

About the fluid structure coupling of Code_Saturne and Code_Aster Part 1

The 13th Open CAE Beginner Study Group

Version used

Code_Aster	STA 10.6 STA 11.1
Code_Saturne	Ver. 2.1.4

Basic flow

Calculate with Code_Saturne and
Output the result in MED format



Read the MED file with Code_Aster and
Take out the pressure on the surface of the structure



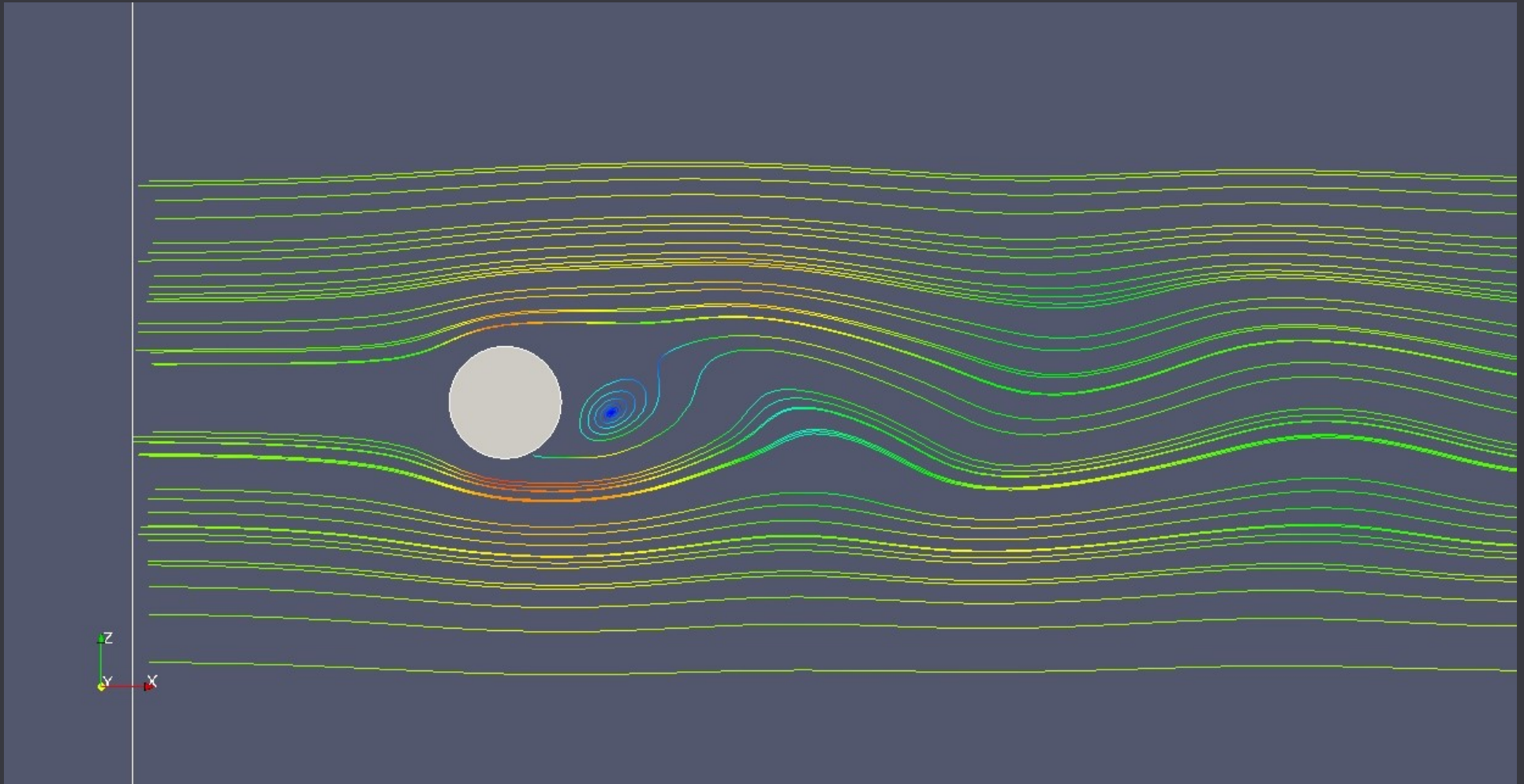
With the pressure on the surface of the structure as the boundary condition

Set and calculate

Target of calculation

The target is a cylinder placed in a flow where Karman vortices are generated as shown below.

