
Macro-command MACRO_MATR_AJOU

1 Drank

Compute in a way more condensed than with `CALC_MATR_AJOU` of the mass matrixes, of added damping or stiffness [R4.07.03]. The matrixes are induced by a fluid true, incompressible, at rest or out of potential flow, on a structure in 2D, 2D axisymmetric or in 3D.

The terms of these matrixes are calculated on the basis of the structure modal base in the vacuum.

One can also calculate by the launching of `CALC_FORC_AJOU` [U4.66.03] the vectors of the added forces induced by a seismic motion of training also calculated on the basis of the structure modal base in the vacuum.

The interest of this macro-command is primarily to mask the calls to the operators of linear thermal who calculate the hydrodynamic pressures caused by the vibration of structure in the fluid. The user should from now on and the inform only to the characteristics of his fluid field eigen modes in air of structure, the operator undertaking to calculate the added matrixes.

The possibilities of the command preserve those of operator `CALC_MATR_AJOU` [U4.66.01].

Examples of use of macro-command `MACRO_MATR_AJOU` are presented in the benchmark:

- FDLV101 [V8.01.101],
- FDLV102 [V8.01.102],
- FDLV106 [V8.01.106],
- FDLV108 [V8.01.108],
- FDLV109 [V8.01.109],
- FDLV112 [V8.01.112].

2 Syntax

```

MACRO_MATR_AJOU

(
  ◆MAILLAGE= netted [mesh]
  fluid ◆GROUP_MA_FLUIDE= [gr_ma]
  ◆GROUP_MA_INTERF= interf [gr_ma]
  ◆MODELISATION = "3D"
                /"PLANE"
                /"AXIS"
  ◆ FLUIDE =_F ( ◆ RHO= rho [R]
                ◇TOUT= "OUI"
                ◇GROUP_MA= grma
                ◇MAILLE= nets [mesh]
                )

  ◆DDL_IMPO =_F ( ◆/PRES_FLUIDE = pfluide [R]
                  /PRES_SORTIE = psortie [R]
                  ◆ /NOEUD = node [node]
                  /GROUP_NO = grno [group_no]
                  )

  ◇ ECOULEMENT =_F ( ◆ V NOR_1 = vnor1 [R]
                    ◇ V NOR_2 = vnor2 [R]
                    ◆ GROUP_MA_1 = grma1 [group_ma]
                    ◆ GROUP_MA_2 = grma2 [group_ma]
                    ◇ POTENTIEL = phi [evol_ther]
                    )

  ◆/MODE_MECA=modes [mode_meca]
  /DEPL_IMPO =chamno
[cham_no_DEPL_R]
  /MODELE_GENE =modgen [modele_gene]

  ◇ NUME_DDL_GENE = numgen [nume_ddl_gene]

  ◇ DIST_REFE =/distance [R]
                /1.0 D-2 [DEFAULT]

  ◆ | MATR_MASS_AJOU=massaj
[matr_asse_gene_R]
  | MATR_RIGI_AJOU=rigiaj
[matr_asse_gene_R]
  | MATR_AMOR_AJOU=amoraj
[matr_asse_gene_R]

  ◇/MONO_APPUI= " /MODE_STAT
  OUI' = mode [mode_meca]

  ◇ FORC_AJOU =_F ( ◇ NOEUD= No [l_noeud]
                   ◇ GROUP_NO= grno [l_group_no]
                   ◆DIRECTION= direction [l_R]
                   ◆VECTEUR= vector [vect_asse_gene]
                   )

  ◇SOLVEUR to =voir [U4.50.01]
  ◇INFO =/1 [DEFAULT]

```

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.

```
                /2  
  
        ◇NOEUD_DOUBLE =      "OUI"  
                          /  "NON"                               [DEFAULT]  
  
        ◇AVEC_MODE_STAT=/      "OUI"                               [DEFAULT]  
                          /  "NON"  
  
    );
```

