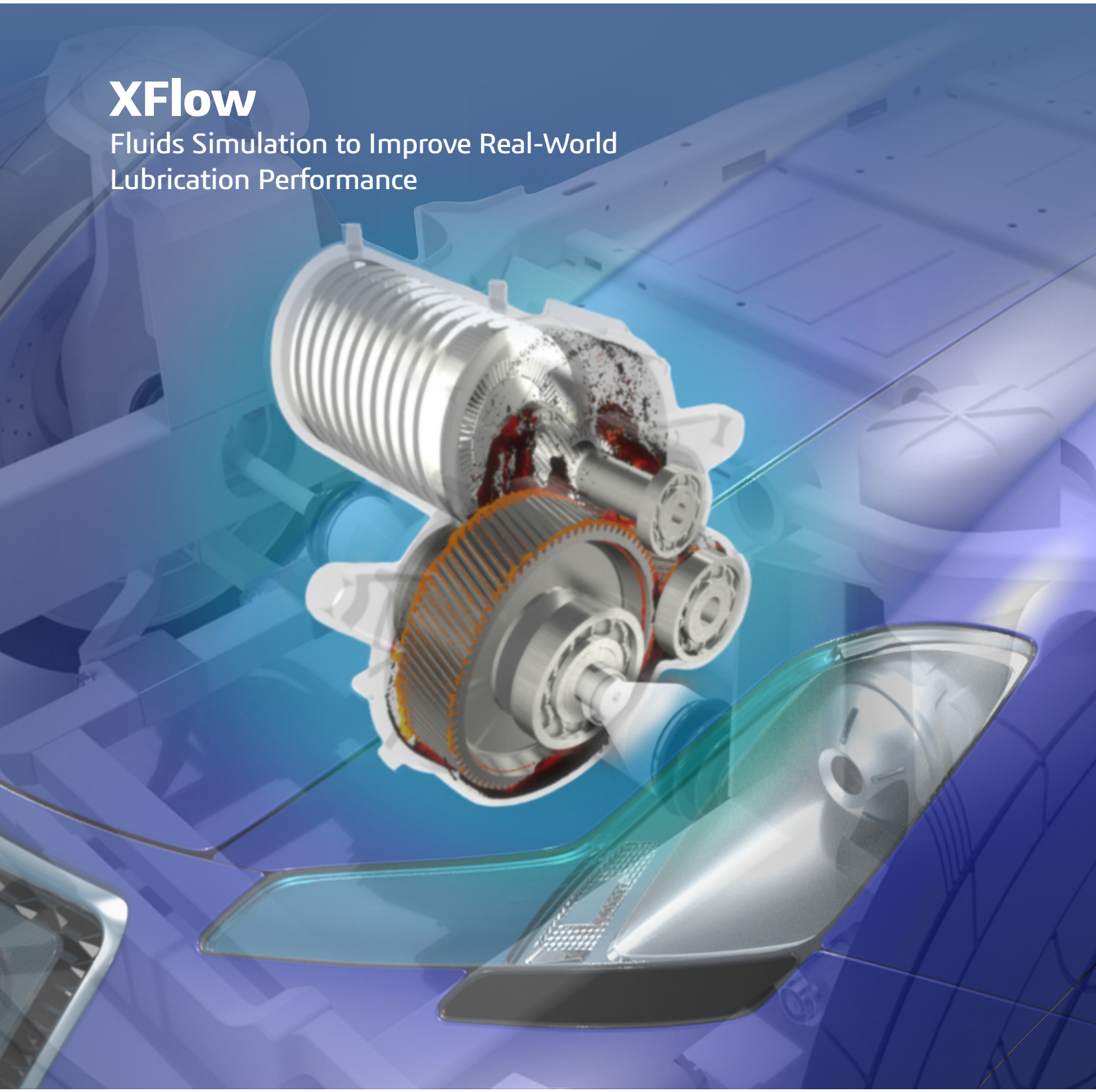
SIMULIA

3DEXPERIENCE®

XFlow

Fluids Simulation to Improve Real-World Lubrication Performance



DASSAULT SYSTEMES

XFlow

OVERVIEW

XFlow is a particle-based Lattice Boltzmann technology solver for high fidelity Computational Fluid Dynamics (CFD) applications as a part of SIMULIA's Fluids Simulation portfolio. XFlow offers multiphase and moving parts modeling capabilities specially focused on lubrication workflows such as gearboxes and electric motor drives.