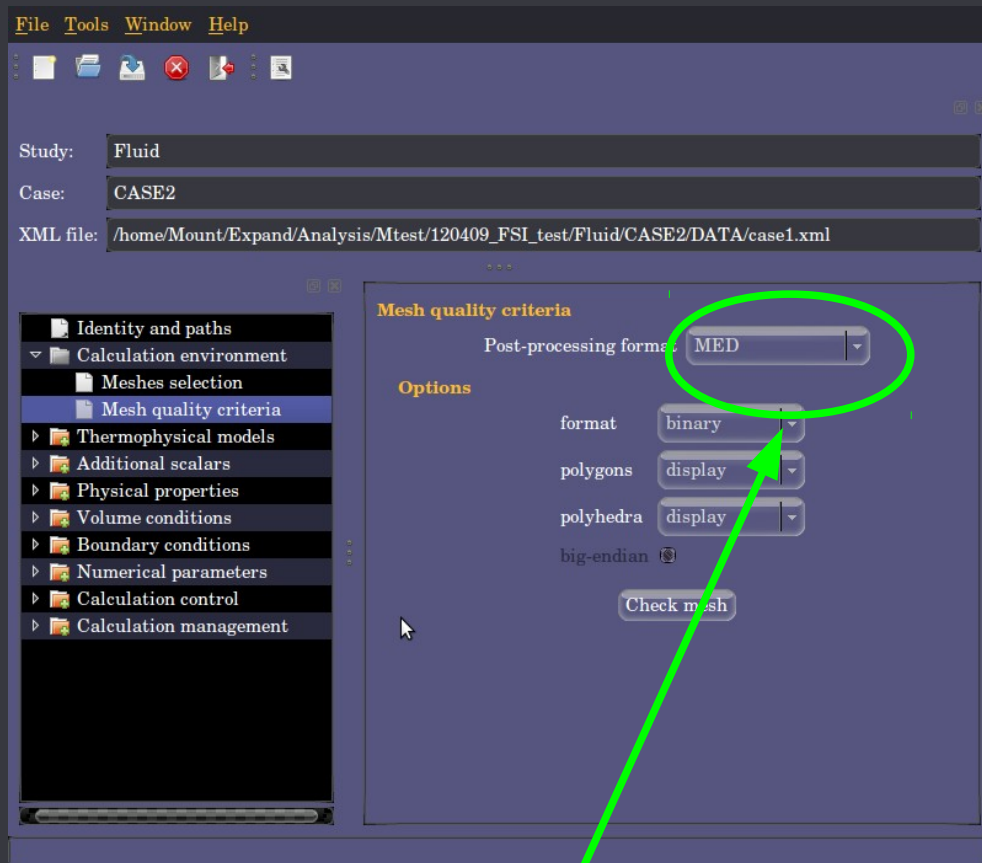
Extracts the pressure on the surface of the cylinder received from the flow



