Macro-command CALC_ESSAI

1 Drank

Launching of the macro-command CALC_ESSAI, which allows, through a graphic interface, of launching computations of identification and expansion on telegraphic telegraphic structures and of launching computations of structural modification:

- expansion of experimental data on basis of numerical deformed shapes, by means of the macro-command MACRO_EXPANS (which carries out elementary operations EXTR_MODE, PROJ_MESU_MODAL, REST_GENE_PHYS and PROJ_CHAMP),
- identification of forces on an unspecified structure, with decomposition of motion on the basis of modal base and localization *a priori* loadings,
- structural modification: to the model evaluate the effect of a modification knowing modal experimental initial structure and the model with the finite elements of the made modification,
- processing of the signal: to control operator CALC_SPEC to compute: inter-spectrums, auto-- spectrums and FRF from temporal signals,
- visualization of the modal deformed shapes, generation of FRF “blow of hammer”, visualization of spectrums and matrixes of MAC (via Salomé or GMSH/Xmgrace/Tk).

Contents

2 Syntax

```
CALC_ESSAI (

        ◊ INTERACTIF =/"YES",                                          [DEFAULT]
                      /"NON",
```

1. Expansion of an experimental model on basis numerical (MACRO_EXPANS)

```
        ◊ EXPANSION = _F (♦ CALCUL = computation,
        [mode_meca]

                         ♦ MESURE = measurement,              [mode_meca,
        dyna_harmo]

                         ♦ NUME_MODE_CALCUL = L_I,                    [L_I]

                         ♦ NUME_MODE_MESURE = L_I,                    [L_I]

                         ◊   RESOLUTION =/"SVD",                  [DEFAULT]
                                        /"READ",

                         # If RESOLUTION = "SVD",
                               ◊ EPS = /0. ,
        [DEFAULT]
                                       /epsilon,                       [R]
                       ),
```

2. Structural modification

```
        ◊ MODIFSTRUCT  = _F (♦ MESURE = measurement,
        [mode_meca]

                            ♦ MODELE_SUP = model,                  [model]

                            ♦ MODELE_MODIF = model,                [model]

                            ♦ NUME_MODE_CALCUL = L_I,                  [L_I]

                            ♦ NUME_MODE_MESU = L_I,                    [L_I]

                            ♦ MATR_RIGI = matrix,                [matr_asse]

                            ◊ RESOLUTION =/"ES",                   [DEFAULT]
                                         /"LMME",

                            If RESOLUTION = "LMME",

                            ♦ MATR_MASS = matrix,                [matr_asse]

                           ),
```

If MODIFSTRUCT:

```
        ◊ GROUP_NO_CAPTEURS = _F (♦ GROUP_NO = gr_no,               [mode_meca]

                                 ♦ . NOM_CMP = nom_cmp,
        [matr_asse]
```

```
                            ),

◊ GROUP_NO_EXTERIEUR = _F (♦ GROUP_NO = gr_no,              [mode_meca]

                           ♦ NOM_CMP = nom_cmp,             [matr_asse]
                          ),

◊ RESU_MODIFSTRU = _F ( ◊ MODE_MECA = mode,
[mode_meca]

                        ◊ MODELS = model,                      [model]

                        ◊ MAILLAGE = mesh,                [mesh]

                        numerical ◊ NUME_DDL=,
[nume_ddl]

                        ◊ MASS_MECA = mass,                [matr_asse]

                        ◊ RIGI_MECA = raid,                [matr_asse]

                        ◊ AMOR_MECA = amor,                [matr_asse]

                        ◊ MACR_ELEM = water caltrop,
[macr_elem_stat]

                        ◊ PROJ_MESU = proj,                [mode_gene]

                       | ◊ BASE_LMME = ba_lmme,             [mode_meca]
                       | ◊ BASE_ES = ba_es,                 [mode_meca]

                        ◊ MODE_STA = modesta          [mode_stat_force]
                      ),
```

5. Identification of forces with localization a priori

```
◊ IDENTIFICATION = _F (♦ BASE = bases,
[mode_meca]

                      ♦ INTE_SPEC = intsp,
[interspectrum]

                      ♦ OBSERVABILITY = mode_obs,          [mode_meca]

                      ♦ COMMANDABILITE = mode_com,         [mode_meca]

                      ♦ RESU_EXPANSION = "OUI',
                                        /"NON" .................
[default]

                      ◊   EPS = /0. ,
[default]
                                /epsilon,                          [R]
                      ◊   ALPHA = /0. ,
[default]
                                  /alpha,                          [R]

◊  RESU_IDENTIFICATION = _F (♦ ARRAY = array,                [function]
                            ),
```

6. Traitement of the signal with operator CALC_SPEC

It does not have there a specific key word associated with this functionality:
this command cannot be used in noninteractive mode (it
is to better use operator CALC_SPEC directly), and the names
of the outgoing concepts are currently given by default:

- FRF for the functions of frequency response,
- Spec for the inter-spectrums,
- Coh for coherences.

```
                                    ),
)
```

3 Introduction

3.1 Purposes of the command

macro-command CALC_ESSAI makes it possible to carry out computations of identification from measured data: expansion of experimental data on digital model, identification of forces, and structural modification. It can function in NON-interactive mode, but it is not the most relevant way. In interactive, it uses a GUI (coded in python/Tk) which makes it possible to carry out several classification tests after by checking quality the results immediately. This use makes it possible to the user as well as possible to choose the parameters of computation to arrive at result suitable:

1) Choice of the modes of the base of expansion,
2) Choice of the points of localization a priori (for the forces, turbulent mitre),
3) Choice of the parameters of regularization,
4) …

3.2 Parameters of visualization

the macro-command used in interactive has tools making it possible to observe interesting results:

- Visualization of deformed shapes,
- Visualization of curves,
- Visualization of MAC (operator MAC_MODES, Tk visualization).

