

Titre : Modélisations 3D_FLUIDE, FLUI_STRU, 2D_FLUI_PESA Responsable : GREFFET Nicolas Date : 22/03/2017 Page : 1/4 Clé : U3.14.02 Révision : 2288d249fbb6

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Modelings 3D_FLUIDE, FLUI_STRU, 2D FLUI PESA

Summary:

This document describes for modelings 3D FLUIDE, FLUI STRU, 2D FLUI PESA:

- · degrees of freedom carried by the finite elements which support modeling,
- the related meshs supports,
- supported loadings,
- nonlinear possibilities,
- CAS-tests implementing modelings.

Modelings 3D_FLUIDE (elements of volume) and FLUI_STRU (elements 2D of interaction fluid-structure) correspond to the linear formulation of the coupled problem allowing the study of the vibratory behavior of a structure in the presence of a nonviscous, compressible fluid [R4.04.01]. Free surface is taken into account by modeling 2D FLUI PESA (surface elements).

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1 Discretization

1.1 Degrees of freedom

Finite element	Degrees of freedom (with each node top)		
MEFL (3D_FLUIDE)	NEAR : pressure		
	PHI : fluid potential of displacement		
MEFL_FACE (3D_FLUIDE)	PHI : fluid potential of displacement		
MEFS (FLUI_STRU)	DX, DY, DZ: components of structure displacement		
	PHI : fluid potential of displacement		
MEFP_FACE	DZ : deflection of free surface		
(2D_FLUI_PESA)	PHI : fluid potential of displacement		

1.2 Mesh support of the matrices of rigidity

Modeling	Mesh	Finite element	Remarks
3D FLUIDE	TETRA4	MEFL TETRA4	
—	TETRA10	MEFL TETRA10	
	PENTA6	MEFL PENTA6	
	PENTA15	MEFL PENTA15	
	HEXA8	MEFL HEXA8	
	HEXA20	MEFL HEXA20	
	HEXA27	MEFL HEXA27	
FLUI_STRU	TRIA3	MEFS_FACE3	
—	TRIA6	MEFS_FACE6	
	QUAD4	MEFS FACE4	
	QUAD8	MEFS_FACE8	
	QUAD9	MEFS_FACE9	
2D_FLUI_PESA	TRIA3	MEFP_FACE3	
	TRIA6	MEFP_FACE6	
	QUAD4	MEFP_FACE4	
	QUAD8	MEFP_FACE8	
	QUAD9	MEFP_FACE9	

Notice 1:

Coupling with a structure with a grid in elements *COQUE_3D* force to net the interface fluidstructure with elements *QUAD8* (and not *QUAD9*). The fluid massive field is thus with a grid in *HEXA20* (and not *HEXA27*). Indeed, the coupling fluid-structure is only done on the degrees of freedom of displacement, for the solid.

Notice 2:

It is imperative that the normal external with the fluid field is always directed in the same direction. It is strongly advised to keep the convention of orientation of the structure towards the fluid for all modelings of interface fluid-structure, in particular FLUI STRU.

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1.3 Mesh support of the loadings

Modeling	Mesh	Finite element	Remarks
3D_FLUIDE	TRIA3	MEFL FACE3	
	TRIA6	MEFL FACE6	
	QUAD4	MEFL FACE4	
	QUAD8	MEFL FACE8	
	QUAD9	MEFL FACE9	
2D_FLUI_PESA	TRIA3	MEFP FACE3	
	TRIA6	MEFP FACE6	
	QUAD4	MEFP FACE4	
	QUAD8	MEFP FACE8	
	QUAD9	MEFP_FACE9	

2 Supported loadings

Loadings available are following:

GRAVITY

Allows to apply a loading of type gravity. Supported modeling: 2D FLUI PESA

VITE_FACE

Allows to specify the field speed vibratory imposed in loading on elements of border. Supported modeling: 3D FLUIDE

IMPE_FACE

Allows to specify the map of impedance imposed in boundary condition on elements of border. Supported modeling: 3D FLUIDE

ONDE_FLUI

Allows to apply an amplitude of pressure of sinusoidal incidental wave arriving normally at a face. Supported modeling: 3D FLUIDE

3 Non-linear possibilities

3.1 Laws of behaviors

The only relation of behavior available in DYNA_NON_LINE, for modeling FLUI_STRU under BEHAVIOR is RELATION 'ELAS' (Cf [U4.51.11]).

3.2 Deformations

Only linearized deformations keyword `SMALL' under DEFORMATION are available in the relations of behavior (cf [U4.51.11]).

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4 Example of implementation: CAS-tests

4.1 3D FLUIDE

AHLV100B [V8.22.100]: A rectilinear guide of wave at anechoic exit whose propagation medium is "normal" air, is excited by a harmonically vibrating piston. Calculation consists in determining the field of acoustic pressure of the harmonic answer.

FDLV111A [V8.01.111]: Absorption of a wave of pressure created by a piston in a fluid column.

4.2 FLUI STRU

FDLV111A [V8.01.111]: Absorption of a wave of pressure created by a piston in a fluid column. FDNV100A [V8.01.111]: Analysis of the shaking of a water tank with elastic deformable wall.

4.3 2D FLUI PESA

FDNV100A [V8.01.111]: Analysis of the shaking of a water tank with elastic deformable wall.

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