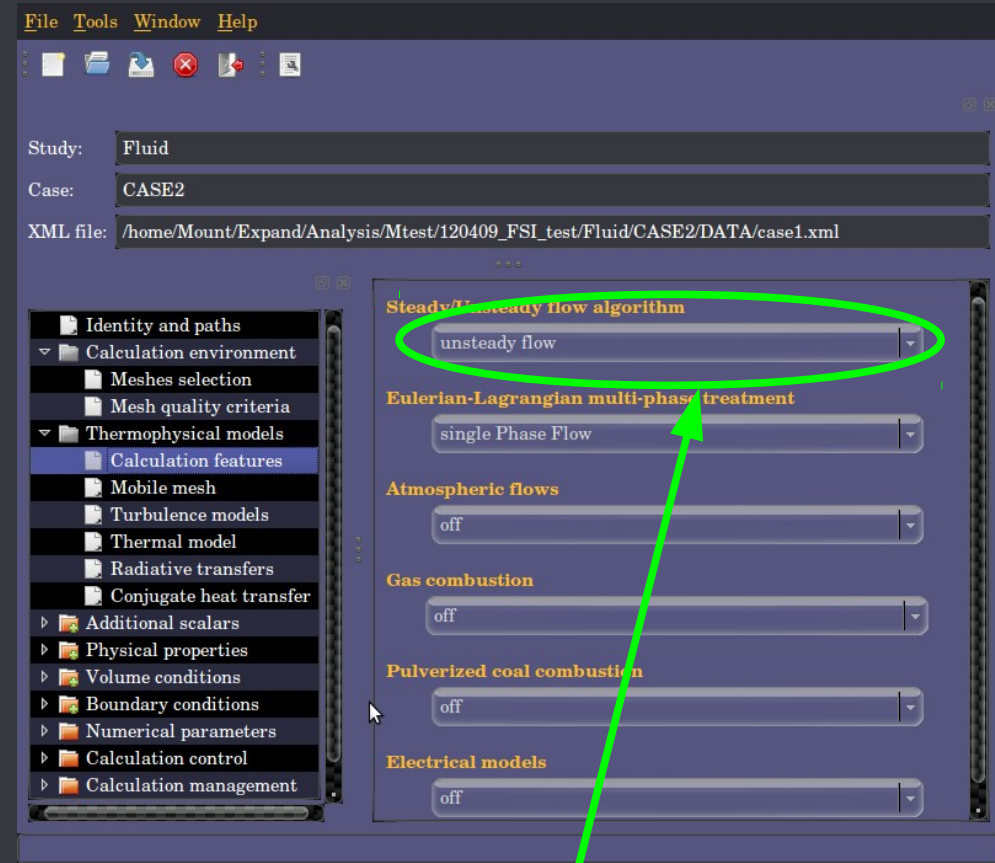
Code_Saturne settings

Output the calculation result in MED format

Perform unsteady calculation



Output in MED format

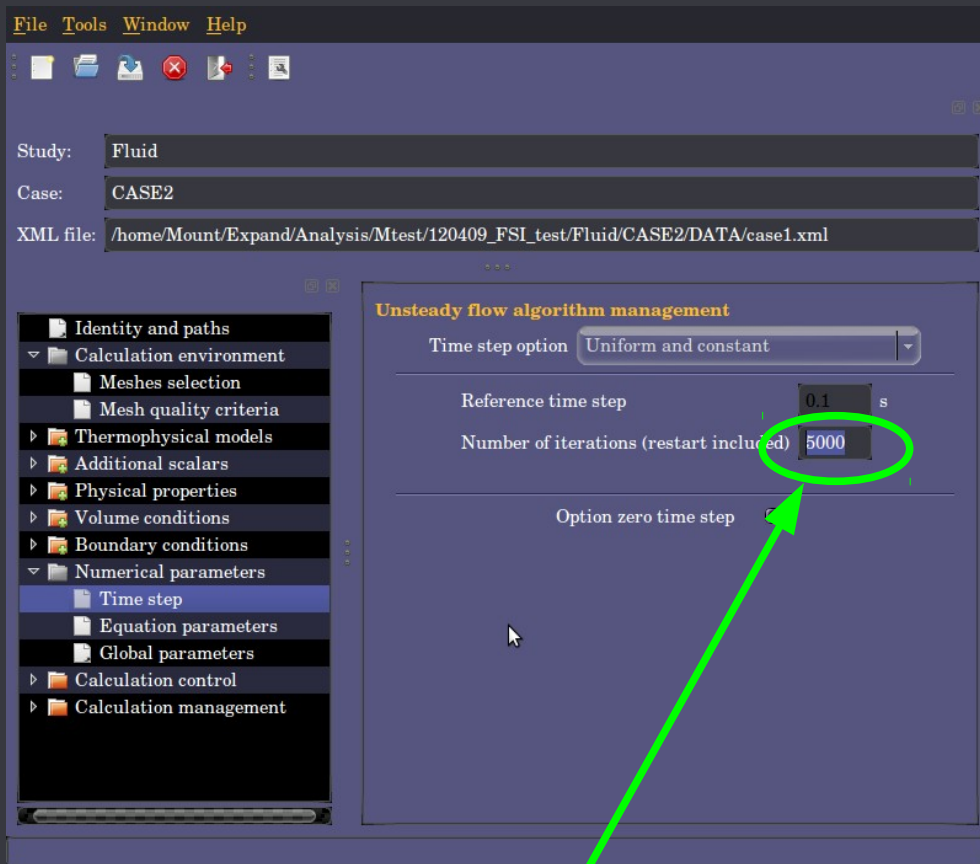