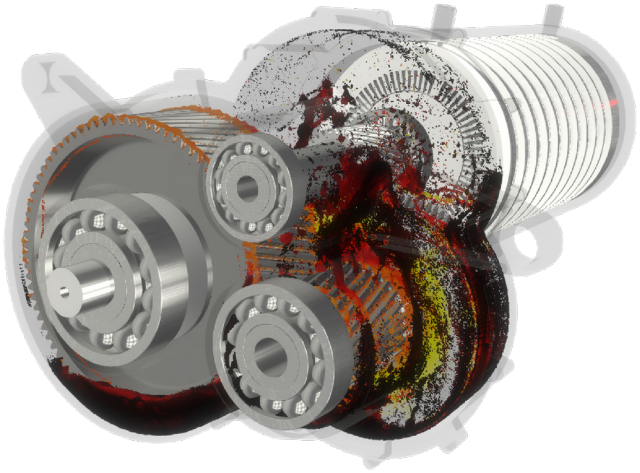
Regardless of the system complexity, gear types or lubrication method, XFlow provides detailed insight into the system performance. Lubrication simulation can reduce the number of physical tests, reducing development times and costs. It also provides quantitative predictions for results like wetted area and churning losses that can be very difficult or impossible to measure experimentally.

XFlow's automatic lattice generation minimizes user inputs thereby reducing time and effort in the meshing and pre-processing phase. XFlow fully supports GPU computing to accelerate the time to solution. Problem setup and results exploration are easy and intuitive, enabling users to focus their efforts on design iteration and optimization. In addition, advanced rendering capabilities provide realistic visualization to gain deeper insight into flow performance.

The state-of-the-art technology in XFlow for lubrication enables users to address other related CFD workflows involving high frequency transient simulations with real moving geometries, complex multiphase flows and free surface flows.

KEY BENEFITS

- Reduce physical tests, saving time and money
- Analyze lubrication performance at any stage of development
- Get quantitative predictions of results that can't be measured experimentally
- Compare many different design variants to optimize trade-offs and maximise performance



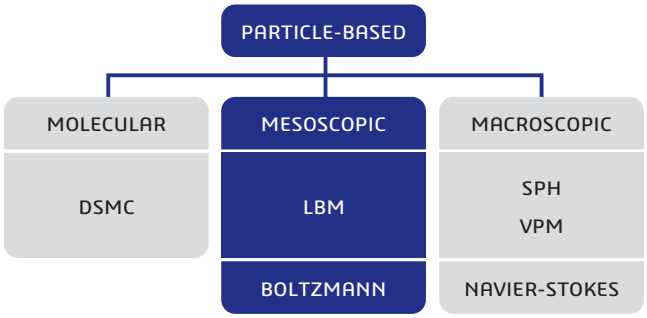
UNIQUE CFD APPROACH

In non-equilibrium statistical mechanics, the Boltzmann equation describes the behavior of a gas modeled at mesoscopic scale.

