{VALE}_R = \text{valr} \]
\[ / \text{VALE}_C = \text{valc} \]

\( \text{fmoy} \) and \( \text{amor} \) are the Eigen frequency and the reduced damping of the filter. The level can be given in the complex or real form.

For more details to see them [§3.4] and [§3.5].
if the extrapolation of the values apart from the field of definition of the parameter is prohibited (in this case if a calculation requires a value of the function out of field of definition, the code will stop in fatal error).

For example:

- PROL_DROITE = ‘CONSTANT’, PROL_GAUCHE = ‘CONSTANT’

\[
\begin{align*}
\text{y} & \quad \text{x}_1 \quad \text{x}_2 \quad \text{x}_{n-1} \quad \text{x}_n \\
\end{align*}
\]

- PROL_DROITE = ‘LINEAR’, PROL_GAUCHE = ‘EXCLUDED’

\[
\begin{align*}
\text{y} & \quad \text{x}_1 \quad \text{x}_2 \quad \text{x}_{n-1} \quad \text{x}_n \\
\end{align*}
\]

\[
\begin{align*}
\text{y} & \quad \text{x}_1 \quad \text{x}_2 \quad \text{x}_{n-1} \quad \text{x}_n \\
\end{align*}
\]

Note: The type of prolongation and interpolation are independent one of the other.

### 3.3.7 Operand Interpol

◊ Interpol =

Type of interpolation of the function enters the values of the field of definition of the function: a type for the interpolation of the parameter and for the interpolation of the function. This is obtained by providing a list of texts among:

\[
\text{INTERPOL} = (‘FLAX’, ‘LOG’)\]

‘FLAX’: linear,

‘LOG’: logarithmic curve,

Note:

If only one value is specified, she is taken into account at the same time by the interpolation of the parameter and the function. \text{INTERPOL} = ‘LOG’ is equivalent to (‘LOG’, ‘LOG’).

### 3.4 Keyword CONSTANT

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CONSTANT =

Keyword factor which allows to define a function of spectral concentration corresponding to a white vibration with band (constant spectral concentration on the waveband considered).

All the keywords under this keyword factor have the same direction as for the keyword factor KANAI_TAJIMI except AMOR and FREQ_MOY who do not have a direction here.

3.5 Operand TITLE

◊ TITLE = title

title is the title of calculation to be printed at the top of the results. See [U4.03.01].

3.6 Operand INFORMATION

◊ INFORMATION =

1: pas d' impression.
2: impression of the characteristics of the definite matrix interspectrale.

4 Example

In the example below one defines a function of spectral concentration (in terms of interspectre it is about a matrix 1 X 1) with constant value:

\[
\text{INTEREXC = DEFI_INTE_SPEC} (\\n\text{DIMENSION=1,}\\n\text{INFO=2,}\\n\text{CONSTANT=_F (}\\\n\quad \text{NUME_ORDRE_I=1,}\\\quad \text{NUME_ORDRE_J=1,}\\\quad \text{FREQ_MIN=0.,}\\\quad \text{FREQ_MAX=100.,}\\\quad \text{PAS=1.,}\\\quad \text{PROL_GAUche=' CONSTANT',}\\\quad \text{PROL_DROITE=' CONSTANT',}\\\quad \text{INTERPOL=' LIN',}\\\quad \text{VALE_C= ('IH', 1. , 0.),}\\\quad ) ) ;
\]

To define the interspectre of a white vibration filtered by an oscillator represented by the filter of KANAI - TAJIMI:
INTKTJ1 = DEFI_INTE_SPEC (  
  DIMENSION=1,  
  INFO=2,  
  KANAI_TAJIMI= F (  
    NUME_ORDRE_I=1,  
    NUME_ORDRE_J=1,  
    FREQ_MOY=15.,  
    AMOR=0.05,  
    VALE_R=1.,  
    INTERPOL=' LIN',  
    PROL_GAUCHE=' CONSTANT',  
    PROL_DROITE=' CONSTANT',  
    FREQ_MIN=0.,  
    FREQ_MAX=30.,  
    PAS=5.,  
    ),  
  ),  
) ;

The 3 parameters of the filter were given:  
1) damping = 0.05,  
2) frequency = 15. Hz,  
3) level = 1.
5 Bibliography

1) J.S. BENDAT, J. WILEGSON: “Spectral engineering application of correlation and analysis”.

2) C. DUVAL “Dynamic response under random excitations in Code_Aster: theoretical principles and examples of use”. Note DER HP-61/92-148