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## Operator DEFI\_FLUI\_STRU

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### 1 Drank

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To define the characteristics necessary under investigation dynamic of a structure under flow. By the choice of one of the key words factors, the user specifies the type of configuration "structure - flow" studied: tube bundle under transverse or axial flow, control rod, shells coaxial. According to the type of configuration, the abundant data make it possible to realize downstream:

- a study of coupling fluid/structure: estimate of the coefficients of forces fluid-elastics and computation of the new modal parameters of structure using the operator `CALC_FLUI_STRU` [U4.66.02],
- projection on modal base under flow of one or several turbulent excitations defined by their (S) density (S) spectral (S): operators `DEFI_SPEC_TURB` [U4.44.31] and `PROJ_SPEC_BASE` [U4.63.14]. One can then calculate the response of structure with the turbulent excitation, into temporal and frequential.

Operator "DEFI\_FLUI\_STRU" produces a concept of the `type_flui_stru` type intended to be used downstream by operators `FONC_FLUI_STRU` [U4.35.02], `CALC_FLUI_STRU` [U4.66.02] or, indirectly, `PROJ_SPEC_BASE` [U4.63.14].

## 2 Syntax

```

typeflui [type_flui_stru] = DEFI_FLUI_STRU (
  ◆/FAISCEAU_TRANS =_F (
    ◇COUPLAGE=/ "OUI" [kN]
    / "NON",
    will ◇CARA_ELEM=cara , [cara_elem]
    ◆PROFESSEUR_VITE_FLUI=profv , [function,
formula]
    ◇PROFESSEUR_RHO_F_INT=profrhoi , [function,
formula]
    ◇PROFESSEUR_RHO_F_EXT=profrhoe , [function,
formula]
    ◇NOM_CMP=/ "DX" [kN]
    / "DY"
    / "DZ",
    ◇COEF_MASS_AJOU=cm , [R]
    ◇CSTE_CONNORS=cste , [l_R]
    ◇ RHO_TUBE=rho , [R]
    ◇ NB_CONNORS=nb , [I]
    ◇TYPE_PAS=/ "CARRE_LIGN"
    / "TRIA_LIGN",
    ◇TYPE_RESEAU=/tr , [I]
    ◇UNITE_CA=/iu1 , [I]
    /70 , [DEFAULT]
    ◇UNITE_KA=/iu2 , [I]
    /71 , [DEFAULT]
    ◇PAS=pas , [R]
  ) ,
  /GRAPPE =_F (
    ◆COUPLAGE=/ "OUI" [kN]
    / "NON" ,
    ◇/◆GRAPPE_2=/ "ASC_CEN" [kN]
    / "ASC_EXC"
    / "DES_CEN"
    / "DES_EXC" ,
    ◆NOEUD=no , [node]
    will ◆CARA_ELEM=cara ,
[cara_elem]
    ◆MODELE=modele , [model]
    ◇COEF_MASS_AJOU=cm1 , [R]
    ◆ RHO_FLUI=rho_f , [R]
  ) ,
  /FAISCEAU_AXIAL =_F (
    ◆ /GROUP_MA =l_grma ,
[l_gr_ma]
    /TRI_GROUP_MA = "racine*"
    / "*racine*"
    / "*racine",
    ◆VECT_X=l_comp , [l_R]
    ◆PROFESSEUR_RHO_FLUI=profrho ,
[function]

```

```

        ◆PROFESSEUR_VISC_CINE=profvisc
[function]
will ◆/CARA_ELEM=cara
[cara_elem]
    /   ◆ RAYON_TUBE=rayon
        ◆ COOR_TUBE=1_coor
    ◇PESANTEUR=1_g
    ◆ RUGOSITE=rug
will ◆CARA_PAROI=1_cara
    ◆VALE_PAROI=1_vale
    ◇ANGL_VRIL=alpha
        ),

/COQUE_COAX =_F (
    ◇MASS_AJOU=/"OUI"
[DEFAULT]
/ "NON",
◆GROUP_MA_INT=gr_ma_i
    ◆ GROUP_MA_EXT=gr_ma_e
    ◆ VECT_X=1_comp
    ◆ CARA_ELEM=cara
    ◆ MATER_INT=mater_i
    ◆ MATER_EXT=mater_e
    ◆ RHO_FLUI=rho_f
    ◆ VISC_CINE=visco
    ◆ RUGOSITE=rug
    ◆ PDC_MOY_1=cde
    ◆ PDC_DYN_1=cdep
    ◆ PDC_MOY_2=cds
    ◆ PDC_DYN_2=cdsp
        ),
    ◇ INFO=/1
/2 ,
)