Transient calculation

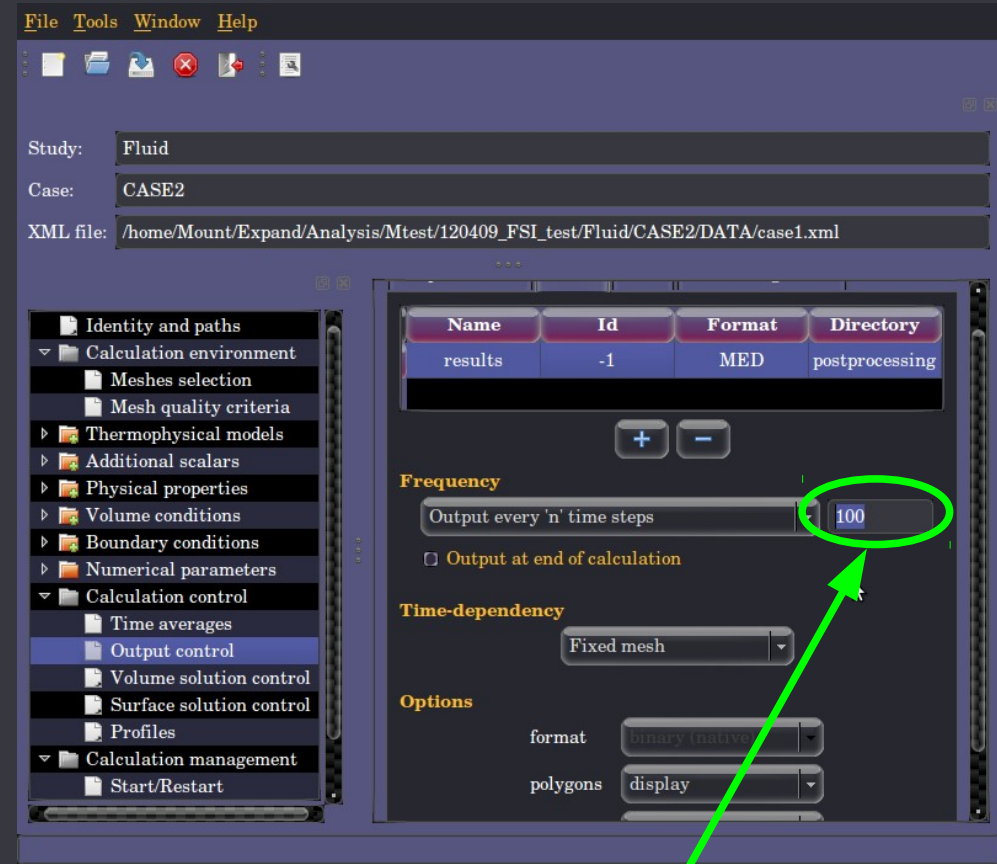
Code_Saturne settings

Perform unsteady calculation in 5,000 steps (500 seconds)

Output the result every 100 steps (10 seconds)

