
Operator CALC_FORC_AJOU

1 Drank

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

The computation added masses [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 macro-command MACRO_MATR_AJOU [U4.66.11].

Product a concept of the type `vect_asse_gene_R`

2 Syntax

```
forceaj [vect_asse_gene_R] = CALC_FORC_AJOU

( ♦ MODELE_FLUIDE = fluid [model]
  ♦ MODELE_INTERFACE = interf [model]
  ♦ CHAM_MATER = matflui [cham_mater]
  ♦ CHARGE = 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 [DEFAULT]
  ◊AVEC_MODE_STAT = "OUI" [DEFAULT]
  / "NON"
  ♦DIRECTION to =dir [l_R]
  ♦/MONO_APPUI = ' /MODE_STAT
  OUI' = mode [mode_meca]
  ♦ /NOEUD = No [l_noeud]
  /GROUP_NO = grno [l_gr_noeud]
  ◊ NUME_MODE_MECA =numeric [l_I]
  ◊INFO =/1 [DEFAULT]
  /2

  ◊POTENTIEL = phi [evol_ther]
  ◊SOLVEUR to =voir [U4.50.01]

  ◊NOEUD_DOUBLE = "OUI"
  / "NON" [DEFAULT]
);
```

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3 Operands

3.1 Operand MODELE_FLUIDE

◆MODELE_FLUIDE = fluid

thermal **Model** which one assigns to the part of the mesh which corresponds to the fluid. The elements of edge to the fluid interface/structure must be present in the model fluid. It is on this model that one solves the equation of Laplace with boundary condition of type "fluid flux", 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 mesh must all be numbered so that the jacobian of the element is of positive sign on all the fluid mesh.

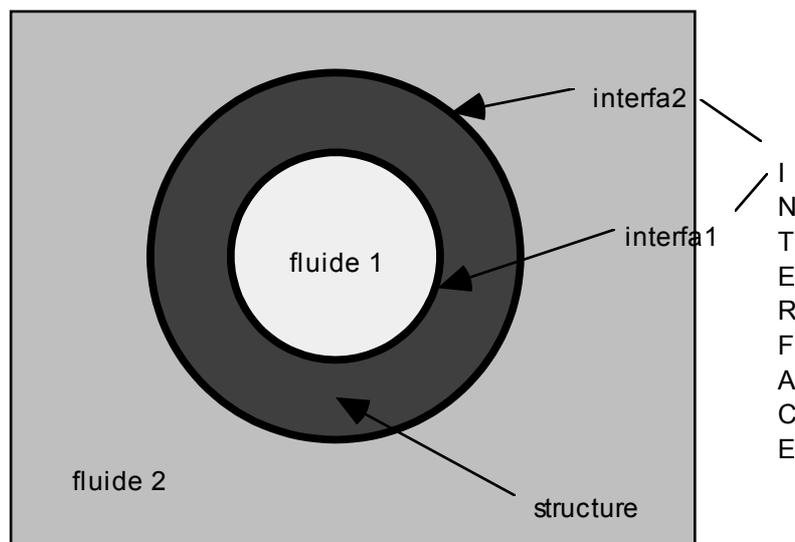
3.2 Operand MODELE_INTERFACE

◆MODELE_INTERFACE = interf

Models **thermal** of interface gathering all the edge elements defining the fluid interface/structure. It is on this model that one calculates the terms of the added matrixes.

The computation depends on **the directional sense** of the norm of these elements of interface. It is necessary to take care that this norm is directed towards **all** these elements, from structure towards the fluid (adopted convention).

If the fluids bathing structure are different densities, it is necessary the model to define interface per as many not geometrically confused mesh groups than there are fluids in contact with structure. For example, a pipework 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 mesh groups 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).



3.3 Operands CHAM_MATER / CHARGE

◆CHAM_MATER = matflui

Material field defining the fluid immersing structure. This material is defined by equivalent **thermal** characteristics in operator `DEFI_MATERIAU` [U4.43.01]. Thermal conductivity (key word `LAMBDA`) **is always taken equalizes to 1**. Specific heat (key - key `RHO_CP`) check the role of **density of the fluid**.