```

## 3 Operands

### 3.1 Key word FAISCEAU\_TRANS

#### ◆/FAISCEAU\_TRANS

Factor key word allowing to characterize a configuration of type "tube bundle under transverse flow". If the study leans on the definition of several excitation zones, one factor key word needs as many occurrences of the FAISCEAU\_TRANS of zones.

◇COUPLAGE = "OUI" or "NON"

Indicator of type text specifying the taking into account or not forces elastic fluid -. This operand must appear in at least one of the occurrences of factor key word the FAISCEAU\_TRANS, and can be omitted in the others.

◇CARA\_ELEM = will cara

Concept of the type [cara\_elem] making it possible to provide all the relative data to the geometry of the elements of structure: useful for the estimate of the hydraulic diameters. This operand must appear in at least one of the occurrences of factor key word the FAISCEAU\_TRANS, and can be omitted in the others.

◆PROFESSEUR\_VITE\_FLUI = profv

Concept of the type [function] allowing to provide the profile adimensionné transverse velocity along the tube. The parameter of the function is the curvilinear abscisse. This operand must appear in all the occurrences of factor key word the FAISCEAU\_TRANS.

◇ PROF\_RHO\_F\_INT = profrhoi

Concept of the type [function] making it possible to provide the profile of density of the fluid interns with the tube, along the tube. The parameter of the function is the curvilinear abscisse. This operand must appear in at least one of the occurrences of factor key word the FAISCEAU\_TRANS, and can be omitted in the others.

◇ PROF\_RHO\_F\_EXT = profrhoe

Concept of the type [function] allowing to provide the profile of density of the external fluid to the tube, the tube. The parameter of the function is the curvilinear abscisse. This operand must appear in at least one of the occurrences of factor key word the FAISCEAU\_TRANS, and can be omitted in the others.

◇NOM\_CMP = "DX" or "DY" or "DZ"

Indicator of type text [TXM] specifying the direction according to which act the turbulent forces fluid-elastics and/or forces. This operand must appear in at least one of the occurrences of factor key word the FAISCEAU\_TRANS, and can be omitted in the others.

◇ COEF\_MASS\_AJOU = cm

Value of the coefficient of added mass cm. This operand, if it is used, can be defined only in one of the occurrences of factor key word the FAISCEAU\_TRANS, and can be omitted in the others.

◇CSTE\_CONNORS=cste

List of two realities defining the interval of the constants of Connors for the method of the same name (see R4.07.04).

◇RHO\_TUBE=rho

Density of the tube for the method of Connors

◇ NB\_CONNORS=nb , [I]

Number of points of discretization inside the interval defined by key word CSTE\_CONNORS presented above.

◇/◇TYPE\_PAS = "CARRE\_LIGN" or "TRIA\_LIGN"

Indicator of type text [TXM] allowing to specify the type of step of the beam, defined by the arrangement of the tubes the ones compared to the others and by the direction of flow compared to the beam. This operand can appear only in one of the occurrences of factor key word the FAISCEAU\_TRANS, and can be omitted in the others.

" Square CARRE\_LIGN'=pas line.  
" Triangular TRIA\_LIGN'=pas line.

◆TYPE\_RESEAU = tr

Indicateur integer strictly lower than 1000 and positive defining the experimental configuration for which the coefficients of coupling used for L" study were obtained [bib1]. This operand must appear in all the occurrences of factor key word the FAISCEAU\_TRANS.