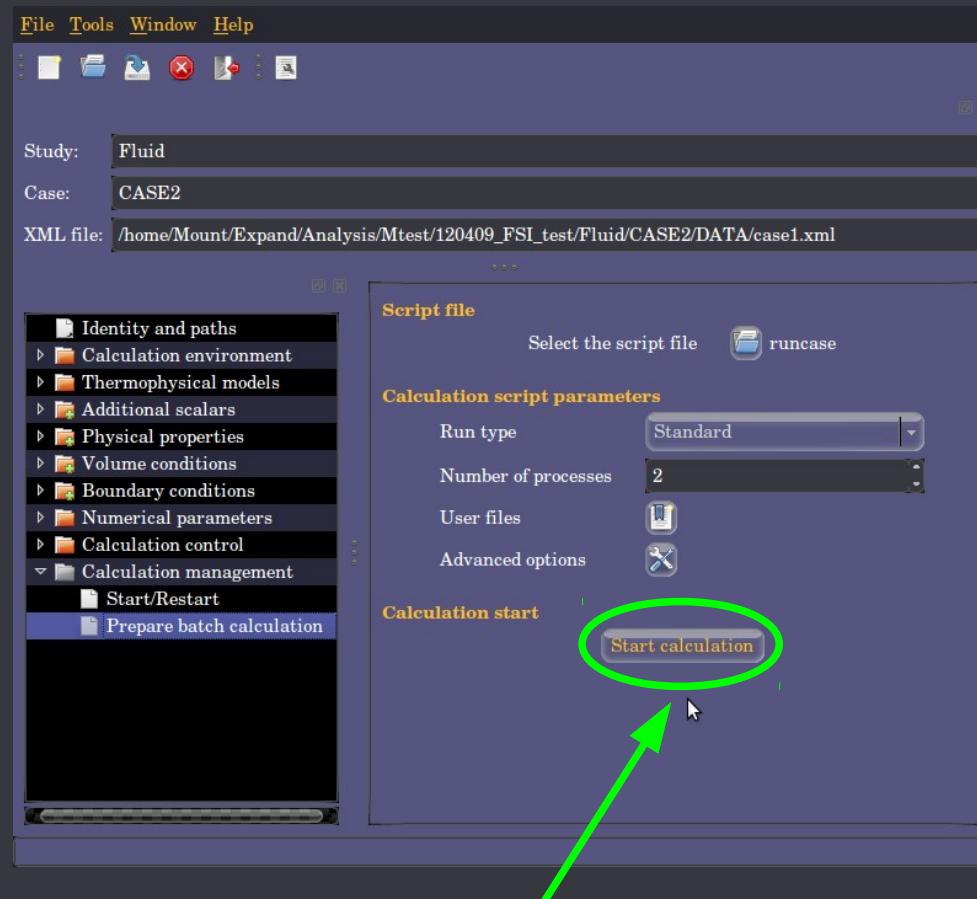


Calculate 5,000 steps



Output every 100 steps

Code_Saturne settings



Press the Start calculation button to execute the calculation

RESU / (time-job number) / postprocessing under the case folder
Result.med is output to the folder

ASTK settings

Copy the fluid calculation result to the working folder and set ASTK as shown below.

File Configuration Tools Options Help

STUDY ☒ **TEST** ☐ **DEVELOP** ☐ **AGLA** ☐ **FEEDBACK** ☐

FILES

Base path

Type	Server	Name	LU	D	R	C
mmed	Local	./Mesh_2.med	20	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
mmed	Local	./results_Flu.med	21	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
comm	Local	./FSI_unsteady.comm	1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
mess	Local	./test.mess	6	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
rmed	Local	./results_Sol.med	80	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Arguments

Total memory (MB) 5120
including Aster (MB) ☐ 512
Time (h:m:s) 9999:00:00

Structure side mesh

Fluid side mesh
&
Result file on the fluid side

nodebug
debug

Run run

Progress of jobs

ASTK settings

Copy the fluid calculation result to the working folder and set ASTK as shown below.