In the GUI, visualization can control with the mitre “parameters of visualization” which makes it possible to choose:

1) GMSH for the deformed shapes and XMGrace for the curves,
2) Salome.

If the user launched Salomé before the macro-command, the display of the results is made by default according to the second option. It is also possible, if one launched Salomé on a distant machine with a display locally, to return the results towards this session of Salomé, by giving the parameters of the distant machine.

3.3 Outgoing concepts

In mitre EXPANSION of the macro-command, it is possible to name the outgoing concept interactivement, and to create as many outgoing concepts thus one wishes. A each new computation, one brings up to date the menus unrolling by adding the new concepts. On the other hand, since these concepts pre-were not declared, it cannot be used in the continuation of computation, except in poursuite. In the mitre of processing of the signal, the concepts are named interactivement at the time of their creation. On the other hand, it is not possible to choose their name: the inter-spectrums are named Spec, the transfer transfer functions FRF and the functions of Coh coherence.
In the mitre of identification of forces, it is necessary pre-to declare the concepts outgoing with the call of the macro-command. In this case, one adds factor key word a RESU_IDENTIFICATION. The concepts can then be used in the continuation of computation, without having to pass by a poursuite.

4 Use of the modal expansion (EXPANSION)

4.1 Key words in mode NON-interactive

the mode of NON-interactive use of this option is not very relevant, it is especially useful for the validation. It is preferable, if one wishes to carry out a modal expansion, to directly use the command MACRO_EXPANS, or sequence PROJ_MESU_MODAL, REST_GENE_PHYS and PROJ_CHAMP.

4.1.1 Key words MESURE and NUME_MODE_MESURE

♦ MESURE = measurement,

Concept sd_resultat of the mode_meca type or dyna_harmo which contains the modes to be extended on the model numerical.
♦ NUME_MODE_MESURE = L_I,

Makes it possible to select the sequence numbers of the modes which one wishes to extend.

4.1.2 Key word CALCUL

♦ CALCUL = computation,

Concept sd_resultat of the mode_meca type which will be the base of expansion. The choice of the base of expansion is important for the quality of the results.

♦ NUME_MODE_CALCUL = L_I,

Makes it possible to select the sequence numbers of the modes which one wishes to use in the base of expansion. It is more interesting to keep only the modes which “resemble” the deformed shapes to extend, the criterion of resemblance which can be obtained by computation of MAC.

4.1.3 Key words RESOLUTION and EPS

the expansion consists of the resolution of inverse problems for the determination of generalized coefficients PROJ_MESU_MODAL. The methods of inversion and coefficients of regularization are detailed in the user's documentation of this operator (cf [U4.73.01]).

4.2 Use in interactive

In interactive, the call of the macro-command opens the following window:

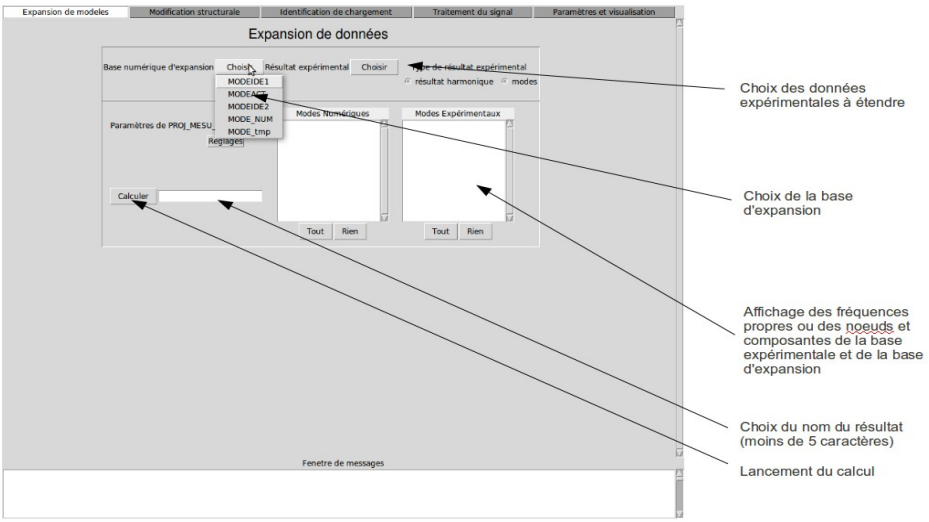


Figure **4-1** *: mitre “Expansion of data”.*

4.2.1 Theoretical principles

the principle of an expansion of data consists in finding the best combination linear of quite selected vectors (the base of expansion) allowing, projecting it on the space of measurement, to find the measured data. If one notes C, the operator of expansion of the digital model towards the space of measurement, one seeks to solve the problem of optimization according to (PROJ_MESU_MODAL in Aster):