## Note:

*"tr" must appear in two files "cd.70" and "ck.71" which makes it possible to describe L" evolution of damping and the stiffness added by flow according to the fallback speed  $V_r$ , the latter being calculated from the velocity inter-tubes.*

*The files "cd.70" and "ck.71" are read by the logical units 70 and 71. They have both the following structure:*

**Line 1 of the file:** many correlations present in the group of the file (whole)

*\*\*\* then, for each one of these correlations, a block made up from \*\*\**

**Line 1 of the block:** type of step of the network associated with the correlation (1 if TYPE\_PAS= "CARRE\_LIGN", 2 if TYPE\_PAS= "TRIA\_LIGN")

**Line 2 with the block:** tr (whole well informed on the level of operand "TYPE\_RESEAU")

**Line 3 of the block:** nbplages (many contiguous beaches fallback speed on which added damping and the stiffness were interpolated by the user in polynomial form)

**Line 4 of the block:** nbplages real, followed by two realities A and B; the nbplages the first realities correspond to the values fallback speed - Y-coordinates by order ascending - lower limits of the contiguous nbplages; two realities A and B are respectively smallest and largest values fallback speed for which added damping and the stiffness were in experiments given on a test bench in thermohydraulic similarity; they thus delimit the beach fallback speeds inside which the correlation can be interpolated starting from the values identified on test bench. In general, one thus chooses the first of the real nbplages equal to A and the last of the real nbplages equal to B.

**Nbplages following lines:** each line corresponds to the polynomial interpolation of the correlation of damping or the stiffness added in the beach considered, the first beach fallback speeds extending between the first and the second of the real nbplages. On each line, 11 coefficients are with being

informed. These coefficients are defining  $(\alpha_i)_{1 \leq i \leq 11}$  them the polynomial used for the interpolation in the beach considered. Thus, for the example,  $C_d$  indicating the damping added by flow. The statement which will be taken by it into account according to the fallback speed is the following one  $V_r$  (the statement for the added stiffness is similar):

$$C_d(V_r) = \sum_{i=1}^{11} \alpha_i V_r^{(i-4)}$$

Line following: one line allowing to delimit the blocks associated with each correlation, in general of the form: "\*\*\*\*\*"

\*\*\* fine of the block \*\*\*

If there are other correlations, Line 1 of the block corresponding to the following correlation.

On the basis of number certain of tests, EDF worked out and validated a set of correlations fluid-elastics allowing to simulate the damping and the stiffness added to a structure by a flow. The supply of these correlations in the shape of two files of a format in conformity with that specified Ci high will be studied on a case-by-case basis according to the request.

◇UNITE\_CA=iu1

Number of the logical unit in which is written the file "cd.70" the depreciation added by flow.

◇UNITE\_KA=iu2

Number of the logical unit in which is written the file "cd.71" stiffness added by flow.

◇PAS = not

Step value reduced of the beam: ratio enters, on the one hand the distance between centres between 2 close tubes, and on the other hand the diameter external of the tubes. This operand can appear only in one of the occurrences of factor key word the FAISCEAU\_TRANS, and can be omitted in the others.

## 3.2 Key word GRAPPE

◆/GRAPPE

Factor key word allowing to characterize a configuration of type "control rod".

◆COUPLAGE = "OUI" or "NON"

Indicator of type text [TXM] specifying the taking into account of the forces fluid-elastics. The coupling fluid-elastic, if he is taken into account, utilizes the adimensional coefficients of forces fluid-elastics identified on model GRAPPE2, which are used to represent a resulting force and a moment [bib2].

If COUPLAGE = "OUI", it is necessary to inform the following operands obligatorily, except for COEF\_MASS\_AJOU which remains optional.

◇/◆GRAPPE\_2 = "ASC\_CEN" or "ASC\_EXC" or "DES\_CEN" or "DES\_EXC"

Four possible choices corresponding to the various experimental configurations for which the coefficients of forces fluid-elastics were identified:

- ascending flow rod of Centered command;
- ascending flow rod of Offset command;
- flow Descending rod from Centered command;
- flow Descending rod from Offset command.

◆NOEUD = Identifying

No of the node (concept of the type [node]) where the force and the moment are applied resulting representing the action from the forces fluid-elastics.

◆CARA\_ELEM = will cara

Concept of the type [cara\_elem] providing all the relative data to the geometry of the elements of structure: useful for the estimate of the diameter of the rod of command. This concept brings inter alia the relative information to the directional senses of the elements.

◆MODELE = model

Concept of the type [model] providing the relative information to the types of the elements of structure.

