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## Operator CALC\_SPEC

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### 1 Drank

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To build whole or part of a matrix inter spectral or transfer from functions or of a function table.

When the selected user to return a series of functions, those Ci are used completely. When the selected user to return a `table_fonction`, the stored functions can be cut out, realised and fenestrated, with a given covering.

To clear up the matter, it is supposed that the user has 2 functions  $A$  and  $B$ . If it chooses to use the operator from functions, the definition of the interspectrum  $G_{AB}$  which it will calculate will necessarily be

$$G_{AB} = \frac{1}{N_A} FFT(A) * FFT(B)^H.$$

Where  $N_A$  is the number of points contained in the vector  $A$ . If it chooses to build a `table_fonction` with the functions  $A$  and  $B$ , it will be able to extract  $N$  under vectors  $A_1, \dots, A_N$  from the vector  $A$  (resp.  $B_1, \dots, B_N$  vector  $B$ ), and compute an interspectrum realised  $G_{AB}$  such as

$$G_{AB} = \frac{1}{N_A} \left( \frac{1}{N} \sum_{k=1}^N FFT(A_k) * FFT(B_k)^H \right).$$

The functions read are of `sd_fonction` type.

The product concept is of standard interspectrum.

# Code\_Aster

Version  
default

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Titre : Opérateur CALC\_SPEC  
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It is possible to exploit this operator in an interactive way but *command file* Code\_Aster, also by the means of operator CALC\_ESSAI (U4.90.01).

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## 2 Syntax

```
int [ interspectrum ] = CALC_SPEC
(
  ◆/TAB_ECHANT=_F (
    ◆NOM_TAB=nom [table_fonction],

    ◇/LONGUEUR_DUREE= / [R]
      /LONGUEUR_POURCENT = [R]
      /LONGUEUR_NB_PTS = [I]

    ◇/RECOUVREMENT_DUREE=/ [R]
      /RECOUVREMENT_POURCENT = [R]
      /RECOUVREMENT_NB_PTS = [I]
    ),

  /ECHANT =_F (
    ◆FONCTION=fonc/
    [fonction_sdaster]

    ◆NUMÉRIQUE_ORDRE_I=/ [I]

    ◆NUMÉRIQUE_MES=/ [I]
    ),

  ◆/INTERSPE=_F (
    ◇ FENETRE=/ "RECT" [DEFAULT]
      / "HAMM"
      / "HANN"
      / "EXPO"
      / "PART"

    ◇ DEFI_FENE=/ [1_R]
    ),

  /TRANSFERT =_F (
    ◇ ESTIM=/ "H1" [DEFAULT]
      / "H2"
      / "CO"

    ◆ REFER= [1_I]

    ◇ FENETRE=/ "RECT" [DEFAULT]
      / "HAMM"
      / "HANN"
      / "EXPO"
      / "PART"

    ◇ DEFI_FENE=/ [1_R]
    ),

  ◇ TITER=nom/ [TXM]
)
)
```

## 3 Key Keys

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### 3.1 Key word **TAB\_ECHANT**

Defines the `table_fonction` of the temporal samples and the associated parameters of processing of the signal. Cannot be associated with key word `ECHANT`.

#### 3.1.1 Key word **NOM\_TAB**

Name of the `table_fonction` in which the samples are stored. One can specify one name of `table_fonction` as starter to carry out computations.

The functions stored in the `table_fonction` correspond to the results of measurement, true or simulated, which are used as a basis for computation of the matrix of spectral concentration. All the functions stored in the `table_fonction` must be defined with the same sampling rate.

NB: The `table_fonction` must associate a sequence number and a number of measurement to each function (see sections 3.2.2 and 3.2.3 for the meaning of these parameters)

#### 3.1.2 Keywords **LONGUEUR\_DUREE/LONGUEUR\_POURCENT/LONGUEUR\_NB\_PTS**

Defines the length of the subsamples which will be retained for the processing of the signal. If the key word is not indicated, the length of the smallest sample available is affected by default. If the specified length is shorter than the length of the smallest sample, one cuts out the total sample in as much length than the specified length. This length can be specified in three different ways:

- **LONGUEUR\_DUREE** : One defines the length of the sample by their period, expressed in the same unit as that used for the vector defining times.
- **LONGUEUR\_POURCENT** : One defines the length of the sample as a percentage overall length.
- **LONGUEUR\_NB\_PTS** : One defines the length of the sample starting from the number of point which one wishes to retain.

