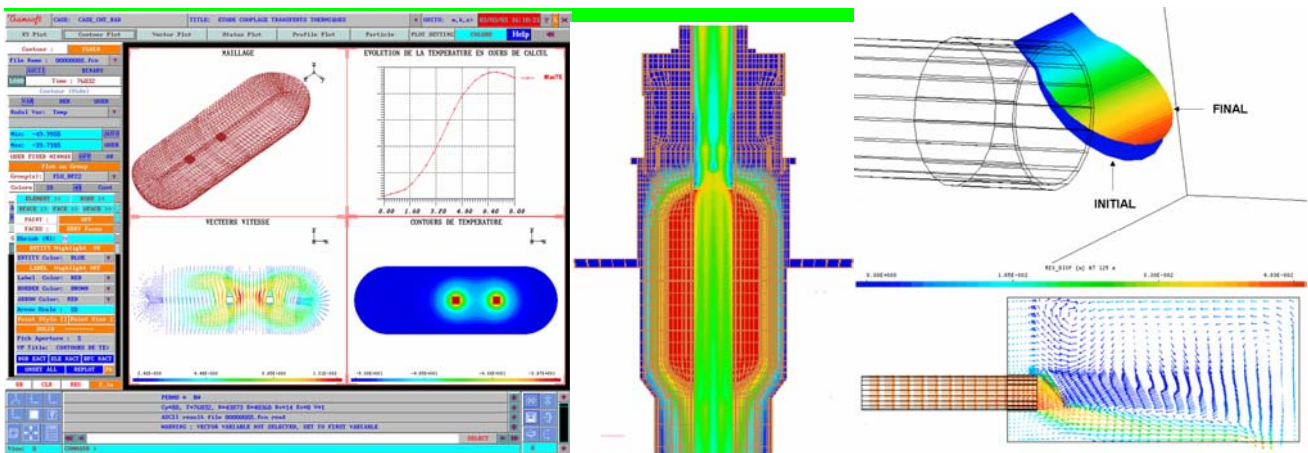


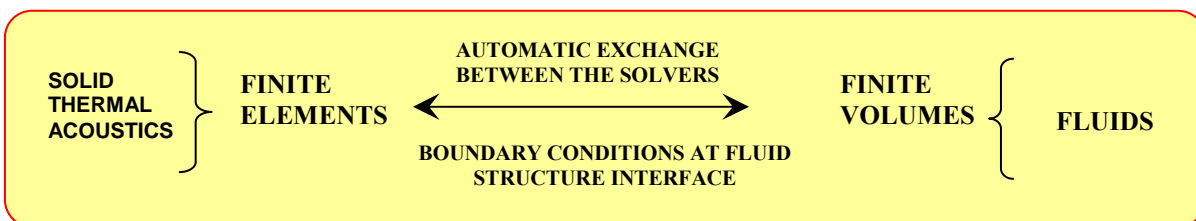
COUPLED MULTI-PHYSICS PHENOMENA

FLUID / STRUCTURE / THERMAL / ACOUSTIC INTERACTIONS



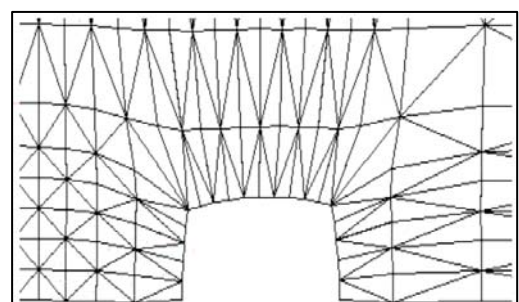
fluidyn-MP is a general numerical platform for the simulation of fluid structure interactions and coupling. **fluidyn-MP** simultaneously calculates **heat conduction** and **mechanical stress**, in structures and **flow** and **heat convection** in the fluids in contact. It can also simulate vibratory - acoustics or pressure fluctuations.

fluidyn-MP models the multi-physics interactions by an innovative method which includes the strong coupling of advanced solution techniques for each study domain : **Finite Volumes (FV)** scheme for fluid flow calculations and **Finite Elements** scheme for structural, heat and acoustic calculations. For each of these solution techniques, **various numerical schemes are available to adapt the software to the problem.**



The strong coupling characteristic of the tested fluid and structure solution methods and the availability of various numerical schemes help to optimize the computational time to give precise and accurate results.