Contents

1But1.....	.....
2Syntaxe2.....	.....
3Opérandes4.....	.....
3.1Opérande MAILLAGE4.....	.....
3.2Opérande GROUP_MA_FLUIDE4.....	.....
3.3Opérande GROUP_MA_INTERF4.....	.....
3.4Opérande MODELISATION4.....	.....
3.5Mot key FLUIDE4.....	.....
3.5.1Opérande RHO4.....	.....
3.5.2Opérandes TOUT/GROUP_MA/MAILLE4.....	.....
3.6Mot key DDL_IMPO4.....	.....
3.6.1Opérandes NOEUD/GROUP_NO4.....	.....
3.6.2Opérande PRES_FLUIDE5.....	.....
3.6.3Opérande PRES_SORTIE5.....	.....
3.7Mot key ECOULEMENT5.....	.....
3.7.1Opérandes GROUP_MA_1/GROUP_MA_25.....	.....
3.7.2Opérandes VNOR_1/VNOR_25.....	.....
3.7.3Opérande POTENTIEL5.....	.....
3.8Opérandes MODE_MECA/DEPL_IMPO/MODELE_GENE5.....	.....
3.9Opérandes MATR_MASS_AJOU/MATR_AMOR_AJOU/MATR_RIGI_AJOU6.....	.....
3.10Opérande DIST_REFE6.....	.....
3.11Opérande NOEUD_DOUBLE7.....	.....
3.12Opérande AVEC_MODE_STAT7.....	.....
3.13Opérande NUME_DDL_GENE7.....	.....
3.14Description of the motion of training sismique7.....	.....
3.14.1Opérande MONO_APPUI7.....	.....
3.14.2Excitation multi bearings: operand MODE_STAT8.....	.....
3.15Forces added due to the seismic motion of training: key word FORC_AJOU8.....	.....
3.15.1Opérandes NOEUD/GROUP_NO8.....	.....
3.15.2Opérande DIRECTION8.....	.....
3.15.3Opérande VECTEUR8.....	.....
3.16Mot key SOLVEUR8.....	.....

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.

3.17Opérande INFO8.....	9
4Phase of exécution9.....	9
5Exemple9.....	9
5.1Exemple 1: Computation of the added mass matrix of a structure made up of two concentric cylinders separated by a fluid incompressible9.....	9
5.2Exemple 2: MAILLAGE roll subjected to a flow.....	9

3 annulaire11

3.1 Operands Operand

Name of the mesh containing the fluid field and the fluid interface/structure. This mesh can also include structure.

3.2 Operand GROUP_MA_FLUIDE

◆ GROUP_MA_FLUIDE = fluid

Mesh groups (meshes plane in 2D and 2D axisymmetric, meshes voluminal in 3D) representing the fluid field acting on the structure studied.

3.3 Operand GROUP_MA_INTERF

◆GROUP_MA_INTERF = interf

Mesh groups representing the interface enters the fluid and the structure (meshes plane or telegraphic). It should be stressed that this mesh group can be one of those used to model the surface of structure, in particular if this one is modelled by shell elements. It is not always necessary to create a specific mesh group of interface with meshes except for whole.

3.4 Operand MODELISATION

Type of modelization to be assigned to the fluid field and the fluid interface/structure. Currently, the modelizations "PLANE" (fluid field 2D), "3D" (voluminal fluid field) and "AXIS" (axisymmetric fluid field) are only authorized.

3.5 Key word FLUIDE

Key word factor where one affects the characteristics of fluid material. If the density of the fluid varies on the fluid field, it is necessary to specify these various densities by several occurrences of the key word factor FLUIDE.

3.5.1 Operand RHO

◆RHO = rho

Value of the density of the fluid to be affected on the below definite topological entities.

3.5.2 Operands TOUT / GROUP_MA / MESH

Meshes, mesh group or totality of the fluid field where one affects the RHO density .

3.6 Key word DDL_IMPO

Key word factor by which one specifies the boundary conditions of the fluid (of Dirichlet type).

3.6.1 Operands NOEUD / GROUP_NO

Nodes or nodes groups where one imposes the boundary conditions on the fluid field.

3.6.2 Operand PRES_FLUIDE

Key word under which one specifies the value that one imposes on the hydrodynamic pressure (i.e. the disturbance of pressure created by the vibration of structure) on topological entity given Ci - above. This key word must appear at least once because it makes it possible to calculate the generating non stationary fields of pressure of the added mechanical magnitudes.

3.6.3 Operand PRES_SORTIE

Pressure of output to be imposed on a permanent flow. Key word to be used (in an occurrence different from the key word factor DDL_IMPO where PRES_FLUIDE was used) to specify the boundary conditions on the permanent quantities to calculate (like the potential permanent fluid velocities characterizing a permanent flow disturbed by vibrations). This key word is to be used only if one wants to calculate the damping matrixes and of stiffness added which require the computation of a presumed potential steady flow.

3.7 Key word ECOULEMENT

This key word factor makes it possible to determine the boundary conditions of the Neumann type when one wants to calculate a presumed potential permanent flow, to be able to calculate added damping and stiffness.