File Configuration Tools Options Help

STUDY ☒ **TEST** ☐ **DEVELOP** ☐ **AGLA** ☐ **FEEDBACK** ☐

FILES

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rmed	Local	./results_Sol.med	80	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Arguments

Total memory (MB) 5120
including Aster (MB) ☐ 512
Time (h:m:s) 9999:00:00
Execution machine
Version STA11.1

Command file

Message file

Result file on the structure side

Run **run**

Progress of jobs

comm file settings

Fluid side model settings

FSI_unsteady.comm

Fichier Edition JdC Aide Options Traduction

Supprimer

Commande Concept/Valeur

- FSI_unsteady.comm
 - DEBUT :
 - LIRE_MALLAGE : maFlu
 - UNITE : 21
 - FORMAT : MED
 - b_format_med
 - AFFE_MODELE : moFlu
 - MAILLAGE : maFlu
 - AFFE :
 - TOUT : OUI
 - PHENOMENE : MECANIQUE
 - b_mecanique
 - MODELISATION : 3D
 - LIRE_RESU : resFlu
 - LIRE_MALLAGE : maSol
 - AFFE_MODELE : moSol
 - PROJ_CHAMP : resProj
 - DEFI_MATERIAU : PROP
 - AFFE_MATERIAU : MATERIAL
 - AFFE_CHAR_MECA : H_1
 - AFFE_CHAR_MECA : F_1
 - DEFI_LIST_REEL : inst
 - MECA_STATIQUE : RESULTS
 - CALC_ELEM : RESULTS
 - CALC_NO : RESULTS
 - IMPR_RESU :
 - FIN :

Ajouter Mot-Clef

Valider

Loading mesh on the fluid side

Building a model on the fluid side

comm file settings

Reading the calculation result on the fluid side (LIRE_RESU)

Fichier Edition JdC Aide Options Traduction

Supprimer

FSI_unsteady.comm

Commande	Concept/Valeur
FSI_unsteady.comm	
DEBUT :	
LIRE_MALLAGE :	maFlu
AFFE_MODELE :	moFlu
LIRE_RESU :	resFlu
TYPE_RESU :	EVOL_CHAR
FORMAT :	MED
MODELE :	moFlu
b_med	
UNITE :	21
FORMAT_MED :	
NOM_CHAM :	PRES
NOM_CHAM_MED :	Pressure (Boundary)
NOM_CMP :	PRES
NOM_CMP_MED :	Scalar
PROL_ZERO :	OUI
b_extrac	
TOUT_ORDRE :	OUI
LIRE_MALLAGE :	maSol
AFFE_MODELE :	moSol
PROJ_CHAMP :	resProj
DEFI_MATERIAU :	PROP
AFFE_MATERIAU :	MATERIAL
AFFE_CHAR_MECA :	H_1
AFFE_CHAR_MECA :	F_1
DEFI_LIST_REEL :	inst
MECA_STATIQUE :	RESULTS
CALC_ELEM :	RESULTS
CALC_NO :	RESULTS
IMPR_RESU :	
FIN :	

TYPE_RESU: EVOL_CHAR

Specify the fluid model built earlier

Match the ASTK number

Un objet de type maillage_sdaster est attendu

Valider

comm file settings

Reading the calculation result on the fluid side (LIRE_RESU)

Fichier Edition JdC Aide Options Traduction

Supprimer

FSI_unsteady.comm

Commande	Concept/Valeur
FSI_unsteady.comm	
DEBUT :	maFlu
LIRE_MALLAGE :	moFlu
AFFE_MODELE :	resFlu
LIRE_RESU :	EVOL_CHAR
TYPE_RESU :	MED
MODELE :	moFlu
b_med	
UNITE :	21
FORMAT_MED :	
NOM_CHAM :	PRES
NOM_CHAM_MED :	Pressure (Boundary)
NOM_CMP :	PRES
NOM_CMP_MED :	Scalar
PROL_ZERO :	OUI
b_extrac	
TOUT_ORDRE :	OUI
LIRE_MALLAGE :	maSol
AFFE_MODELE :	moSol
PROJ_CHAMP :	resProj
DEFI_MATERIAU :	PROP
AFFE_MATERIAU :	MATERIAL
AFFE_CHAR_MECA :	H_1
AFFE_CHAR_MECA :	F_1
DEFI_LIST_REEL :	inst
MECA_STATIQUE :	RESULTS
CALC_ELEM :	RESULTS
CALC_NO :	RESULTS
IMPR_RESU :	
FIN :	