$$\min_{\eta} \left\| C.\Phi_{num}.\eta - \Phi_{\exp} \right\|$$

The base of extend modes is then calculated in the following way (REST_GENE_PHYS in Aster):

$$\Phi_{et} = \Phi_{num}.\eta$$

The extend modes "resemble" the experimental modes, but are defined on all the nodes of the numerical mesh, which gives access data not measured by postprocessing as one would do it for any numerical computation.
The significant point is the choice of the base of expansion. The vectors which compose it can be eigen modes of the digital models, nouveau riches by fields of deformed shapes, such as static raisings.

4.2.2 Execution of computation

By leaning on the button "compute", one calculates 4 concepts leaving:

- XX_EX, extraction of the deformed shapes selected in the window "Experimental Modes",
- XX_ET, extend modes (Φ_{et}),
- XX_NX, extraction of the deformed shapes selected in the window "Numerical Modes",
- XX_RD , reprojection of the extend modes on the experimental mesh.

XX is the basic name given in the window "To export". Concept XX_RD makes it possible to check if the reprojetés modes "resemble" the extend modes. It is a quality standard.

4.2.3 Visualization

In the display window (mitre "parameters and visualization"), one can choose one or two concepts simultaneously to be visualized and compare. The comparison can be done by criterion of MAC, by superimposing the deformed shapes, or by comparing two FRF. If the concepts are dyna_harmo, the FRF is already calculated. If the concepts to be compared are bases of modes, one can simulate a FRF : while clicking on FRF, one then chooses a point of excitation, to which one applies an excitation of type "hammer" (constant spectrum on a given frequency). One chooses then a node of visualization.
When the MAC button is grayed, whereas two bases were selected in Results 1 and 2, that means that the two concepts are calculated on nume_ddl different and that the computation of MAC is not possible.

5 Structural modification (MODIFSTRUCT)

This technique of structural modification is based on the method of substructuring. The first substructure corresponds to initial structure and the second substructure corresponds to the made modification.
The initial structure is modelled starting from in experiments identified eigen modes. The second substructure is modelled numerically by finite elements. Except very particular case, the points of measurement are not at the level of the interface between initial structure and the modification. It is thus necessary to pass by an intermediate stage which consists in carrying out an expansion of measurement on the degrees of freedom interfaces. This expansion is done via the model numerical support. The following paragraphs describe the key words necessary in CALC_ESSAI for this functionality.
More details on the method and the principles of implementation in Code_Aster are given in U2.07.03 documentation.

5.1 Key words in mode NON-interactive

5.1.1 Key word MESURE

♦ MESURE = measurement [mode_meca]

measurement is the name of the concept which contains the identified eigen modes.

5.1.2 Key word MODELE_SUP

♦ MODELE_SUP = model [model]

Name of the model support on which the base of expansion is built.

5.1.3 Key word MODELE_MODIF

♦ MODELE_MODIF = model [model]

Name of the model of the modification made to initial structure.

5.1.4 Key word MATR_RIGI

♦ MATR_RIGI = matrix, [matr_asse]

Stiffness matrix defined on the model support, necessary for the computation of the static modes.

5.1.5 Key word RESOLUTION

♦ RESOLUTION = "ES", [DEFAULT]
/"LMME"

This key word makes it possible to choose the method used for computation of the base of expansion. ES corresponds to the static expansion and LMME corresponds to "Local Model Modeshapes Expansion".

5.1.6 Key word NUME_MODE_MESU

♦ NUME_MODE_MESU = L_I, [l_I]

This key word makes it possible to select the numbers of the modes to be exploited among the identified eigen modes. By default, one takes into account all the eigen modes of the concept measures.

5.1.7 Key word NUME_MODE_CALCUL

♦ NUME_MODE_CALCUL = L_I, [l_I]

This key word makes it possible to select the numbers of the modes to be used among the vectors of the base of expansion. By default, one takes into account all the vectors of the base of expansion.

5.1.8 Key word GROUP_NO_CAPTEURS

◊ GROUP_NO_CAPTEURS = _F (♦GROUP_NO = gr_no, [mode_meca]
♦NOM_CMP = nom_cmp, [matr_asse]

This factor key word makes it possible to select the list of the nodes groups which will be used for the computation of the static modes associated with the points of measurement. These nodes groups are defined on the model support.

5.1.9 Key word GROUP_NO_EXTERIEUR

◊ GROUP_NO_EXTERIEUR = _F (♦GROUP_NO = gr_no, [mode_meca]
♦NOM_CMP = nom_cmp, [matr_asse]

This factor key word makes it possible to define the “external” nodes groups where will be condensed measured information. These nodes groups must the model contain at least the interface between support and the model of the modification.

