Operator MACR_ELEM_DYNA

1 Goal

To define a dynamic macronutrient of under-structuring.

Within the framework of a transitory, modal or harmonic analysis, with dynamic under-structuring the operator MACR_ELEM_DYNA carry out the projection of the matrices of rigidity, mass and possibly of damping (analyzes harmonic) on the basis of modal substructure defined by DEFI_BASE_MODALE [U4.64.02], and the extraction of the matrices of connection of the interfaces. The result is consisted by the projected matrices and of the matrices of connection. It can be used several times with different orientations in the same model (cf. DEFI_MODELE_GENE [U4.65.02]). It can be printed on file by the order IMPR_MACR_ELEM [U7.04.33].

Product a concept of the type macr_elem_dyna.

Contents

2 Syntax

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macro_dyna [macr_elem_dyna] = MACR_ELEM_DYNA

    (       ♦  BASE_MODALE      =  bamo,                [mode_meca]
            ◊  MACR_ELEM_DYNA   =  macro_dyna,          [macR_elem_dyna]

               # Given matrices :

               ◊  /  MATR_RIGI        =  Mr.,              [matr_asse_DEPL_R]
                                                           [matr_asse_DEPL_C]

                  /  MATR_MASS        =  mm,               [matr_asse_DEPL_R]

                  /  MATR_IMPE        =  semi,             [matr_asse_gene_C]

                     # If well informed MATR_IMPE:
                     ♦  FREQ_EXTR     =  freq,            [R]
                     ◊  AMOR_SOL      =  /  0.0,          [DEFECT]
                                         /  amosol,       [R]
                     ◊  MATR_IMPE_INIT   =  mi0,          [matr_asse_gene_C]
                  /  |  MATR_IMPE_RIGI  = Mr.,            [matr_asse_gene_C]
                     |  MATR_IMPE_AMOR  = my,             [matr_asse_gene_C]
                     |  MATR_IMPE_MASS  = mm,             [matr_asse_gene_C]


               ◊  /  MATR_AMOR     =  my,                 [matr_asse_DEPL_R]
                  /  AMOR_REDUIT   =  ,                   [l_R]

               ◊  /  GROUP_NO         =  grno,            [group_no]
                  /  SANS_GROUP_NO    =  grno,            [group_no]

            # Under-structuring static:

               ◊  CAS_CHARGE = _F (
                  ♦  NOM_CAS       =  nocas  ,            [k8]
                  ♦  /  VECT_ASSE_GENE=  vgen   ,         [vect_asse_gene]
                     /  RESU_GENE=       resugen   ,      [tran_gene]
                              ),
            # manual Filling of the reduced matrices (given experimental):

               ◊  MODELE_MESURE =  _F (
                  ♦  FREQ      =  freq   ,                [l_R]
                  ♦  MASS_GENE =  mgen   ,                [l_R]
                  ◊  AMOR_REDUIT  =  xsi,                 [l_R]
                                     ),

    )
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3 Operands

3.1 Operand BASE_MODALE

♦ BASE_MODALE = bamo

Name of the concept mode_meca product by the operator DEFI_BASE_MODALE [U4.64.02].

3.2 Operand MYCR_ELEM_DYNA

◊ MYCR_ELEM_DYNA = macro_dyna

Name of the concept mydynamic cro-element of type myCr_elem_dyna identical in the name of the produced concept. It is thus D-entering when it is present. The contents of the concept are modified starting from the data of the operands MATR_IMPE* present.

3.3 Operand MATR_RIGI

◊ MATR_RIGI = Mr.

Name of the concept stamps assembled of type matr_asse_DEPL_R or matr_asse_DEPL_C product by the operator ASSE_MATRICE [U4.61.22] or the macro-order ASSEMBLY [U4.61.21] corresponding to the matrix of rigidity of the substructure.

3.4 Operand MATR_MASS

◊ MATR_MASS = mm

Name of the concept stamps assembled of type matr_asse_DEPL_R product by the operator ASSE_MATRICE [U4.61.22] or the macro-order ASSEMBLY [U4.61.21] corresponding to the matrix of mass.

These two operands are to be employed if the modal base is used bamo is of type 'RITZ'.

3.5 Operand MATR_AMOR / AMOR_REDUIT

◊ / MATR_AMOR = my

Name of the concept stamps assembled of type matr_asse_DEPL_R product by the operator ASSE_MATRICE [U4.61.22] or the macro-order ASSEMBLY [U4.61.21] corresponding to the matrix of damping viscous, specific to the macronutrient. This damping must be of RAYLEIGH type by element (linear combination of rigidity and the mass on the level of the element) and is thus defined by the properties of the material (operator: DEFI_MATERIAU [U4.43.01], operands AMOR_ALPHA and AMOR_BETA).

/ AMOR_REDUIT =

List of reduced depreciation (percentage of damping criticizes) correspondent with each mode of vibration of the macronutrient. The length of the list is (with more) equal to the number of clean modes of the modal base; if it is lower, one supplements the list with reduced depreciation equal to the last term of the list entered by the user. No damping is associated with the static modes. The matrix of damping generalized of the macronutrient k is thus diagonal incomplete (j index of the clean mode):

$$\overline{C}^k = \begin{pmatrix} \xi_j & 0 \\ 0 & 0 \end{pmatrix}$$

3.6 Operands MATR_IMPE / FREQ_EXTR / AMOR_SOL

◊ MATR_IMPE = semi

Name of the concept stamps assembled of type matr_asse_gene_C product by the operator LIRE_IMPE_MISS [U7.02.32] corresponding to the matrix of impedance of ground constitutive of the macronutrient.