Saisir Valeur

Specify PRES (pressure)

Describe the pressure in the result file

Pressure (Boundary)

Described as Scalar

PROL_ZERO: OUI

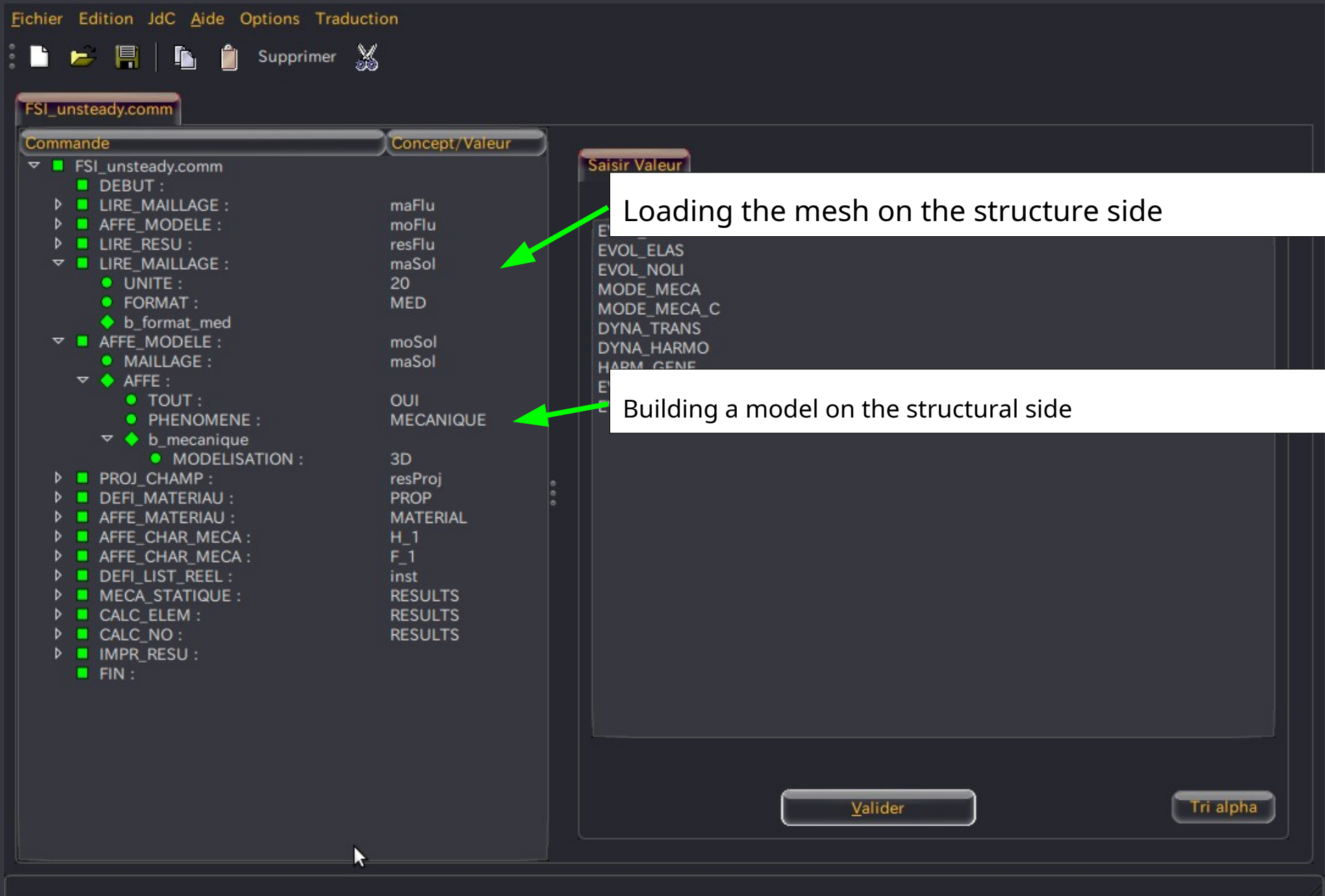
Read all time steps

Un objet de type maillage_sdaster est attendu

Valider

comm file settings

Structure side model settings



comm file settings

Transfer the fluid side calculation result to the structure side model (PROJ_CHAMP)

The screenshot shows the 'FSI_unsteady.comm' file settings window. The 'Commande' tab is active, displaying a tree structure of settings. The 'Concept/Valeur' column shows the values for each setting. Annotations with green arrows point to specific settings and their values:

- File read by LIRE_RESU**: Points to the 'LIRE_RESU' setting, which has the value 'resFlu'.
- METHOD: COLLOCATION**: Points to the 'METHODE' setting, which has the value 'COLLOCATION'.
- 1: Transfer source (fluid side)**: Points to the 'MODELE_1' setting, which has the value 'moFlu'.
- 2: Transfer destination (structural side)**: Points to the 'MODELE_2' setting, which has the value 'moSol'.
- Transcribe all time steps**: Points to the 'TOUT_ORDRE' setting, which has the value 'OUI'.
- 1: Name of the interface between fluid and structure (Fluid side)**: Points to the 'GROUP_MA_1' setting, which has the value 'bwall'.
- 2: Name of the interface between fluid and structure (Structural side)**: Points to the 'GROUP_MA_2' setting, which has the value 'bwall'.

The 'Saisir Valeur' dialog box is open, showing the 'VALIDER' button. The 'Tri alpha' button is also visible at the bottom right.

