



XFlow 2017

COMPUTATIONAL FLUID DYNAMICS

FULL FEATURES LIST

Engine

Solver

- Fully Lagrangian kinetic solver - Lattice Boltzmann Method
- Compressible / Enforced incompressible (Labs mode)
- Transient
- 2D / 3D
- Single phase flow: internal / external (Virtual wind tunnel)
- Free surface flow: internal / external (Water channel)
- Multiphase flow: two immiscible fluids / continuous phase + discrete phase (DPM)
- Heat transfer: conduction / convection / energy-momentum coupling
- Buoyancy: Boussinesq approximation
- Radiation: surface-to-surface Monte-Carlo model
- Supersonic flow model (Labs mode)
- Turbulence flow: Large Eddy Simulation (LES)
- Subgrid-scale turbulence model: Smagorinsky / dynamic Smagorinsky / Wall-Adapting Local-Eddy (WALE)
- Acoustics – Noise direct computation
- Non-Newtonian fluids viscosity models: Herschel-Bulkley / Power-law / Cross / Carreau / user-defined
- Fluid state-equations: incompressible / ideal gas / Boussinesq model
- Scalar (species) transport equation

Fluid-Structure Interaction (FSI)

- Multi-body solver integrated and fully coupled with fluid solver
- Rigid body dynamics: 6 DOF / input mass properties / external forces and moments / automatic contact detection / friction and restitution coefficients
- Enforced: input position and angular laws
- One-way coupled with MSC.Adams: kinematic from MSC.Adams can be imported in XFlow
- FSI co-simulations with MSC.Adams and OpenModelica through FMI standard

Boundary Conditions

- Wall models: no-slip / free slip / turbulent boundary layer / universal wall model
- Inlet: velocity / mass flow / gauge total pressure
- Outlet: gauge pressure / convective / velocity / velocity / mass flow / gauge total pressure
- Others: fan model / porous jump / porous volume (w/ or w/o heat generation) / periodicity
- Thermal analysis: adiabatic / temperature / heat flux / free convection / conjugate heat transfer / Volume heat source / surface emissivity
- Absorbing inlet and outlet boundary conditions (LODI)

User Interface

General

- Unified working environment: pre-processing / domain generation / run / post-processing in one single graphical user interface (GUI)
- Configurable layout: dynamic windows and toolbars
- Advanced real-time graphics visualization
- Integrated ray-tracing and OpenGL post-processing
- Inputs: drop-down multiple-choice list / switch / user-defined functions / tabular data
- XML project file format

Pre-Processing

- Easy-to-use setup workflow
- Built-in modules for Virtual-wind-tunnel and Water-channel
- Geometry creation tools: basic-shapes generation / create mesh shape / duplicate shapes and faces
- Geometry modification tools: translation / rotation / scale / symmetry / split / heal / holes detection
- Geometry import - compatible standard formats: STEP / STL / IGES / BREP / NFF / NFB / CSFDB / OFF / BDF
- Automatic tessellation for parametric geometries
- Domain initialization from previous XFlow computations
- Graphic function viewer for user-defined input laws
- Symbolic function parser

Domain Generation

- Automatic domain generation (meshless technology) - octree-like grid
- Multi-resolution scheme, refinement criteria: near static walls / adaptive refinement / user-defined region (rectangular, spherical, cylinder and tubular refinement regions) / curvature adapted
- Low geometry requirements ("watertight" only)
- Geometry motion and wake/free surface adaptive refinement - domain is dynamically and automatically refined (meshless technology)

Run

- Start computation / Start FMU computation / Stop-Resume computation / Restart computation from a previous one
- FMU computation dialog box to perform co-simulations through FMI standard
- Batch mode available - command lines
- Serial multi-threaded computation (SMP)
- Distributed computation - MPI implementation supported: Intel, OpenMPI, MPICH2
- Efficient scalability on shared and distributed memory environment

Post-Processing

- Visualization mode: volumetric field / surface field distribution / markers / isocontours
- Visualization utilities: cutting planes / vectors / isosurfaces / stream tracers
- Function viewer for the monitoring of: stability parameter / forces / moments / probes data / mass-momentum integrals
- Post-process operations and measurement: probes and sensors (which can be associated to an arbitrary, even moving, geometry or reference frame), lines measurement, surface integral / volume integral / custom field calculation
- Post-processing tools for signal processing: Power Spectral Density (PSD) + filtering window functions
- Instantaneous, average, standard deviation and RMS data available
- Discrete Phase Model (DPM): spherical particles defined with their materials properties driven by the flow and external accelerations
- Export and Import of post-processing setup for quicker analysis of simulation results
- Export data to other formats: raw format / VTK / ParaView / EnSight Gold / CGNS / Surface data ABAQUS, XFlow surface format (including mesh connectivity), NASTRAN thermal data
- Animation tool - to save an image sequence that can be assembled in a video file
- Script and automation: numerical post-processing scripting possibilities (parsing numerical data binary file)

Connectivity

- One-way coupled with MSC.Adams (MSC Software): MSC.Adams → XFlow
- One-way coupled with EDEM (DEM Solutions): XFlow → EDEM
- FMI standard co-simulations available as slave
- Fully coupled with optimization software: modeFRONTIER (ESTECO) / CASES (Friendship) / Optimus (Noesis)
- CGNS data export and/or directly output from engine (standard data format)
- ParaView data export (Open Source)
- EnSight Gold data export (CEI Software)
- ABAQUS surface pressure export (Dassault Systèmes)