◇COEF\_MASS\_AJOU = cm1

Value of the coefficient of added mass due to the local containment of the rod of command on the level of the plate of housing. If the modal water characteristics at rest of structure were calculated with the equivalent density.

$$\rho_{eq} = \alpha \frac{\pi D^2}{4S} \rho_{eau} + \rho_{poutre}$$

The coefficient  $cm1$  of added mass due to local containment on the level of the plate of housing is given by the relation:

$$cm1 = \frac{\pi \left( \frac{D}{2H} - \alpha \right)}{2}$$

where  $D$  the diameter external of the rod indicates;  $S$  is the area of the cross-section of the tube and  $H$  represents the thickness of the fluid film on the level of containment.

**Note:**

When the user does not inform operand `COEF_MASS_AJOU`,  $cm1$  is estimated automatically using this statement with  $\alpha = 1$ .

◆ RHO\_FLUI = rho\_f

Value of the density of the fluid surrounding structure.

## 3.3 Key word FAISCEAU\_AXIAL

◆/FAISCEAU\_AXIAL

Factor key word allowing to characterize a configuration of standard "the tube bundle under axial flow" [bib2].

**Note:**

*If the study is carried out using a representation of the complete beam, one authorizes only one occurrence for this factor key word.*

*If the study leans on a simplified representation, one needs as many occurrences as there are tubes in the simplified beam. Each tube of the simplified beam defines a class of equivalence for the tubes of the real beam. The characteristics of the tubes of the real beam for the same class of equivalence (common radius, positions) are the object of an occurrence of factor key word.*

*To be able to use a simplified representation of the beam, it is necessary that the modal base calculated in air is equivalent to complete modal base in air of the real beam; each tube of the simplified beam must thus be a tube equivalent to each class of real tubes. For example, for a class of  $N$  real tubes, density and Young  $E$  modulus  $\rho$ , a possible equivalent tube is characterized by a Young modulus  $NE$  and a density  $N\rho$ .*

◆ /GROUP\_MA = l\_grma

If the study relates to the complete beam: list mesh groups corresponding to the tubes of the beam (concepts of the type [group\_ma]).

If the study leans on a simplified representation: the use of this operand is compulsory and excludes the recourse to TRI\_GROUP\_MA. One expects a concept of the type [group\_ma] corresponding to the one of the equivalent tubes of the simplified beam.

/TRI\_GROUP\_MA = "racine\*" or "\*racine\*" or "\*racine"

Argument of type text [TXM] defining the root of the names of the mesh groups corresponding to the tubes of the beam. The use of this operand is licit only if the study is carried out using a representation of the complete beam. The root can be a prefix, an intermediate character string or a suffix.

◆ VECT\_X = l\_comp

List of three realities giving the components of the directing vector of the beam in the total reference. The beam having to be directed according to one of the axes of the total reference, only three sets of components are acceptable: (1.,0.,0.), (0.,1.,0.) or (0.,0.,1.). This operand is compulsory if the study relates to the complete beam, and must appear at least in one of the occurrences of factor key word if the study leans on a simplified representation.

◆ PROF\_RHO\_FLUI = profrho

Concept of the type [function] defining the profile of density of the fluid surrounding the tubes. The parameter of the function is the coordinate of space corresponding to the axis of the total reference directing the tube bundle. This operand is compulsory if the study relates to the complete beam, and must appear at least in one of the occurrences of factor key word if the study leans on a simplified representation.

◆ PROFESSEUR\_VISC\_CINE = profvisc

Concept of the type [function] defining the kinematical profile of viscosity of the fluid surrounding the tubes. The parameter of the function is the coordinate of space corresponding to the axis of the total reference directing the tube bundle. This operand is compulsory if the study relates to the complete beam, and must appear at least in one of the occurrences of factor key word if the study leans on a simplified representation.

◆ /CARA\_ELEM = will cara

Concept of the type [cara\_elem] providing all the relative data to the geometry of the elements of structure: radius of each tube. This concept is with being provided only if the study relates to the complete beam.

/♦RAYON\_TUBE = radius

Radius of the tubes of the real beam for the same class of equivalence. This operand is used only if the study leans on a simplified representation.