3.7.1 Operands GROUP_MA_1 / GROUP_MA_2

Names of the mesh groups respectively of entry and output of the fluid field where one imposes conditions normal velocity of entry or output of the fluid.

3.7.2 Operands VNOR_1 / VNOR_2

Actual values normal velocities of the fluid respectively at the entry and the exit of the fluid field.

3.7.3 Operand POTENTIEL

Name given by the user to the potential permanent fluid velocities if he wants possibly post-to treat it.

3.8 Operands MODE_MECA / DEPL_IMPO / MODELE_GENE

♦/MODE_MECA = dynamic

Modes modes calculated on the model structure. If there are several nonrelated structures immersed in the same fluid, for which one wants to determine the added matrixes including the terms of coupling by the fluid, the model structure which one defines gathers the totality of immersed structures. The modes used by the operator are the modes calculated for total structure.

/DEPL_IMPO = chamno

Fields at nodes of displacements affected on nodes groups defining the fluid interface/structure. By affecting such a field of displacement on (S) the group (S) of nodes of interface thanks to operator CREA_CHAMP, one can for example easily simulate modes of rigid body of structures. This operand is to be used if one wants to estimate the terms of the added matrixes and coupling for a plane geometry **without doing as a preliminary modal computation** of structure in the vacuum, and that one wants to affect these terms in discrete elements (modelization DIS_T). Operand INFO must imperatively be active to visualize the calculated terms.

Caution:

The use of this operand **excludes** that from operand `NUME_DDL_GENE`. One cannot thus do modal computation, transient or harmonic by means of operand `CHAM_NO`.

Indeed, to do calculation of modes out of water, it is necessary to have a generalized mass matrix and a generalized stiffness matrix of structure. This on the structure supposes to have done a modal computation in the vacuum (what one wants precisely to avoid).

This operand is used ultimately only **to evaluate the mass matrix, of added stiffness and damping**, and to use to couple structures of type beam by discrete elements of mass, for example.

`/MODELE_GENE = modgen`

Generalized model built by the operator `DEFI_MODELE_GENE` [U4.65.02]. This key word is to be used when one does a calculation by dynamic substructuring, and that one wants to calculate the added mass matrix coupling the group of under - structures. In this case, the substructures can be in different mesh files, these files being able to be themselves distinct from mesh file fluid. The substructures which have a repetitivity within the fluid are to be netted only once, but one will take care on the level it fluid mesh to net all the interfaces fluid/structure. Moreover, it is necessary to take care that the nodes of fluid interface coincide as well as possible with the nodes of structure interface, in order to be able to recopy, on the basis of geometrical criterion of proximity, the values of the fields of displacement of structure on the nodes of fluid interface (see operand `DIST_REFE`).

3.9 Operands `MATR_MASS_AJOU`/`MATR_AMOR_AJOU`/`MATR_RIGI_AJOU`

These keywords specify the name user of the mass matrixes, stiffness or added damping (E) that one wants to calculate. One needs at least one of these keywords to operate computation. The 3 key keys can be used simultaneously, but in the case of the use of `MATR_AMOR_AJOU` or `MATR_RIGI_AJOU`, it is necessary to inform key keys `ECOULEMENT` and `DDL_IMPO` with `PRES_SORTIE`.

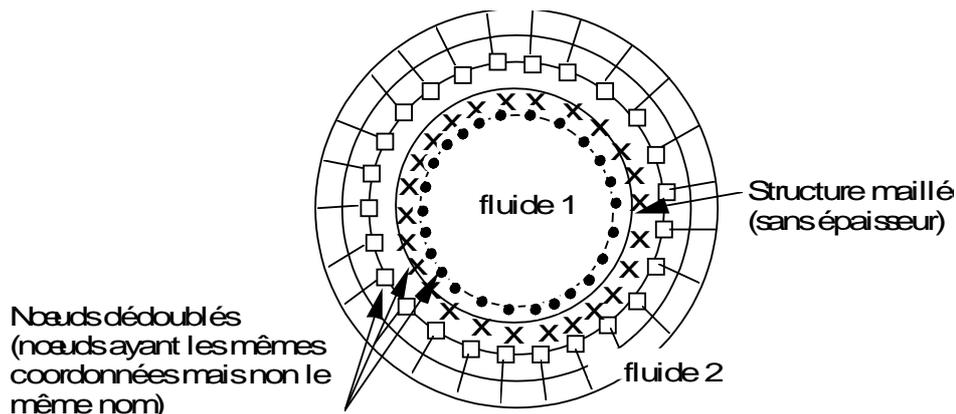
3.10 Operand `DIST_REFE`

Outdistances reference to informing when one does a calculation of **added mass** on one modele generalized. This distance is a geometrical absolute criterion of proximity intended to recopy values of structural displacements in a fluid field, in order to solve there the equation of Laplace of the field of non stationary pressure. By default, it is equal to 10-2.