Particle-Based Kinetic Solver

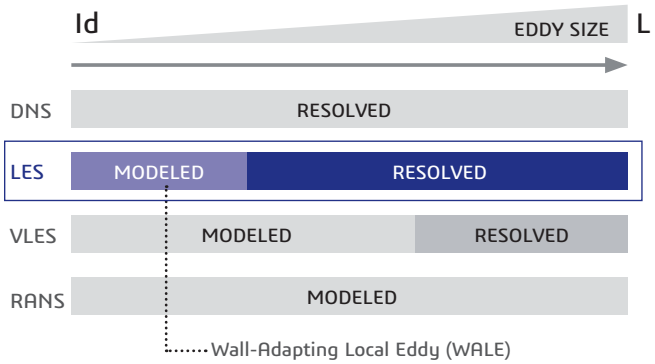
XFlow features a novel particle-based kinetic algorithm that has been specifically designed to perform very fast with accessible hardware.

The discretization approach in XFlow avoids the classic domain meshing process and the surface complexity is not a limiting factor anymore. The user can easily control the level of detail of the underlying lattice with a small set of parameters, the lattice is tolerant to the quality of the input geometry, and adapts to the presence of moving parts.



Turbulence Model

XFlow features a high fidelity Wall-Modeled Large Eddy Simulation (WMLES) approach to turbulence modeling. The underlying state-of-the-art LES, based on the Wall-Adapting Local Eddy (WALE) viscosity model, provides a consistent local eddy-viscosity and near wall behavior.

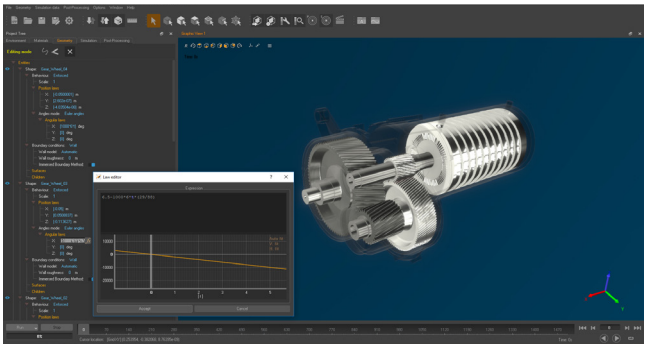


DNS: Direct Numerical Simulation
LES: Large Eddy Simulation
VLES: Very Large Eddy Simulation
RANS: Reynolds Averaged Navier Stokes

SOFTWARE ENVIRONMENT

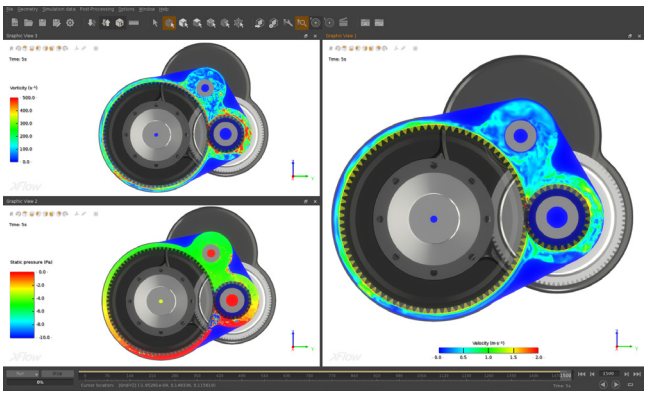
Unified Pre-processor, Solver and Post-processor

XFlow provides a unique and novel interface and working environment for the user. The pre-processor, solver and post-processor are fully integrated in the same environment. The User Interface layout is fully configurable with movable workspace windows and options to use pre-set display settings.



Pre-processing

Being particle-based, the algorithms behind XFlow lower the requirements imposed on the CAD models. For example, in the analysis of powertrain lubrication, the software is not concerned with moving or crossing surfaces as long as these define a coherent fluid volume. XFlow reduces the number of parameters the user has to set to define the flow characteristics and generate the fluid domain. Thus, the complexity of the geometry is not a limiting factor in XFlow.