♦ COOR\_TUBE = l\_coor

List of the coordinates of the centers of the tubes of the real beam pertaining to the same class of equivalence. This operand is used only if the study leans on a simplified representation.

◇PESANTEUR = l\_g

List of four realities laying the norm and down the direction of the vector gravity  $\mathbf{g}$  in the total reference. It is necessary to provide in the order the data  $(g, a_p, b_p, c_p)$  such as:

$$\mathbf{g} = g \frac{a_p \mathbf{X} + b_p \mathbf{Y} + c_p \mathbf{Z}}{\sqrt{a_p^2 + b_p^2 + c_p^2}}$$

The values by default are:  $g = 9.81$  ;  $a_p = 0$  . ;  $b_p = 0$  . ;  $c_p = -1$ .

♦RUGO\_TUBE = rug

Value of the absolute roughness of the walls of the tubes, being used for the estimate of the axial coefficient of kinetic friction. This operand is compulsory if the study relates to the complete beam, and must appear at least in one of the occurrences of factor key word if the study leans on a simplified representation. A characteristic value for a smooth steel is 10-5 meter.

♦CARA\_PAROI = will l\_cara

List of arguments of type text [TXM] giving the names of the geometrical characteristics of the enclosure wrapping the beam. The licit arguments are the following:

- "YC" , "ZC" and "R" in the case of a circular enclosure: "YC" , "ZC" coordinated center in any plane  $x = x_0$  along the axes of the total reference perpendicular to the beam and ordered such as (X, Y, Z) is direct so X is the axis of the total reference directed according to the beam. "R" radius.

"YC" , "ZC" , "HY" and "HZ" in the case of a rectangular enclosure: "YC" , "ZC" coordinated center in any plane  $x = x_0$  . "HY" , "HZ" dimensions on the sides of the enclosure parallel respectively with the directions Y and Z.

♦ VALE\_PAROI = l\_vale

List of realities giving the values of the geometrical characteristics, in correspondence with the list of the names received for CARA\_PAROI.

◇ANGL\_VRIL = alpha

Angle swing (in degrees) around the directing axis of the beam for a rectangular enclosure. This operand is compulsory if one defines a rectangular enclosure by CARA\_PAROI and VALE\_PAROI. It is prohibited in the case of a circular enclosure.

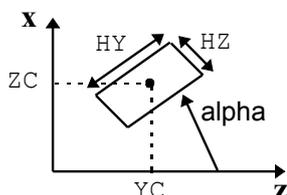
#### Note:

*Operands CARA\_PAROI and VALE\_PAROI are compulsory when the study relates to the complete beam. When the study leans on a simplified representation, these operands must appear together in at least one of the occurrences of factor key word*

*the FAISCEAU\_AXIAL . Operand ANGL\_VRIL must also be present under the same occurrence if a rectangular enclosure is defined.*

## Example:

Total reference  $(x, y, z)$  beam axis  $y$



## Note:

*If the study is carried out with the taking into account of the grids of the tube bundle, the user must inform each of the eight operands which follow. It is pointed out that the geometry of a grid is a prismatic network at square base. It can exist several types of grid; for example, grids of end and the grids of mixture in the fuel assemblies. The grids of the same type are characterized by identical dimensions and coefficients.*

- LONG\_TYPG = l\_hg

List of realities giving the lengths of each type of grid of the tube bundle. The length of a grid is its dimension according to the direction of the beam.

- LARG\_TYPG = l\_dg

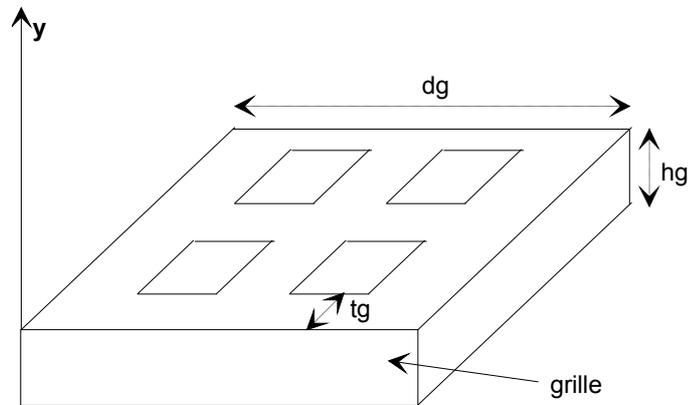
List of realities giving the widths of each type of grid. The width of a grid is its dimension in the plane perpendicular to the beam axis (i.e. the length of with dimensions of the network).