3.11 Operand NOEUD_DOUBLE

◇NOEUD_DOUBLE = "OUI"

This operand is to be used when one does a calculation of **added mass** from one modele generalized which understands substructure with a grid by a mesh telegraphic or surface (*i.e without* thickness like beam or shell) and surrounded by two fluids. One needs in this case for the level it mesh to duplicate the nodes of the fluid interfaces of those of structure, in order to be able to calculate the hydrodynamic jump of pressure on both sides of structure (cf *appears* Ci - below).
Operand



3.12 AVEC_MODE_STAT ◇

AVEC_MODE_STAT = "NON" This

operand makes it possible to disconnect the computation of the terms of added mass on the static modes contained in the modal base of substructures in the case of a computation with one modele generalized (cf [§ 3.8]). Operand

3.13 NUME_DDL_GENE ◇

NUME_DDL_GENE = numgen generalized

Classification based on the mechanical modes of total structure. The presence of this operand makes it possible to calculate an added mass matrix of type `matr_asse_gene_R`. It must be necessarily present if one wants to thereafter do modal computation, harmonic or transient.
Description

3.14 of the seismic motion of training Operand

3.14.1 MONO_APPUI ◆

/MONO_APPUI = "OUI"

the structure is uniformly excited in all the bearings (motion of training of solid body).
Excitation

4 One

checks that the storage of the added matrixes is done on a full profile . It

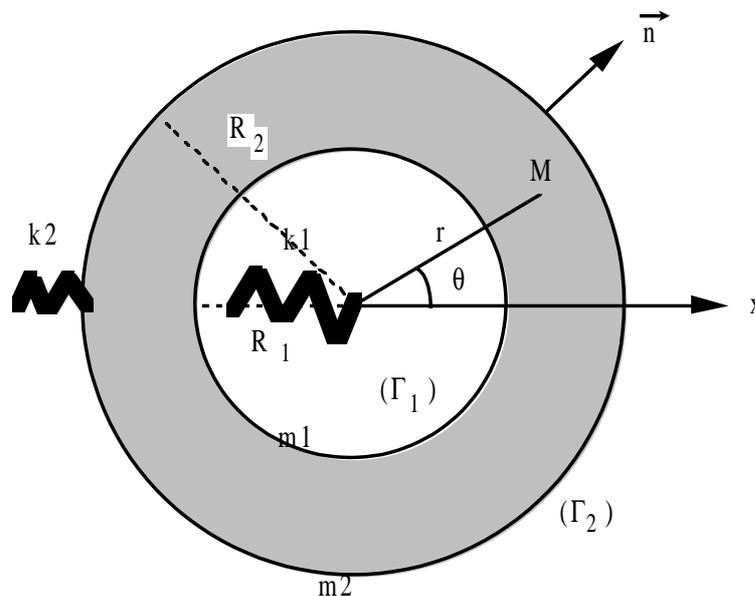
is checked that the coefficients of car added mass (diagonal terms of the matrix) are well all positive. In the contrary case, an alarm message is transmitted so that the user checks the directional sense of the norms. In the case of

a computation of added mass on one modele generalized, one informs the user on the recopies of fields of structural displacements in the fluid (many recopied values) and one indicates how to change the distance from reference (DIST_REFE) . Example

5 Example

5.1 1: Computation of the added mass matrix of a structure made up of two concentric cylinders separated by an incompressible fluid

the cylinders are supported each one by springs. The added mass matrix is calculated for the first two modes of structure, namely the modes of rigid body of each cylinder in direction OX (cf *diagram*). One will present here only the stages of the command file, because this example is inspired by benchmark FDLV101 [V8.01.101]. For the detail of the syntax of the other operators, the user will be able to thus refer to the command file of this benchmark. Assignment



1)of model structure total (including the two cylinders and their springs of self-supporting quality). 2)

Computation of the eigen modes of structure in the vacuum 3)

Generalized classification based on the calculated mechanical modes 4)

