Operator MAC_MODES

1 Goal

The operator MAC_MODES allows to calculate a matrix of correlation between two modal bases. The coefficient of correlation between two vectors of this base is all the more close to 1 these two vectors are colinéaires.
It also makes it possible to calculate the difference between two modal bases by using energy criterion IERI (Indicating Energy of Regularity of Interface). This criterion is all the more close to 0 the two vectors are very close.
It also makes it possible to calculate the generalized matrix relating to the matrix of seized weighting as starter.
Product a concept of the type table_sdaster.

Contents

2 Syntax

```
mac [table_sdaster] = MAC_MODES

    (  ♦  BASE_1 = base_1  ,                          /  [mode_meca]
                                                      /  [mode_meca_c]
                                                      /  [mode_flamb]
       ♦  BASE_2 = base_2  ,                          /  [mode_meca]
                                                      /  [mode_meca_c]
                                                      /  [mode_flamb]

       ◊  IERI =        'YES'                             [KN]

       ◊  MATR_ASSE = matr,                           /  [matr_asse_depl_r]
                                                      /  [matr_asse_depl_c]


       ◊  TITLE =       /   'tit'                         [KN]

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

3 Operands

3.1 General information

The matrix of MAC (**M**odal **With**ssurance **C**riterion) indicate the correlation between two lists of vectors. It is often used to check the orthogonality of two modal bases (experimental or digital).

The 2rd line, j-ième column of the matrix of MAC is defined by the following relation:

$$MAC_{ij}=\frac{\left(\Phi_i^H W \Phi_j\right)^2}{\left(\Phi_i^H W \Phi_i\right)\left(\Phi_j^H W \Phi_j\right)}$$

Where: Φ_i is the 2rd vector of the first base,

Φ_j is the j-ième vector of the second base,

W is a matrix of weighting,

The exhibitor ^{H} indicate transposed combined.

This matrix of MAC is diagonal if the two bases are formed by the modal vectors resulting from the same structure and if the matrix of weighting is equal to the matrix of mass or stiffness of the structure considered. One speaks then about the orthogonality of the clean modes compared to the matrix about mass or stiffness. Quantity $\Phi_i^H W \Phi_j$ corresponds at the end of the matrix of stiffness (or mass) generalized if the matrix of weighting is equal to the matrix of stiffness (or of mass).

Criterion IERI (**I**ndicator **E**nergetic of **R**egularity of**I**nterface) is an energy indicator making it possible to calculate the difference between two vectors. It is defined by the following relation:

$$IERI_{ij}=\frac{\left(\left(\Phi_i-\Phi_j\right)^H W \left(\Phi_i-\Phi_j\right)\right)^2}{\left(\Phi_i^H W \Phi_i\right)^2+\left(\Phi_j^H W \Phi_j\right)^2}$$

The matrix of weighting is either the matrix of mass, or the matrix of rigidity of the structure considered.

This criterion IERI tends towards 0 if the two vectors are very close.

3.2 Operand BASE_1/BASE_2

- ♦ BASE_1 = base_1
- ♦ BASE_2 = base_2

Name of the modal concepts (mode_meca, mode_meca_c, mode_flamb) to compare. In general, one compares a digital modal base resulting from a calculation (by CALC_MODES) and an experimental modal base, imported by LIRE_RESU. The two bases must be defined on the same model and have same classification.

3.3 Operand IERI

- ◊ IERI = 'YES'

This operand is used to specify that one wants to calculate criterion IERI. In this case, the operand MATR_ASSE must be well informed. It is necessary to associate a matrix of mass or a matrix of rigidity to him.

3.4 Operand MATR_ASSE

◊ MATR_ASSE = matr

Operand indicating an assembled matrix used as weighting.

matr is the matrix of weighting which one applies to the basic vectors. It must have same classification as base1 and base2. One chooses usually the matrix of mass or the matrix of stiffness like stamps weighting.

If this operand is not indicated, the matrix of selected weighting is equal to the matrix identity.

This matrix of weighting is obligatory for the calculation of criterion IERI.

3.5 Operand TITLE

◊ TITLE = 'tit'

Optional name to give to the table.

3.6 Operand INFORMATION

◊ INFORMATION = 1 or 2

The matrix of MAC or IERI and the generalized matrix are displayed in the form of table in the file MESSAGE if INFO=2.
The name of the parameter of the table of exit, associated with the generalized matrix is Y1_W_Y2. This generalized matrix is calculated if the basic vectors are of real type.