#### 3.1.3 Key **RECOUVREMENT\_DUREE/RECOUVREMENT\_POURCENT/RECOUVREMENT\_NB\_PTS** **word**

Defines the length of covering between two subsample which will be retained for the processing of the signal. If the key word is not indicated, there is no covering, the initial sample corresponds to the juxtaposition of the subsamples. This length can be specified in three different ways:

- **RECOUVREMENT\_DUREE**: One defines the length of the sample by their period, expressed in the same unit as that used for the vector defining times.
- **RECOUVREMENT\_POURCENT** : One defines the length of the sample as a percentage overall length.
- **RECOUVREMENT\_NB\_PTS** : One defines the length of the sample starting from the number of points which one wishes to retain.

Figure 3.1.3-1 illustrates the cutting and the fenestration of an initial sample under fenestrated samples.

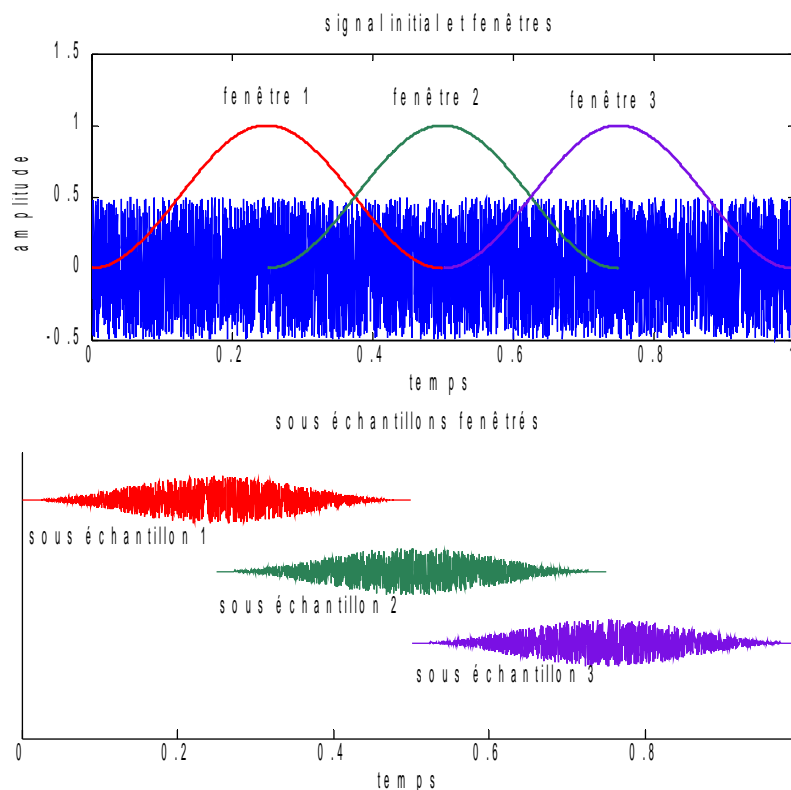


Figure 3.1.3-1: illustration of the cutting and the fenestration of an initial sample. The window applied is of Hanning type, with a covering of 50% between under samples.

## 3.2 Key word ECHANT

Key word factor where the functions used for the processing of the signal are defined. Cannot be used jointly with key word TAB\_ECH

### 3.2.1 Key word FONCTION

Name of the function containing the temporal sample.

### 3.2.2 Key word NUME\_ORDRE\_I

Defines the sequence number of the temporal sample (for example, a number of sensor, way of measurement, or point on a mesh). This compulsory key word is used to locate the interspectrums or the transfers in the concept interspectrum result

### 3.2.3 Key word NUME\_MES

Defines the number of measurement of the sample. This compulsory key word is used to locate measurements which would be carried out simultaneously, or with the same reference of phase, so that the average of the spectrums is licit. If two samples have the same number of measurement, that means that they were acquired simultaneously. It is then possible to fulfill interspectrums and transfer

functions transfer of the one compared to the other. In another case, it is impossible, because of absence of reference of phase between the two signals.