- EPAIS\_TYPG = l\_tg

List of realities giving the thickness of each type of grid. What is called thickness of grid, it is the thickness of the network constituting the grid in a section perpendicular to the beam axis.

## Example of grid:

Total reference  $(x, y, z)$  beam axis  $y$



- RUGO\_TYPG = l\_rugg

List of realities giving the height of roughness of each type of grid. This roughness is used for the estimate of the axial coefficient of kinetic friction of each grid.

- COEF\_TRAI\_TYPG = l\_cdg

List of realities giving the drag coefficient of each type of grid. These drag coefficients make it possible to calculate the drag loads exerted by each grid on the axial flow of the fluid.

- COEF\_DPOR\_TYPG = l\_cpg

List of realities giving the slope (with incidence null) of the coefficient of bearing pressure of each type of grid, which one supposes slightly tilted. These coefficients make it possible to calculate the forces of bearing pressure exerted by each grid on the flow of the fluid.

- COOR\_GRILLE = l\_zg

List of the coordinates  $y$  (along the beam axis) of the points of discretization of each grid. These coordinates correspond to the points mediums (with mid-length) of the grids.

- TYPE\_GRILLE = l\_itypg

List of integers defining the type of each grid.

## 3.4 Key word COQUE\_COAX

### ◆/COQUE\_COAX

Factor key word allowing to characterize a configuration made up of two coaxial cylindrical shells separated by an annular clearance in which a fluid [bib2] runs out.

◇MASS\_AJOU = "OUI" or "NON"

Indicator of type text [TXM] by which the user specifies the taking into account or not effects of added mass, besides the effects of added damping and stiffness.

◆GROUP\_MA\_INT = gr\_ma\_i

Identifying of the mesh group (concept of the type [group\_ma]) corresponding to the inner shell.

◆ GROUP\_MA\_EXT = gr\_ma\_e

Identifying of the mesh group (concept of the type [group\_ma]) corresponding to the outer shell.

◆VECT\_X = l\_comp

List of three realities giving the components of the directing vector of the axis of revolution of the two shells in the total reference. The axis of revolution of the shells having to be one of the axes of the total reference, only three sets of components are acceptable: (1.,0.,0.) , (0.,1.,0.) or (0.,0.,1.) .

◆CARA\_ELEM = will cara

Concept of the type [cara\_elem] bringing all the geometrical characteristics of the elements.

◆ MATER\_INT = mater\_i

Concept of the type [to subdue] bringing all the physical quantities characteristic of the material constitutive of internal structure.

◆ MATER\_EXT = mater\_e

Concept of the type [to subdue] bringing all the physical quantities characteristic of the material constitutive of external structure.

◆ RHO\_FLUI = rho\_f

Density of the fluid.

Kinematical ◆VISC\_CINE =

visco Viscosity of the fluid.

◆RUGOSITE = rug

absolute Roughness of wall of the shells. A characteristic value for a smooth steel is 10-5 meter.

◆PDC\_MOY\_1 = cde

Left steady (average) the singular loss ratio of load of entry.

◆PDC\_DYN\_1 = cdep

Left non stationary (dynamics) the singular loss ratio of load of entry.

◆PDC\_MOY\_2 = cds

Left steady (average) the singular loss ratio of load of output.

◆PDC\_DYN\_2 = cdsp

Left non stationary (dynamics) the singular loss ratio of load of output.

## Note:

1)The values of the various average and dynamic singular loss ratios of load are given, in complements, for various usual geometrical configurations of entry and output (see hereafter [§6]).

2)By convention, a mean velocity of flow positive means that flow is done in the meaning growing of the parameter of space along the axis of revolution of structures. Contrary, a mean velocity of flow negative means that flow is done in the meaning decreasing of the parameter of space. The sign mean velocity of flow thus fixes the positions of entry and output. So that there is no ambiguity on these positions, one will take care in CALC\_FLUI\_STRU [U4.80.03] to define a beach of the same velocities signs.