comm file settings

Set the pressure of the transferred fluid as a boundary condition

Fichier Edition JdC Aide Options Traduction

FSI_unsteady.comm

Commande Concept/Valeur

FSI_unsteady.comm	
DEBUT :	maFlu
LIRE_MALLAGE :	moFlu
AFFE_MODELE :	resFlu
LIRE_RESU :	maSol
LIRE_MALLAGE :	moSol
AFFE_MODELE :	resProj
PROJ_CHAMP :	PROP
DEFI_MATERIAU :	MATERIAL
AFFE_MATERIAU :	H_1
AFFE_CHAR_MECA :	F_1
AFFE_CHAR_MECA :	moSol
MODELE :	resProj
EVOL_CHAR :	inst
DEFI_LIST_REEL :	10
DEBUT :	
INTERVALLE :	
JUSQU_A :	500
PAS :	10
MECA_STATIQUE :	RESULTS
MODELE :	moSol
CHAM_MATER :	MATERIAL
EXCIT :	
EXCIT_1 :	
CHARGE :	H_1
EXCIT_2 :	
CHARGE :	F_1
LIST_INST :	inst
CALC_ELEM :	RESULTS
CALC_NO :	RESULTS

Ajouter Mot-Clef

Mots Clefs Permis	Règles
NOM_MED	
INFO_MED	
RENOMME	

PROJ_CHAMP in EVOL_CHAR
Specify a name

Time step to fluid output

match

DEBUT: Time of the first step
JUSQU_A: End time
PAS : Time step

Since there is no 0th second value in the fluid calculation result, DEFI_LIST_REEL> DEBUT is in the fluid result file.
Enter the time of the first step (10 seconds this time)

Perform calculation

Perform calculations in ASTK

File Configuration Tools Options Help

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including Aster (MB) ☐ 512

Time (h:m:s) 9999:00:00

Execution machine

Version STA11.1

☐ batch

☒ interactive

☐ interactive follow-up

☒ nodebug

☐ debug

Run

Progress of jobs

Check the calculation result

Open fluid and structure result files in Salome's PARAVIS