5.2 Use in interactive mode

the mitre “Modification structural” comprises the following stages of computation:

Data acquisition of entry:
The data input (concept aster) available are proposed in the form of pull-down menu. The selected user the data which correspond to its study. For the computation of the base of expansion, the user has the choice between the method ES and method LMME (see U2.07.03).

Choice of the base of expansion:
After having seized the parameters of computation, one can click on the button To validate which makes it possible to launch the computation of the base of expansion. One selects then the basic vectors which one considers being most relevant for the expansion of measurement. **The number of basic vectors must be lower or equal to the number of degrees of freedom of measurement**.

Condensation of the model and coupling of the modification to the condensed model:
This stage is activated by the button compute. This button launches a modal computation of the coupled model and evaluates the quality standard of the base of expansion.

Checking of the quality of the base of expansion:
It is considered that the base of expansion is acceptable if one arrives at well by means of representing the field of displacement to the interface two different methods. The base of expansion is supposed to be correct if the diagonal terms of MAC (scalar product) are close to 1, or if the diagonal terms of criterion IERI (energy gap) are null. The computation criterion IERI requires the seizure of a matrix of weighting. This matrix of weighting is either the stiffness matrix, or the mass matrix.

Visualization of the got results:
The display window makes it possible to compare the initial modal deformed shapes measured with the modal deformed shapes of modified structure. It also makes it possible to compare the measured

harmonic response on the structure initial selected by the user and the harmonic response on the structure modified.

The GUI associated with this functionality is presented on the following figure:

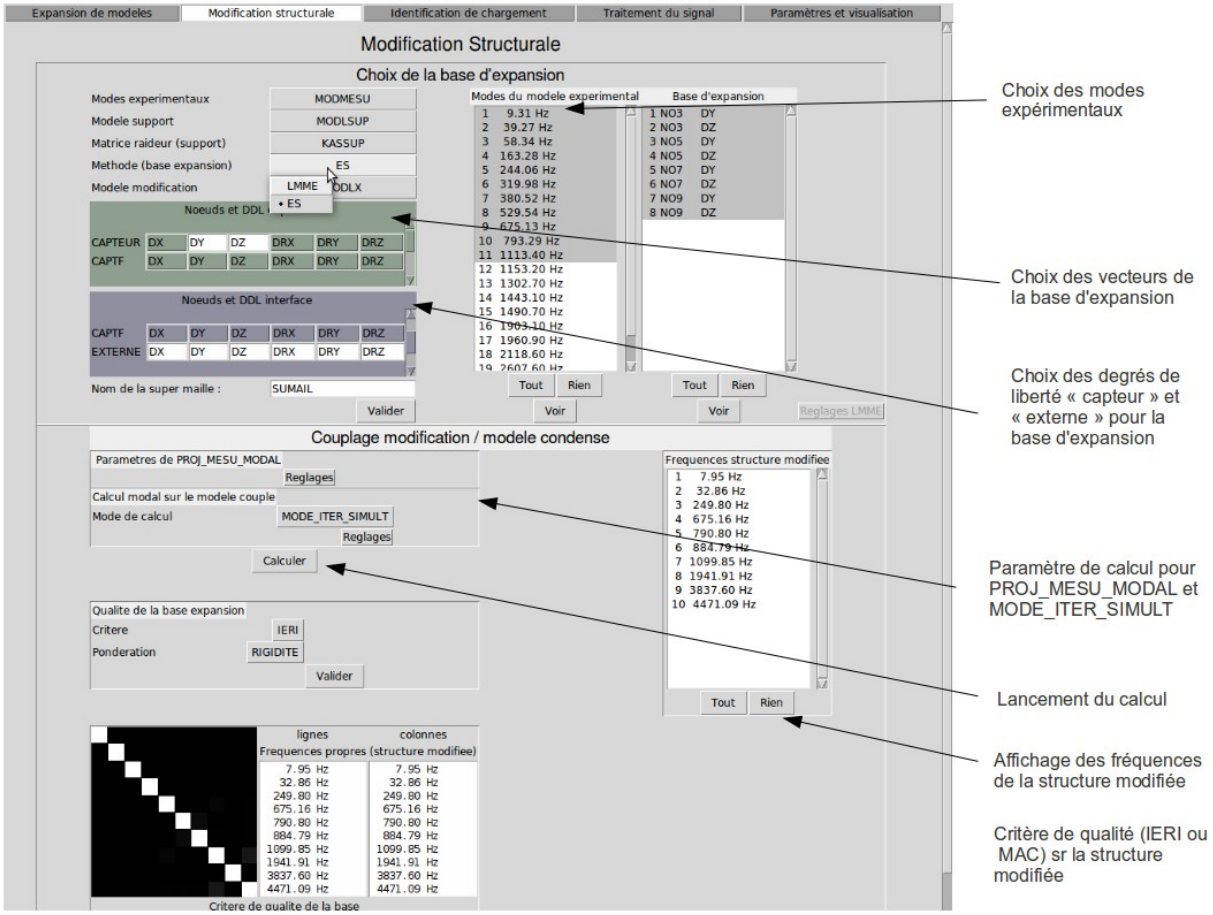


Figure 5-1 *: mitre of structural modification.*

It is pointed out that the various stages of computation and the subjacent commands are presented in detail in the U2.07.03 document.