Computation of the added mass matrix of type `matr_asse_gene_r` (operand `NUME_DDL_GENE` present). So one can then calculate the eigen modes of "wet" structure MACRO

```
_MATR_AJOU (MAILLAGE = Maya, GROUP_MA_FLUIDE  
= "grfluide " , GROUP_MA_INTERF  
= grinter , MODELISATION  
= "PLANE", FLUIDE  
= _F (RHO = rho, GROUP_MA  
= "grtotal"), DDL_IMPO  
= _F (GROUP_NO = "noflui", PRES_FLUIDE  
= 0. ), MATR_MASS_AJOU  
= massaj, MODE_MECA  
= modes, NUME_DDL_GENE  
= numgen, INFO  
=1) 5)
```

Computation of the mass matrixes and stiffness generalized on the generalized classification based on the calculated mechanical modes `numgen`. These matrixes are of type `[matr_asse_gene_r]` 6)

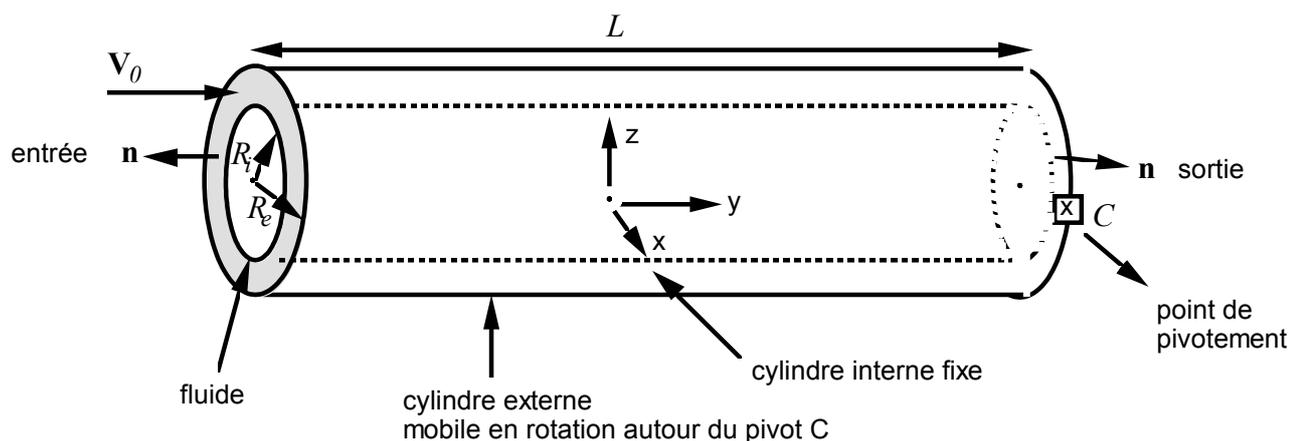
Computation of the total mass matrix of the structure (more generalized mass matrix added mass matrix) 7)

Computation of the modes of immersed structure. 8)

Restitution of the modes "wet" on physical base. Example

5.2 2: roll subjected to an annular flow This

case (very near to benchmark FDLV106 [V8.01.106]) implements the computation of mass, damping added, and stiffness added on a cylindrical structure subjected to an annular flow which one supposes potential. One calculates mass and damping initially added by flow on the structure for various velocities upstream (4 m/s, 4.24 m/s and 6 m/s), this on a model 3D for the fluid and shell for structure. The structure has a displacement of rotation around a pivot located at the downstream end of the cylinder compared to flow. 1)



After having modelled cylindrical structure and having calculated its modes in air, command MACRO_MATR_AJOU makes it possible to calculate the mass, the stiffness and damping added by the fluid flow on this structure: MACRO

```

_MACRO_MATR_AJOU ( MAILLAGE = MAYA, GROUP_MA_FLUIDE
                   = "FLUIDE", GROUP_MA_INTERF
                   = "INTERFACE", FLUIDE
                   = _F (RHO = 1000.), INFO
                   = 2, MODELISATION
                   = "3D", DDL_IMPO
                   = (_F
                     (GROUP_NO = "TEMPIMPO", PRES_FLUIDE = 0.), _F
                     (GROUP_NO = "NOSORT", PRES_SORTIE = 0.)),
                   ECOULEMENT
                   = _F (GROUP_MA_1 = "ENTERED", GROUP_MA_2
                       = "LEFT", VNOR_1
                       = -4., VNOR_2
                       = 4.), MATR_MASS_AJOU
                   = CO ("MASSAJ"), MATR_AMOR_AJOU
                   = CO ("AMORAJ"), MATR_RIGI_AJOU
                   = CO ("RIGIAJ"), MODE_MECA:
                   = MODES, NUME_DDL_GENE
                   = NUMGEN, )

```