♦ FREQ_EXTR = freq

Frequency of extraction of the matrix of impedance of ground necessary for the calculation of the matrix of radiative damping of ground starting from the imaginary part of the matrix mi .

◊ AMOR_SOL = amosol

Value of damping reduces material ground. It serves to distinguish in damping as the ground the properly material part and the radiative part. If it is nonnull, the radiative part C express yourself then such as:

$$2\pi\ freq\ C = Imag(mi(freq)) - 2\ amsol\ Reel(mi(freq))$$

3.7 Operand MATR_IMPE_INIT

◊ MATR_IMPE_INIT = mi0

Name of the concept stamps assembled of type matr_asse_gene_C product by the operator LIRE_IMPE_MISS [U7.02.32] correspondent with a matrix of impedance of ground constitutive of the macronutrient extracted at a quasi-worthless frequency. In particular in the cases of interaction ground-structure-fluid with the keyword ISSF=' OUI' in the call to LIRE_IMPE_MISS, that makes it possible to extract a contribution from mass M such as:

$$(2\pi\ freq)^2 M = Reel(mi0) - Reel(mi(freq))$$

3.8 Operands MATR_IMPE_RIGI/MATR_IMPE_AMOR/MATR_IMPE_MASS

| MATR_IMPE_RIGI = Mr.
| MATR_IMPE_AMOR = my
| MATR_IMPE_MASS = mm

Name of the concepts of assembled matrix of type matr_asse_gene_C products by successive calls to the operator LIRE_IMPE_MISS [U7.02.32] in order to extract the respective contributions constitutive of the macronutrient in rigidity, damping or mass of a matrix of temporal impedance of ground. If at least of the operands is indicated, without others being present, then the contributions of the latter under the macronutrient are filled and put at 0.
An example of use is provided by the test MISS03B [V1.10.122] .

3.9 OperandS GROUP_NO/SANS_GROUP_NO

◊ GROUP_NO = grno

Name of the group of nodes including the list of the nodes attaches with the degrees of freedom of the modes of interface by a relation LIAISON_INTERF (or LIAISON_SOLIDE if the dynamic interface is reduced to a node) with the nodes physical interface of the part of model on which one calculates the dynamic macronutrient. Its data is necessary only if this macronutrient is used as super-mesh of substructures defined by the keyword AFFE_SOUS_STRUC in a mixed model also including classical finite elements, and in this case, only when nodes of the interfaces physics and dynamics (the latter defined by DEFI_INTERF_DYNA) do not coincide. For example in the case of the dynamic interface reduced to a node connected by a solid connection to the physical interface.

◊ SANS_GROUP_NO = grno

Name of the group of nodes including the list of the nodes of the physical interface of the part of model on which one calculates the dynamic macronutrient. These nodes are in direct relationship to the nodes attached to the degrees of freedom of the modes of interface by a relation LIAISON_INTERF (or LIAISON_SOLIDE if the dynamic interface is reduced to a node). Its data is

necessary only if this macronutrient is used as super-mesh of substructures defined by the keyword AFFE_SOUS_STRUC in a mixed model also including classical finite elements, and in this case, only when nodes of the interfaces physics and dynamics (the latter defined by DEFI_INTERF_DYNA) do not coincide. For example in the case of the dynamic interface reduced to a node connected by a solid connection to the physical interface.

3.10 Keyword CAS_CHARGE

◊ CAS_CHARGE

This keyword factor makes it possible to define a set of loading cases **named** (keyword NOM_CAS). These loading cases are used to apply generalized vectors of load applied to the part of model on which one calculates the dynamic macronutrient so then this macronutrient is used as super-mesh of substructures in a mixed model also including classical finite elements.

3.10.1 Operand NOM_CAS

♦ NOM_CAS = nocas

The loading condensed under the name nocas (between “quotes”) corresponds to the loading defined by the argument VECT_ASSE_GENE or RESU_GENE on the part of model on which one calculates the dynamic macronutrient.

3.10.2 OperandS VECT_ASSE_GENE/ RESU_GENE

♦ VECT_ASSE_GENE = vgen

The loading condensed under the name nocas (between “quotes”) corresponds to the loading defined by Lbe argumentS alternate VECT_ASSE_GENE or RESU_GENE. It is obtained by projection that is to say of one vector assembled of load, maybe of a transitory result of force second member, applied to the part of model on which one calculates the dynamic macronutrient, on the modal basis bamo defined higher. These two options are tested simultaneously in the test SDNX101B.

3.11 Operand MODELE_MESURE

◊ MODELE_MESURE

This keyword factor makes it possible to manually fill the reduced matrices of the macronutrient, while using, for example, of the data resulting from measurements (and imported with LIRE_RESU). One must, has minimum, to return the generalized mass and the Eigen frequencies. One can also inform the list of reduced depreciation.

The well informed number of data must be equal to the number of modes of the modal base on which the macronutrient is built.

Not methodological: this kind of use of MACR_ELEM_DYNA justifies itself for the use of the method of structural modification starting from an experimental model. A presentation of the method is given in U2.07.03. **The modal base used to build the macronutrient should be made up only of the clean modes of the measured structure**, and does not have to comprise the static statements with the interface, because those are false (because not measured and, in the actual position of knowledge, nonmeasurable).

The cas-test sdll137e is an example of the implementation of methodology.

3.11.1 Operand FREQ

♦ FREQ = freq

List of the identified Eigen frequencies.

3.11.2 Operand MASS_GENE

♦ MASS_GENE = farmhouse

List of the identified generalized masses.

3.11.3 Operand AMOR_REDUIT

♦ AMOR_REDUIT = xsi

List of reduced depreciation identified.

4 Example

An example of use of this operator is given in the documentation of the operator DEFI_SQUELETTE [U4.24.01].