3)The model MOCCA\_COQUE used for the resolution of fluid-structure coupling requires, for each mode selected, to identify the order of shell on the deformed shape.

The identifiable orders of  $k_i$  shell are such as:  $k_i \leq \frac{N}{2}$  where N the number of nodes of the mesh indicates on a circumference, i.e at a built-in altitude. The

precisely identified orders of  $k_i$  shell are such as,  $k_i \leq \frac{N}{4}$  with the same definition for.  $N$  One advises to use a mesh with at least 20 nodes on the circumferences of the shells. A minimum number of 8 nodes is necessary. Key word

## 3.5 INFO ◇

INFO = 1 or 2 Level

of printing. If

INFO = 2 one prints the characteristics of the configuration in the message file . If

INFO = 1 step of printing. Complements

## 4 concerning the configurations of the type “tube bundles under transverse flow” Definition

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### 4.1 of the characteristics of the beam

four operands TYPE\_PAS , TYPE\_RESEAU , NOT and COEF\_MASS\_AJOU are optional. No value is taken by default. At the time of the definition of these characteristics, three use potential is given: TYPE\_PAS

- , TYPE\_RESEAU and NOT are present. COUPLAGE = “OUI”  
the forces fluid-elastics will be taken into account during a dynamic computation. The coefficient of added mass is calculated according to the step and of the type of step. TYPE\_PAS
- , TYPE\_RESEAU , NOT and COEF\_MASS\_AJOU are present. COUPLAGE = “OUI”  
the forces fluid-elastics will be taken into account during a dynamic computation. The coefficient of added mass is defined by the user. COEF\_MASS\_AJOU
- is present. COUPLAGE = “NON” Only  
the added mass due to the fluid is taken into account (not coupling). Complements

## 5 concerning the configurations "coaxial cylindrical shells" One

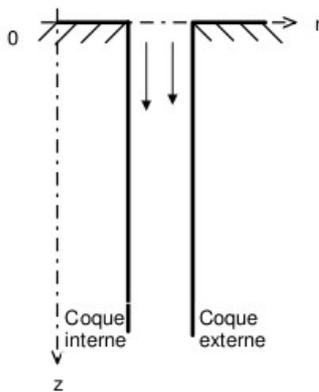
provides hereafter the values of the singular loss ratios of load for some particular geometrical configurations of input-output. Singular

### 5.1 loss ratios of load of entry Configuration

(1) Configuration

$$cde = 0,5$$

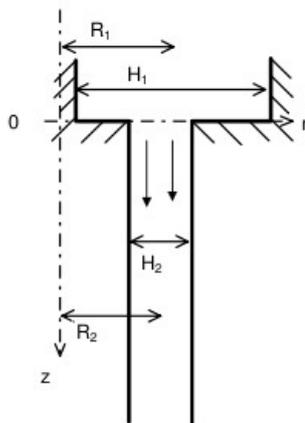
$$cdep = 0$$



(2) Configuration

$$cde = 0,5 \left( 1 - \frac{R_2 H_2}{R_1 H_1} \right)$$

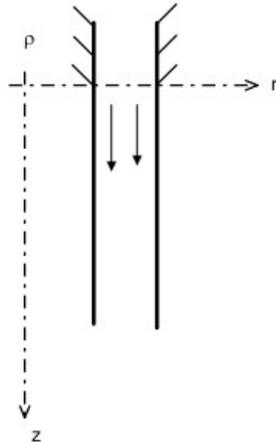
$$cdep = 0$$



(3) Configuration

$$cde=0$$

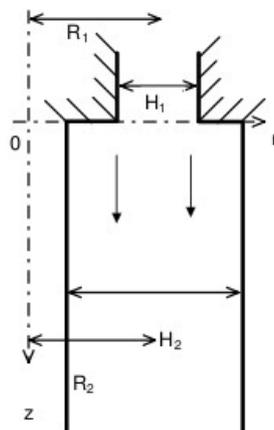
$$cdep=0$$



(4) Configuration

$$cde = \left(1 - \frac{R_1 H_1}{R_2 H_2}\right)^2 \left(\frac{R_2 H_2}{R_1 H_1}\right)^2 = \left(\frac{R_2 H_2}{R_1 H_1} - 1\right)^2$$