The **coupled thermomechanical calculation** helps to simultaneously manage the heat transfer and structural deformation / displacement phenomena. The fluid mesh in contact with the structures deforms automatically (auto-adaptive mesh) as per the structural deformation. The transient phenomena are simulated with precision due to the permanent information exchange between the two solvers (FV et FE). The convective exchange coefficient is calculated at any moment in the boundary layers.



FLUID DOMAIN MESH AROUND THE DEFORMED STRUCTURE

COMPLETE SOFTWARE SOLUTION

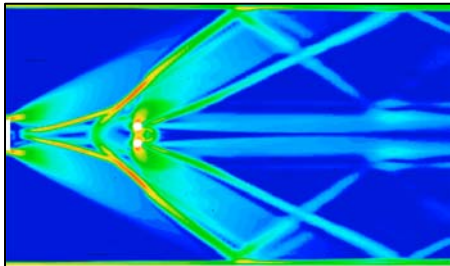
fluidyn - MP offers the complete set of tools necessary for an analysis study:

- **fluidyn - CAD** : Geometry generation (file import from other CAD softwares)
- **fluidyn - GEN** : Mesh generation (file import from other mesh generators)
- **fluidyn - MP GUI** : Single interface with pre and post processor
- **fluidyn - MP batch** : Functions in batch mode (simultaneous or autonomous, on single or multi processor)

MULTIPLICITY OF SOLVERS AND SOLUTION SCHEMES

A highly adaptable and precise solution to each problem is possible thanks to the vast selection of appropriate solver and numerical schemes offered by **fluidyn-MP**.

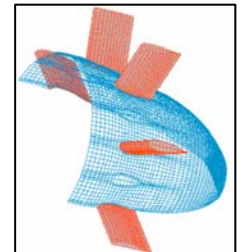
FLUID MODELLING (*fluidyn-NS MODULE*)



- ◆ Steady incompressible to highly unsteady and strongly compressible (detonation, shock waves).
- ◆ Multi species, multi phase flows (dispersed or free surface).
- ◆ Various equations of state for thermodynamic properties
- ◆ Various turbulence models, simple to highly evolutive
- ◆ Reactive flows as per different reaction models.
- ◆ Radiation in semi-transparent media.
- ◆ Structured block, unstructured, hybrid, non-conform, moving mesh.
- ◆ Porous media (surface or volume porosities).

STRUCTURAL MODELLING (*fluidyn-FSI MODULE*)

- ◆ 3D complex structures in finite elements
- ◆ Available elements: hexahedral, tetrahedral or thin plates, beams and springs.
- ◆ Transient (implicit or explicit scheme) or static analysis.
- ◆ Stress and deformations linked to heat load taken into account.
- ◆ Laws of behaviour of elastic, elasto-plastic or piece wise linear materials and isotropic or orthotropic behaviour.
- ◆ Laws of plastification and damage (Steinberg Guinan, Johnson–Cook) available



MODELLING HEAT TRANSFER (*fluidyn-CHT MODULE*)

Conduction calculation in the structure is done by the finite elements matrix solution. The analysis type can be transient (implicit or explicit scheme) or steady. The radiation taken into account with the shadow effect created by different obstacles can be modelled.

ACOUSTIC MODELLING (*fluidyn-CAF MODULE*)

fluidyn-MP calculates the acoustic modes propagating in internal flow systems. The finite elements method is used to solve the Helmholtz equation. The temperature and fluid velocities are taken into account during the calculation of acoustic resonance modes.

POST-PROCESSOR

The user-friendly graphical interface of **fluidyn-MP** allows result visualisation and interpretation (velocities, pressures, stress, deformations, temperature...) at any point during the calculation as well as the easy creation of images and result animations. The results can be viewed on faces, sections and profiles and are displayed in the form of vectors, iso-contours and iso-surfaces.

OPERATING PLATFORMS

The software can be ported to any operating platform: Unix, Linux, Windows.

USER REFERENCES

AIR LIQUIDE, AVENTIS, CEA, CIAT, CITA, Cogentrix, DGA, EADS, EDF, Framatome, IFP, Mitsubishi, RATP, Saint-Gobain, Shell, SNCF, STBFT, Sumitomo, TOTAL, VNF, Zodiac, etc.

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