◆CHARGE = thermal

load 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 an unspecified **temperature** (which plays in fact the part of a pressure) on an unspecified **node** of the fluid mesh, in order to make the system nonsingular. This operation is carried out with operator `AFFE_CHAR_THER` [U4.44.02].

3.4 Operands MODE_MECA / 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.

/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`).

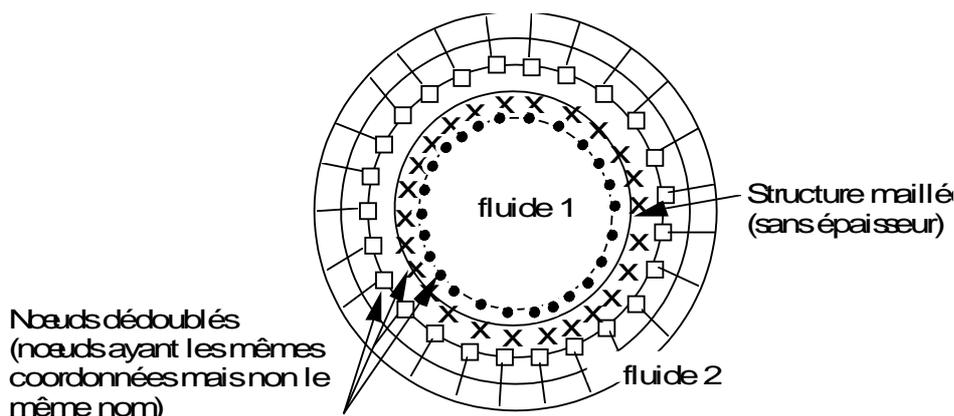
3.5 Operand DIST_REFE

Outdistances reference to informing when one does a calculation of **force added** on one modele generalized. 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.

3.6 Opérande NOEUD_DOUBLE

◇NOEUD_DOUBLE = "OUI"

This operand is to be used when one does a calculation of **force added** 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



3.7 POTENTIEL ◇

POTENTIEL = Potential phi

(thermal) steady necessary to the computation of damping and the stiffness added of structure subjected to a potential flow. This potential is produced by the operator THER_LINEAIRE [U 4.54.01]. Operand

3.8 DIRECTION ◆

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

of a vector giving the direction of the seisme of training in the total reference. It is a list of three realities if the imposed accelero grams are only translations. If accelerations of rotations are also imposed, a list of six realities is expected (valid for modelizations with discrete elements).
Description

3.9 of the motion of training Operand

3.9.1 MONO_APPUI ◆

/MONO_APPUI = "OUI"

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

3.9.2 multi-bearings In this case,

the accelerations undergone by all the points of anchorage of studied structure are not inevitably identical and in phase. Operand

3.9.2.1 MODE_STAT /♦

MODE_STAT = static Modes

mode of structure: concept of type `_meca mode` produces by the operator `MODE _STATIQUE` [U 4.52.14] with option `DDL_IMPO`. They correspond to the 3 or $6 \cdot \text{nb_supports}$ static modes where `nb_supports` is the number of different accelerograms undergone by structure. Note:

If

the structure is requested only by translations, there are then 3 `nb_supports` static modes. Operands

3.9.2.2 NOEUD / GROUP_NO ♦

/ NOEUD = No /GROUP_NO
= grno Nodes list

(no) or nodes groups (grno) of structure subjected to the seismic excitation: these nodes support the d.o.f. of the bearings of structure to which are applied imposed motions. Operand

3.10 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. Key word

3.11 factor solver See

[U4.50.01]. Operand

3.12 AVEC_MODE_STAT 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 [§ 3.4]). Operand

3.13 NUME_MODE_MECA Makes it possible

to specify a list of numbers of modes retained for computation. Operand

3.14 INFO ♦

INFO = Indicates

the level of printing of the results of the operator on the message file . 1

: no printing 2

: printing of the terms of added force.