## 3.3 Key word INTERSPEC

Calculates the matrix of spectral concentration (or inter spectral) starting from the provided temporal samples.

### 3.3.1 Key word FENETRE

Defines the type of window to be applied to the temporal sample. The size of the window is adapted to the length of the sample or the subsamples, according to the treated case. Key word to be chosen among:

- RECT: Defines a rectangular window on the sample.
- HAMM: A window of Hamming defines.
- HANN: A window of Hanning defines.
- EXPO: Defines a decreasing exponential window. Key word DEFI\_FENE should then be informed.
- PART: Allows the user to define his window from a list of realities given in key word DEFI\_FENE. The list must be of the same length than the samples or subsamples considered.

### 3.3.2 Key word DEFI\_FENE

Makes it possible to the user to provide information necessary when key word FENETRE takes values "EXPO" or "PART".

- "EXPO": The list draws up of exactly two values. The first corresponds to the number of point for which the window takes value 1. The second corresponds to the slope of exponential in the beginning. These two quantities are illustrated on figure 3.3.2-1.
- "PART": The window is defined by a list of real re-entry by the user.

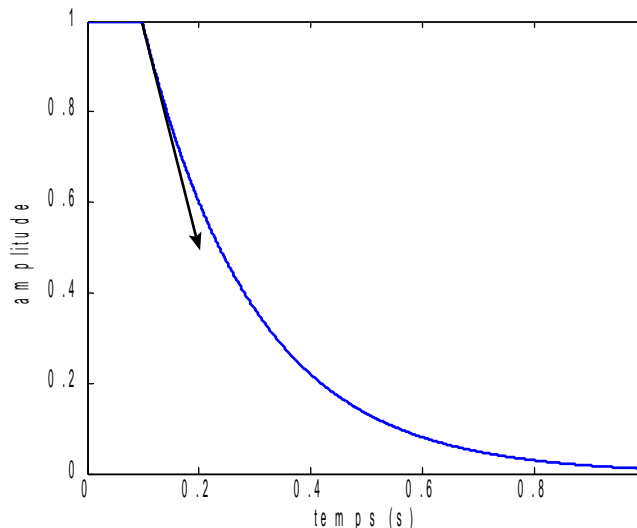


Figure 3.3.2-1: Definition of the parameters of DEFI\_FENE: width (of number of point) of the initial plate, and slope at the origin of the exponential one.

## 3.4 Key word TRANSFERT

Calculates the transfer transfer functions starting from the provided temporal samples.

### 3.4.1 Key word ESTIM

Defines the estimator to be used for the computation of the transfer transfer functions. A to choose among:

- H1: Use the estimator  $H1$
- H2: Use the estimator  $H2$ .
- CO: Calculate coherence between the estimators  $H1$  and  $H2$ .

For memory, if one has two signals  $A$  and  $B$ , the estimator  $H1$  of transfer function east  $A/B$  the transfer defines by:

$$H1(A/B) = G_{AB} / G_{BB},$$

And the estimator  $H2$  by:

$$H2(A/B) = G_{AA} / G_{AB},$$

Where  $G_{AB}$  is the interspectrum between the signals  $A$  and  $B$ . Coherence is defined by:

$$CO(A/B) = |H1/H2|.$$

The estimator  $H1$  minimizes the influence of noises on the measured outputs, and  $H2$  minimizes the influence of the noises likely to appear to the measures of the entries.

### 3.4.2 Key word REFER

Lists integers which define measurements of references for the computation of the transfers. The integers used correspond to the sequence number of the temporal samples.

### 3.4.3 Key word FENETRE

Defines the type of window to be applied to the temporal sample. See section 3.3.1.

### 3.4.4 Key word DEFI\_FENE

Makes it possible to the user to provide information necessary when key word FENETRE takes values "EXPO" or "PART". See section 3.3.2.