5.3 The product concepts

the user can specify the names of the product concepts by the interface by informing factor key word `the RESU_MODIFSTRU`. These concepts could then be used for later computations.

◊ `MODE_MECA = mode, [mode_meca]`

`mode` will be the name of the concept which contains the eigen modes of modified structure.

◊ `MODELS = model, [model]`

`model` will be the name associated with the model with modified structure.

◊ `MAILLAGE = mesh, [mesh]`

`mesh` will be the name of the mesh associated with modified structure.

Numerical ◊ NUME_DDL=, [nume_ddl]

numerical will be the name of the concept nume_ddl associated with modified structure.

◊ MASS_MECA = mass, [matr_asse]

mass will be the name of the concept which contains the assembled mass matrix of modified structure.

◊ RIGI_MECA = raid, [matr_asse]

raid will be the name of the concept which contains the assembled stiffness matrix of modified structure.

◊ AMOR_MECA = amor, [matr_asse]

amor will be the name of the concept which contains the assembled damping matrix of modified structure.

◊ MACR_ELEM = macrel, [macr_elem_stat]

macrel will be the name of the concept which contains the macro-element where measurement is condensed.

◊ PROJ_MESU = proj, [mode_gene]

proj will be the name of the concept which contains the generalized coordinates of the identified modes relating to the base of expansion.

◊ BASE_LMME = balmme, [mode_meca]

balmme will be the name of the base of expansion resulting from method LMME.

◊ BASE_ES = bases, [mode_meca]

base will be the name of the base of expansion resulting from the static expansion (method ES).

◊ MODE_STAT = modest, [mode_stat_force]

modest will be the name of the concept which contains the static modes associated with the points with measurement.

6 Identification of forces located *a priori* (IDENTIFICATION)

6.1 Key words in mode NON-interactive

6.1.1 Key word INTE_SPEC

♦INTE_SPEC = intsp

Inter-spectrum which will be used for the NON-interactive mode as displacements, to find the associated forces.

6.1.2 Key word RESU_EXPANSION

◊ RESU_EXPANSION = "OUI'/"NON"

Made it possible to carry out in same command CALC_ESSAI an expansion of eigen modes, and to use result this one for the phase of identification. This functionality is not any more utliisable in NON-interactive.

6.1.3 Keywords OBSERVABILITY and COMMANDABILITE

♦OBSERVABILITE = observ
♦COMMANDABILITE = command

Concept of the mode_meca type. Correspond respectively to the objects $C\Phi$ and $\Phi^T B$ described in section 6.2. In interactive mode, one can create them from a model, of a base of deformed shapes and an assistant of selection of the active degrees of freedom. In NON-interactive mode, one can either choose a mode_meca gross, or to manufacture it with operator OBSERVATION (U4.90.03).

6.1.4 Key words ALPHA and EPS

♦ALPHA = real
♦EPS = real
Parameters of regularization. More details section 6.2.2. The parameter m cannot be parametered in NON-interactive, it is fixed at 0.

6.2 Use in interactive mode

the GUI associated with this functionality is the following one:

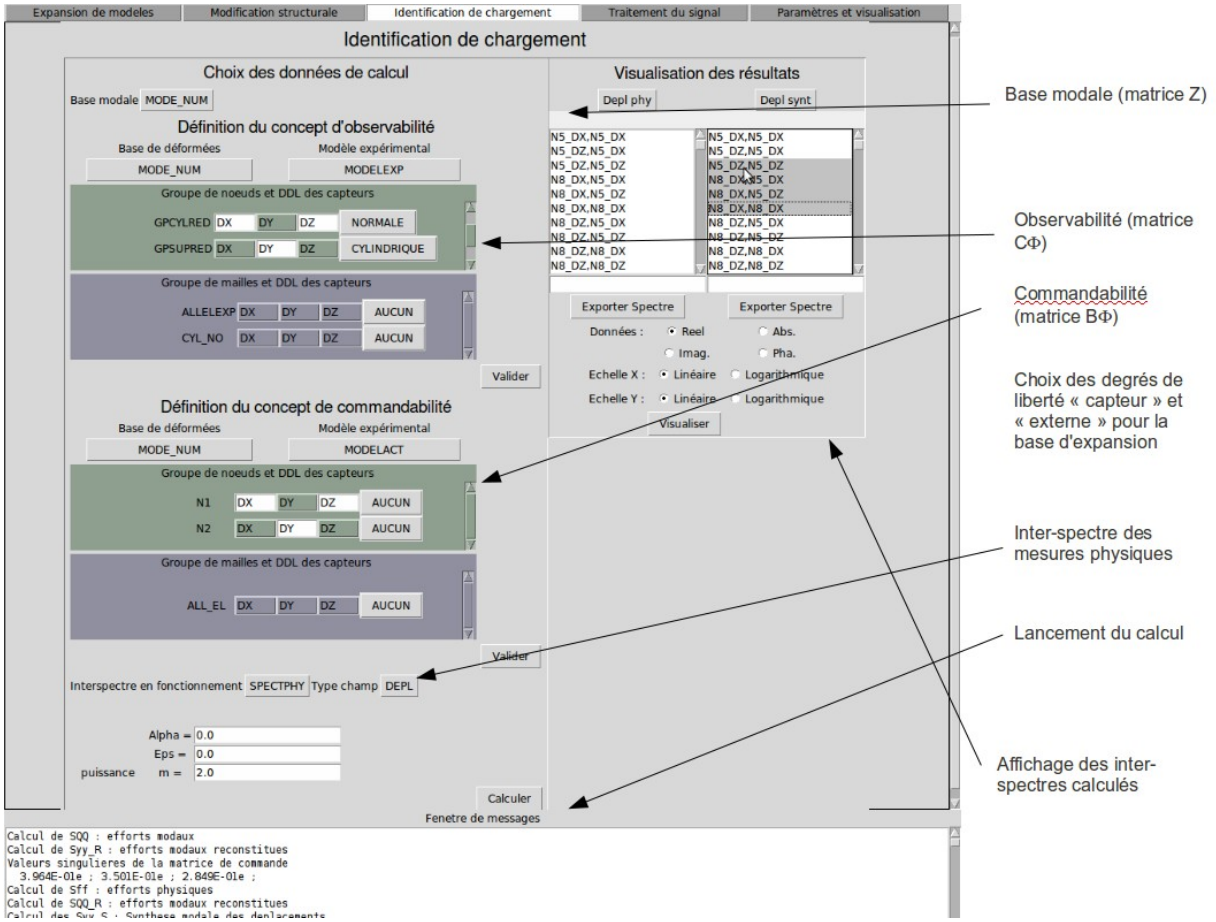


Figure **6-1** *: mitre identification of forces.*

6.2.1 Recall of the theoretical principles

the identification of the forces supposes that one can break up the motion of structure studied on modal base:

$$y(\omega)=\left[C\,\Phi\right].\left[Z(\omega)\right]^{-1.}\left[\Phi^T B\right].f(\omega)$$

In the following equations, one will omit the dependence compared to ω. Φ is a base of modal deformed shapes associated with studied structure. In theory, it is the base of the continuous deformed shapes. In practice, one in general uses a base defined on a digital model with a relatively fine discretization. This base can be calculated numerically, or be result of a modal expansion. The operator C allows to project this base of deformed shapes on the subspace of the observable degrees of freedom.
The operator B allows to project the base of deformed shapes on a set of degrees of freedom called actuators: one finds here one of the fundamental assumptions of the identification: **the identified forces are localised on degrees of freedom declared *a priori*** by the user, as one made to declare the degrees of freedom of measurement (use of operator OBSERVATION). The purpose is to decrease to the maximum the number of unknowns to be determined, which makes it possible to avoid the problems of under-determination of the problem.
To identify the forces amounts reversing the system above:

$$f=\left[\Phi^T B\right]^{-1.}\left[Z\right].\left[C\Phi\right]^{-1.}y \qquad (8\text{-}1)$$

NB: the base Φ can be different on the right and on the left from Z: it is the case when measurements available are strains. The equation connecting the force to measurement is written then:

$$f=\left[\Phi^T B\right]^{-1.}\left[Z\right].\left[C\Psi\right]^{-1.}\epsilon \qquad (8\text{-}2)$$

where the matrix Ψ is the data of the modes in strain. Attention however: to write this last equation is an abuse language, because the transition of displacements to the strains should be normally written in the operator of projection (who, let us recall it, is linear in the case of small strains), and not by replacing Φ par. Ψ But in practice, one often imports a base of modes Ψ directly since the software of measurement.

6.2.2 Concepts to use

Observability and commandability:
The computation of $\left[C\,\Phi\right]$ is made in the frame “Definition of the concept of observability”, in which one gives the base of modes Φ, and an experimental model qu contains the degrees of freedom on which one projects it. One chooses in the degrees of freedom of the experimental model (gathered by groups of node and mesh) the degrees of freedom corresponding to measurement. One can thus choose only one direction if one used during the measurement of the monoaxial sensors. It is in addition possible to carry out a change of reference. For more detail, to refer to the documentation of operator OBSERVATION (U4.90.03).

- **It is important that the nodes the components declared in the inter-spectrum are coherent with the degrees of freedom of the concept of observability**. If the inter-spectrum is read by LIRE_INTE_SPEC (FORMAT = "IDEAS"), the nodes are defined at the head of each dataset; the array then created by this operator keeps the notations of this file.

The computation of $\left[\Phi^T B\right]$ is made in the frame “Definition of the concept of commandability”. The choice of the degrees of freedom and the changes of potential references is done according to the same rule.

Each mitre has a button of basic choice, which allows, as for equation 8-2, to use two different bases.

Regularization:
The inversion of the transfer transfer function is done in two stages:

- inversion of $\left[C\Phi\right].\left[Z\right]^{-1}$, which makes it possible to calculate the modal forces,
- inversion of $\left[\Phi^T B\right]$, which makes it possible to calculate the forces on physical base.

