Code_Aster

Titre : Opérateur CALC_FORC_AJOU
Responsable : GREFFET Nicolas

Version default

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a6b5f5787f25

Operator `CALC_FORC_AJOU`

1   Goal

This order makes it possible to calculate the effect of hydrodynamic overpressure due to the movement of training of the structure in seismic analysis where one breaks up the total movement moving of training and relative movement. The calculation of this force is carried out like that of the mass added by analogy thermal, but instead of taking into account only the relative movement, one obtains a force added to the second member, also projected on the modes of the structure without the fluid, to take into account the movement of training.

The calculation of the masses added [R4.07.03] by `CALC_MATR_AJOU` [U4.66.01] and that of the forces added by `CALC_FORC_AJOU` can be launched simultaneously using the macro-order `MACRO_MATR_AJOU` [U4.66.11].

Product a concept of the type `vect_asse_gene_R`

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2 Syntax

```
forceaj [vect_asse_gene_R] = CALC_FORC_AJOU

    ( ♦  MODELE_FLUIDE = fluid                    [model]

      ♦  MODELE_INTERFACE = interf                [model]

      ♦  CHAM_MATER = matflui                     [cham_mater]

      ♦  LOAD = load                          [char_ther]

      ♦  /  MODE_MECA   =  modes              [mode_meca]
         /  MODELE_GENE  =  modgen            [modele_gene]
      ◊  NUME_DDL_GENE = numgen                [nume_ddl_gene]
      ◊  DIST_REFE =  /  distance             [R]
                      /  1.E-2                 [DEFECT]
      ◊  AVEC_MODE_STAT =   /  'YES'            [DEFECT]
                            /  'NOT'
      ♦  DIRECTION =  to dir                    [l_R]
      ♦  /  MONO_APPUI = 'YES'
         /  MODE_STAT =  mode                  [mode_meca]
      ♦  /  NODE = No                        [l_noeud]
         /  GROUP_NO = grno                    [l_gr_noeud]
      ◊  NUME_MODE_MECA =   digital             [l_I]
      ◊  INFORMATION =   /  1                        [DEFECT]
                         /  2

      ◊  POTENTIAL = phi                        [evol_ther]

      ◊  SOLVEUR = to see [U4.50.01]

      ◊  NOEUD_DOUBLE =  /  'YES'
                         /  'NOT'                 [DEFECT]
    );
```

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3 Operands

3.1 Operand MODELE_FLUIDE

♦ MODELE_FLUIDE = fluid

Model **thermics** that one assigns to the part of the grid which corresponds to the fluid. The elements of edge to the fluid interface/structure must be present in the fluid model. It is on this model that one solves the equation of Laplace with boundary condition of type "fluid flow", to have the field of pressure in all the fluid and *a fortiori* the field of pressure to the fluid interface/structure.

The nodes of the elements of the fluid grid must all be numbered so that the jacobien of the element is of positive sign on all the fluid grid.
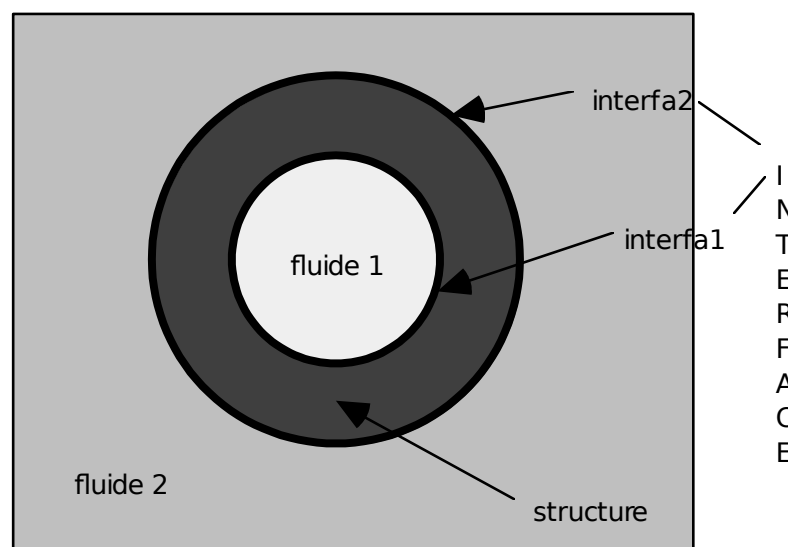
3.2 Operand MODELE_INTERFACE

♦ MODELE_INTERFACE = interf

Model **thermics** of interface gathering all the elements of edge defining the fluid interface/structure. It is on this model that one calculates the terms of the added matrices.

Calculation depends on**orientation** normal of these elements of interface. It should be taken care that this normal is directed towards **all** these elements, from the structure towards the fluid (adopted convention).

If the fluids bathing the structure are different densities, the model should be defined interfaces per as many groups of meshs not confused geometrically than there are fluids in contact with the structure. For example, a piping can have its interior surface in contact with a fluid of density 1, and its surface external in contact with a fluid of density 2. The model interface is thus built on two groups of meshs not confused geometrically, one in contact with the fluid of density 1 (interfa1) and the other in contact with the fluid of density 2 (interfa2).