## 3.5 Key word TITER

Defines the title associated with the data structure interspectrum where the results are stored.



## 4 Examples

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These examples are drawn from the case test zzzz241a.

### 4.1 Computation of matrix inter spectral from a table\_fonction

the temporal responses can be stored in the form of lists in a separated file, or built on the basis of computation. One supposes here to have four responses, of respective names REP\_1, REP\_2, REP\_3 and REP\_4. It is supposed that all these measurements were carried out simultaneously. In the contrary case, it would be necessary to define a number of measurement per batch of simultaneous acquisitions.

# These four responses are initially stored in a table\_fonction :

```
tab_rep=CRÉA_TABLE (LISTE= (_F (PARA=' NOM_CHAM', LISTE_K=' Rep_Temp',),
```

# One defines the various numbers of measurements,

# associated with sensors, or DDL individuals

```
_F (PARA=' NUMÉRIQUE_ORDRE_I', LISTE_I= (1,2,3,4),),
```

# One defines the numbers of measurements. Here, 4 measurements are simultaneous,

# they thus have the same number:

```
_F (PARA=' NUMÉRIQUE_MES', LISTE_I= (1,1,1,1),),
```

# One defines the functions starting from the temporal samples.

```
_F (PARA=' FONCTION',  
    LISTE_K= ("REP_1", "REP_2", "REP_3", "REP_4"),),  
),  
TITER="",  
TYPE_TABLE='table_fonction',  
)
```

# One then selected to calculate the interspectral matrix in

# cutting out each sample in subsamples of 1201 points

# the long ones, with a 6 seconds covering, and balanced each one by

# a window of Hanning

```
SPEC=CALC_SPEC (TAB_ECHANT=_F (NOM_TAB=tab_rep,  
    LONGUEUR_NB_PTS=1201,  
    RECOUVREMENT_DUREE=6,),  
    INTERSPE= (_F (FENETRE=' HANN',),),  
)
```

## 4.2 Computation of transfer transfer function from functions

the temporal responses can be stored in the form of lists in a separated file, or built on the base of a computation. One supposes here to have two measurements carried out at different times. On the one hand, a signal of excitation `EXC_1`, and a response `REP_1` are acquired simultaneously. That can be the response with a shock, or an excitation per vibrating pot. In addition, a signal of excitation `EXC_2`, and associated response `REP_2` are also acquired simultaneously. In both cases, the signal of excitation was applied to the same point. The responses are measured at two different places. The point of excitation to sequence number 1, the point associated with the first measures number 2, and the point associated with the second measures number 3. The computation transfer functions transfer 2/1 and 3/1 is carried out as follows:

# Computation of the transfer from the impulse response:

```
FRF1_IMP=CALC_SPEC (ECHANT= (
```

# Definition of the various temporal samples

```
  _F (NUME_ORDRE_I = 1,  
      NUME_MES=1,  
      FONCTION=REP_1, ),  
  _F (NUME_ORDRE_I = 2,  
      NUME_MES=1,  
      FONCTION=REP_1, ),  
  _F (NUME_ORDRE_I = 1,  
      NUME_MES=2,  
      FONCTION=EXC_2, ),  
  _F (NUME_ORDRE_I = 3,  
      NUME_MES=2,  
      FONCTION=REP_2, ),  
  ),
```

# Definition of the parameters for the computation of the transfers:

# Choice of the estimator:

```
TRANSFERT= (_F (ESTIM=' H1 ',
```

# Choice of the window to be applied:

```
FENETRE=' EXPOSITION ',
```

# Definition complementary to the window:

```
DEFI_FENE= (10, - 0.02),
```

# Definition of the sequence numbers associated with the points of reference:

*Warning : The translation process used on this website is a "Machine Translation". It may be imprecise and inaccurate in whole or in part and is provided as a convenience.*

```
REFER=1, ),  
),  
)
```

By means of directly the functions, rather than the transition by the setting in data in a `table_fonction`, the user does not reach the possibilities of average over the length of the signal. With this intention, either it defines itself the sub-functions, by preserving this same formalism of entry, or it fills a `table_fonction`, and uses the formalism presented in section 4.1.