These two stages are done by SVD (SVD of LinearAlgebra, modulus of python, which calls on a library lapack_lite, in the package numpy). It is possible to regularize the inversion of three ways:

1) truncation of the SVD (parameter ε),
2) regularization of Tikhonov (parameter α),
3) control of the slope: it is possible to multiply the parameter α by $\left(\omega-\omega_i\right)^m$, where ω_i is the own pulsation of the mode and m a parameter to be determined; that allows D to control the slope of the curve obtained for the high frequencies, when the measured signal is strongly made sound effects for out of HF.

6.2.3 Visualization of the results

In the column of right, one can visualize the following functions:

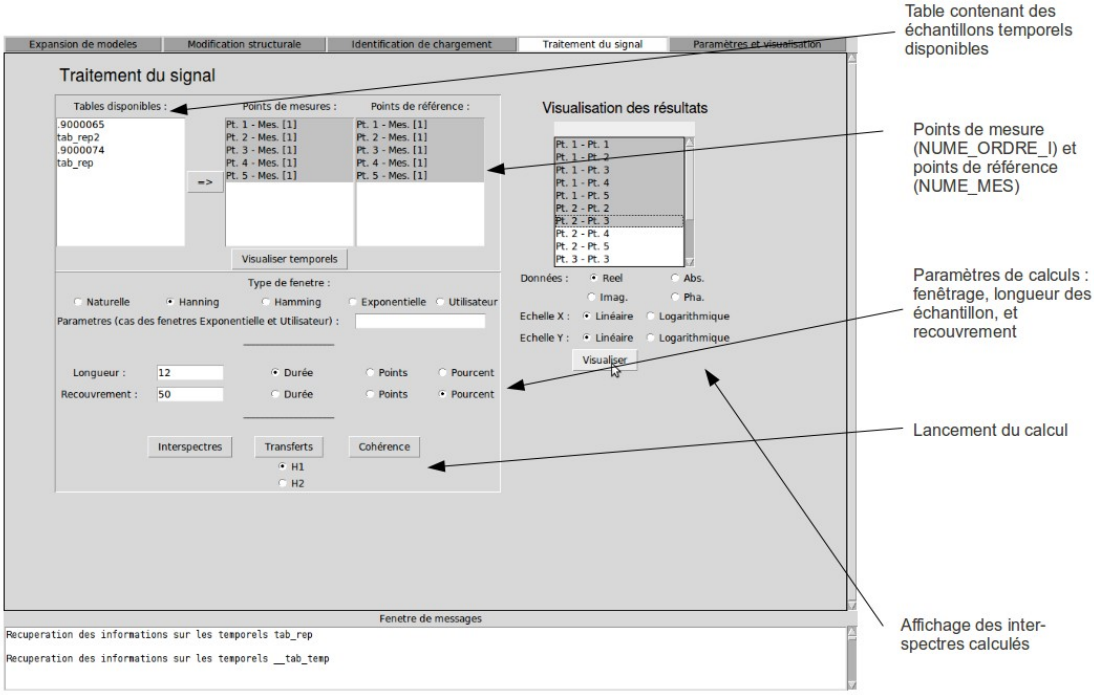
- measured inter-spectrum (`Depl phy`),
- modal forces (`EFF MOD`),
- physical displacements reconstituted starting from the modal forces (`Depl phy R`)
- physical efforts (`EFF phy`),
- modal forces reconstituted starting from physical efforts (`EFF MOD R`),
- physical displacements resynthetized starting from physical efforts (`EFF synt`),
- singular values of the matrixes $\left[C\Phi\right].\left[Z\right]^{-1}$ (`Values sing`),
- parameter of regularization $\alpha\left(\omega-\omega_i\right)^{m.}V$ (`regul`), where V is the matrixes of the eigenvectors on the right of $\left[C\Phi\right].\left[Z\right]^{-1}$ $\left(\left[C\Phi\right].\left[Z\right]^{-1}=\left[U\right].diag\left(\sigma_i\right)\left[V^H\right]\right)$.

While clicking on “Exporting inter-spectrum”, one creates a concept leaving the macro one. It is not possible to choose the name, this one pre-having been declared as starter of the macro-command, but one can add a title.
While clicking on “Displaying curve”, after having selected the curves to be visualized in the 2 columns, one launches the visualisor (XMGrace or Salomé).

7 Interface CALC_ESSAI – Mitre “Processing of the signal”

the mitre “Processing of the signal” of GUI `CALC_ESSAI` makes it possible interactivement to control operator `CALC_SPEC` of *Code_Aster.* This operator allows to build inter-spectrums, auto--spectrums and transfer functions transfers from functions corresponding to temporal samples. Various options of fenestration and average are available. The use of `CALC_SPEC`, as well as the processing carried out, are described precisely in U4.32.21 documentation. One presents here only the use of the mitre.