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3.3   Operands CHAM_MATER / LOAD

♦   CHAM_MATER = matflui

Material field defining the fluid immersing the structure. This material is defined by characteristics **thermics** equivalent in the operator DEFI_MATERIAU [U4.43.01]. Thermal conductivity (keyword LAMBDA) is **always taken equalizes to 1.** Specific heat (keyword RHO_CP) play the part of **density of the fluid.**

♦   LOAD = load

Thermal load of type [char_ther] necessary to the resolution of the linear system rising from the equation of Laplace in the fluid. One must impose a temperature **unspecified** (which plays in fact the part of a pressure) on a node **unspecified** fluid grid, in order to make the system nonsingular. This operation is carried out with the operator AFFE_CHAR_THER [U4.44.02].

3.4   Operands MODE_MECA / MODELE_GENE

♦   /   MODE_MECA = modes

Dynamic 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 matrices including the terms of coupling by the fluid, the model structure which one defines gathers the totality of the immersed structures. The modes used by the operator are the modes calculated for the total structure.

/   MODELE_GENE = modgen

Generalized model built by the operator DEFI_MODELE_GENE [U4.65.02]. This keyword is to be used when one does a calculation by dynamic under-structuring, and that one wants to calculate the matrix of added mass coupling the whole of under - structures. In this case, the substructures can be in different files of grid, these files being able to be themselves distinct from the fluid file of grid. 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 grid 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 interface of structure, 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).

3.5   Operand DIST_REFE

Distance from reference to be informed when one does a calculation of **added force** on a generalized model. This distance is a geometrical absolute criterion intended to recopy values of structural displacements in a thermal fluid model, in order to solve there the equation of Laplace of the field of non stationary pressure. By default, it is equal to 10^{-2} Mr.

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3.6 Operand NOEUD_DOUBLE

◊ NOEUD_DOUBLE = 'YES'

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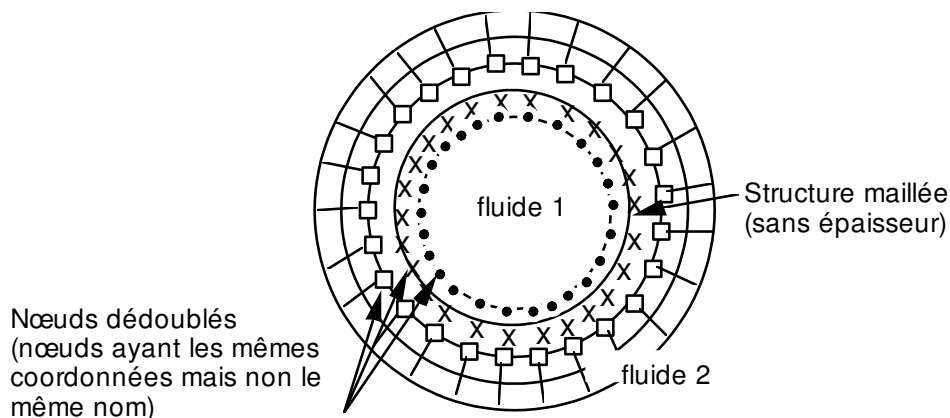
3.7 Operand POTENTIAL

◊ POTENTIAL = phi

Potential (thermal) stationary necessary to the calculation of damping and rigidity added of the structure subjected to a potential flow. This potential is produced by the operator THER_LINEAIRE [U4.54.01].

3.8 Operand DIRECTION

♦ DIRECTION = (d1, d2, d3, r1, r2, r3)

Components of a vector giving the direction of the earthquake of training in the total reference mark. It is a list of three realities if the imposed accélérogrammes are only translations. If accelerations of rotations are also imposed, a list of six realities is expected (valid for modelings with discrete elements).

3.9 Description of the movement of training

3.9.1 Operand MONO_APPUI

♦ / MONO_APPUI = 'YES'

The structure is uniformly excited in all the supports (movement of training of solid body).

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3.9.2 Excitation multi-supports

In this case, the accelerations undergone by the whole of the points of anchoring of the studied structure are not inevitably identical and in phase.

3.9.2.1 Operand MODE_STAT

/ ♦ MODE_STAT = mode

Static modes of the structure: concept of the type mode_meca product by the operator MODE_STATIQUE [U4.52.14] with the option DDL_IMPO. They correspond to the 3 or 6·nb_supports static modes where nb_supports is the number of accélérogrammes different undergone by the structure.

> **Note:**
>
> *If the structure is requested only by translations, there are then 3 nb_supports static modes.*

3.9.2.2 Operands NODE / GROUP_NO

♦ / NODE = No
/ GROUP_NO = grno

List of nodes (No) or groups of nodes (grno) of the structure subjected to the seismic excitation: these nodes support them ddl supports of the structure to which are applied the imposed movements.

3.10 Operand NUME_DDL_GENE

◊ NUME_DDL_GENE = numgen

Generalized classification based on the mechanical modes of the total structure. The presence of this operand makes it possible to calculate a matrix of added mass of type matr_asse_gene_R. It must be necessarily present if one wants to do modal, harmonic or transitory calculation thereafter.

3.11 Keyword factor SOLVEUR

See [U4.50.01].

3.12 Operand AVEC_MODE_STAT

The calculation of the terms of mass added on the static modes contained in the modal base of the substructures a calculation with a generalized model makes it possible to in the case of disconnect (*cf.* [§3.4]).

3.13 Operand NUME_MODE_MECA

Allows to specify a list of numbers of modes retained for calculation.

3.14 Operand INFORMATION

◊ INFORMATION =

Indicate the level of impression of the results of the operator on the file MESSAGE.

1: no impression
2: impression of the terms of added force.