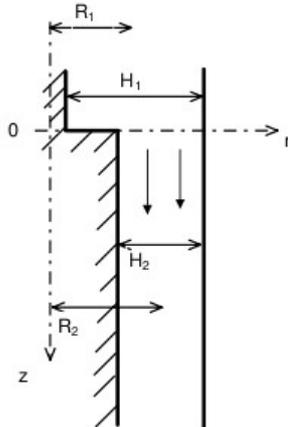
$$cdep=0$$



(5) singular

$$cde = 0,5 \left( 1 - \frac{R_2 H_2}{R_1 H_1} \right)$$

$$cdsp = \frac{cde}{H_1}$$

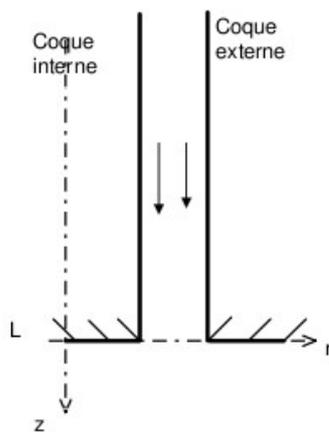


## 5.2 loss Ratios of load of output Configuration

(1) Configuration

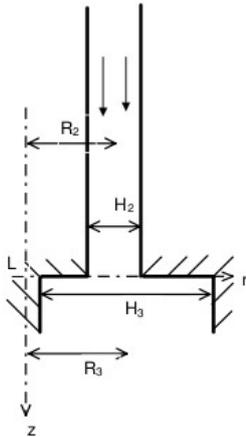
$$cds = 1$$

$$cdsp = 0$$



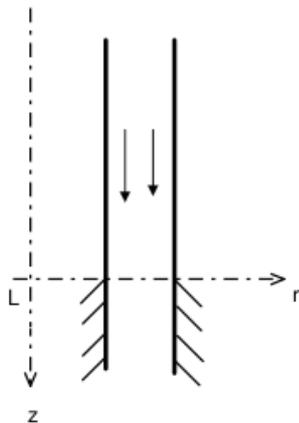
(2) Configuration

$$c_{ds} = \left(1 - \frac{R_2 H_2}{R_3 H_3}\right)^2$$
$$c_{dsp} = 0$$



(3) Configuration

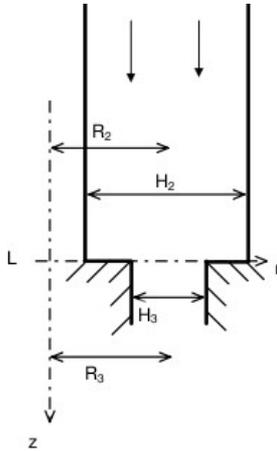
$$c_{ds} = 0$$
$$c_{dsp} = 0$$



(4) Configuration

$$c ds = 0,5 \left( 1 - \frac{R_3 H_3}{R_2 H_2} \right) \left( \frac{R_2 H_2}{R_3 H_3} \right)^2$$

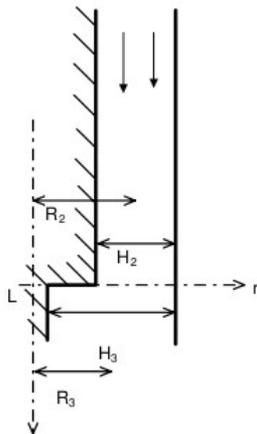
$$cdsp = 0$$



(5) GAY

$$c ds = 0,5 \left( 1 - \frac{R_2 H_2}{R_3 H_3} \right)^2$$

$$cdsp = \frac{-2 c ds}{H_3}$$



## 6 Bibliography N

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- 1) .: Flustru Version 2.0 - general Presentation. Note of use - source FORTRAN of the software. Note technical EDF/DER HT-32/93.05A. L.
- 2) PEROTIN, MR. LAINET: Integration of various models of excitations fluid-elasticity in the Code\_Aster : *specifications* HT-32/96/014/A.