This mitre breaks up into three parts, distributed within the various frameworks. The first frame presents the concepts containing of information available, compatible with the processing suggested by `CALC_SPEC`. These concepts must be of table_fonction type, and contain functions whose X-coordinate is located by a list of times (`NOM_PARA=' INST'`) whose step is constant, and identical for all the functions. These functions are located by sequence numbers and of Figure



measurement 7-1: Mitre "Processing of the signal" of GUI `CALC_ESSAI`

the selection of the concept is carried out while clicking on the name of the concept, to put it in intensified brightness, then while clicking on the button presenting a pictogram of deflection (=>). The functions, located by the numbers of points (`NUME_ORDRE_I`) and measurement (`NUME_MES`), appear in the column under the title "Points of measurements". The samples likely to be used as points of reference are listed under the title "Points of reference". The selection of the data for the different processing is carried out simply by putting in intensified brightness the names of the functions.

Currently, the results generated in the mitre cannot be exported in the environment of Code_Aster. They can however be used for visualization in Xmgrace or Salomé.

8 Parameters and visualization

the GUI "Parameters and visualization" makes it possible, initially, to choose the options of visualization:

- Gmsh/Xmgrace: the results of the mode_meca `type` are displayed with Gmsh, the curves with Xmgrace and the matrixes of MAC with a graphic utility python/Tk,
- Salomé: all the results are displayed in Salomé.

The studies open Salomé are listed in the corresponding table It is not possible to work on a transfer of distant Salomé.

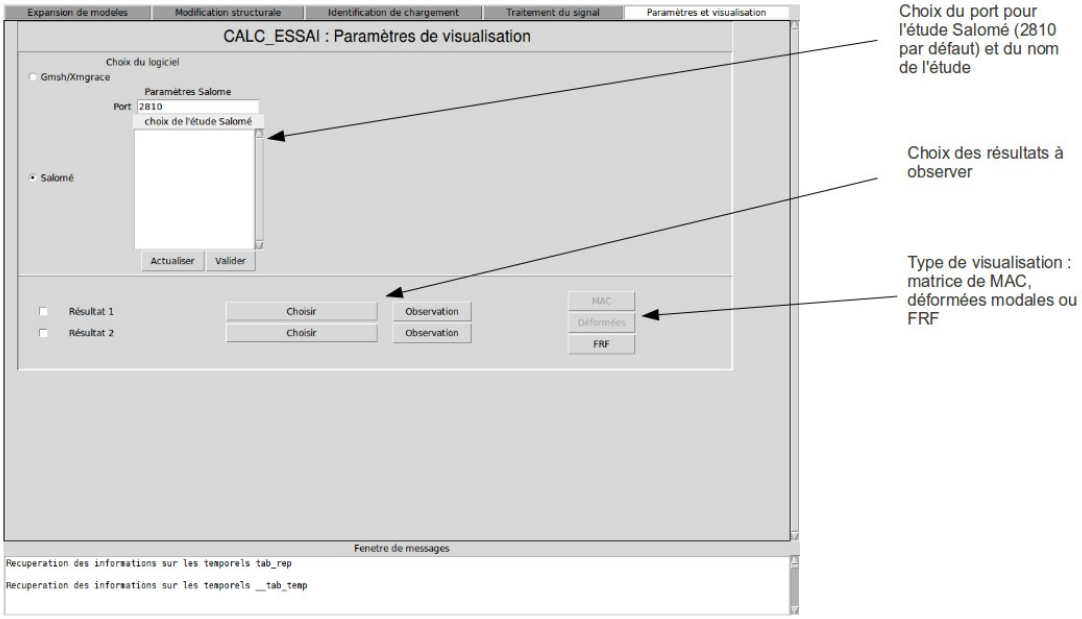


Figure 8-1: CALC_ESSAI, mitre "Parameters and visualization"

By selecting one result, one can, thereafter, click on the button "Observation" to project it on an experimental model with macro-command OBSERVATION . The following window then is opened:

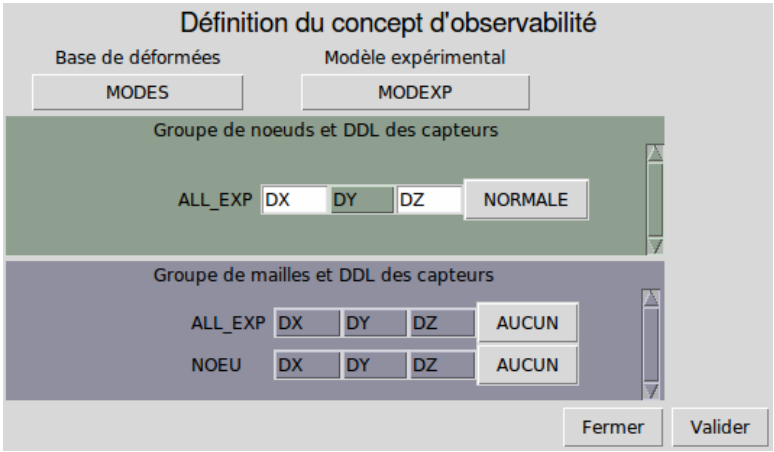


Figure 8-2: window OBSERVATION

If the result selected one were already created by OBSERVATION, then the DDL and parameters of change of reference are notched by default in the interface. It is then possible to modify them in interactive. It is currently not possible to select the nodes alone (except creating a nodes group for each node of the experimental model.