Post-processing

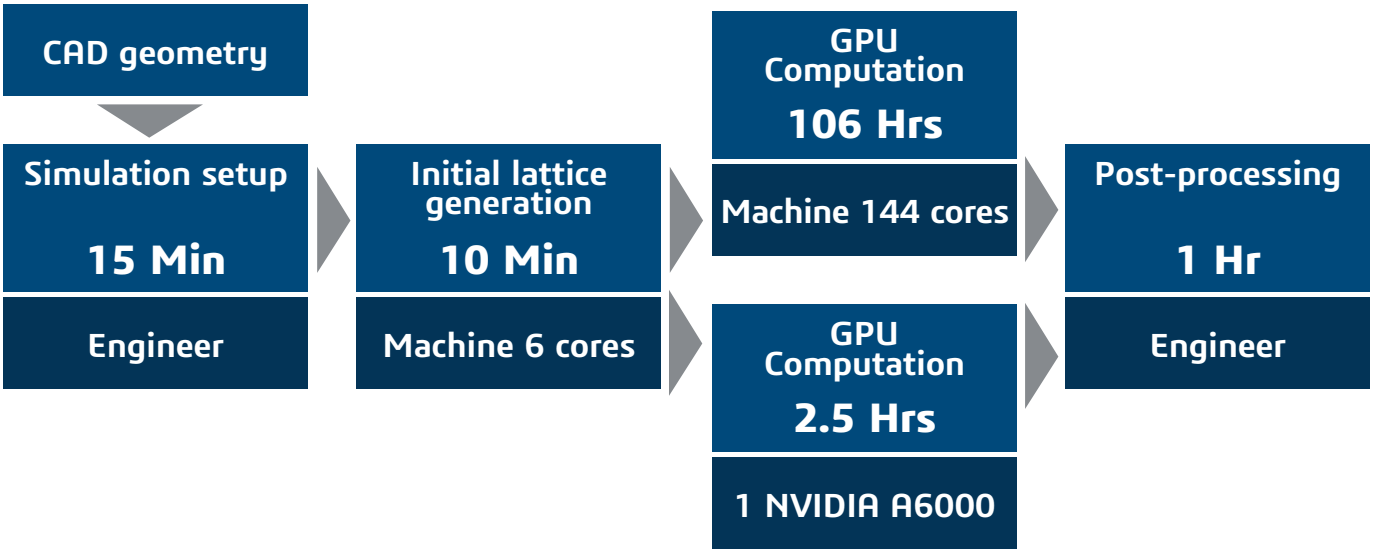
The graphical post-processing capability of XFlow allows interactive visualization of the solution and allows numerical analysis even while the computation is still running. XFlow provides tools for additional processing through export to 3DEXPERIENCE platform or third-party applications such as ParaView and EnSight Gold.

ACCELERATE YOUR SIMULATIONS WITH GPU

XFlow drastically cuts the time spent on the preparation of the simulation, and the initial domain discretization. It enables you to optimize the balance of your engineering and computer time costs.

Classical workstations or HPC environments with many available cores require a notable investment on hardware and maintenance. Also, due to the hardware development, it becomes obsolete in a few years and almost the complete initial investment is required again.

Thanks to the GPU enabled computing, XFlow allows the user to speed up the simulation runtime with a reduced hardware investment.



Based on High-fidelity transient CFD simulation of a standard single phase workflow

APPLICATIONS

Lubrication

XFlow has unique advantages for lubrication workflows, taking gearbox design to the next level. Solutions in this area:

- Powertrain lubrication
- Moving geometries such as rotating gears or pistons
- Splashing
- Wetted area estimation
- Torque calculation
- Churning losses
- Oil jets
- Export of heat transfer coefficients on moving geometries

KEY CAPABILITIES

- Single phase flow model
- Free-surface flow model
- Multiphase flow models: Particle-based tracking, Phase field
- Scalar transport
- Discrete phase model (DPM)
- Moving parts with enforced behavior
- Available on the 3DEXPERIENCE platform through Power'By approach using the XFlow Specialist role
- Thermal analysis

Our **3D**EXPERIENCE® platform powers our brand applications, serving 11 industries, and provides a rich portfolio of industry solution experiences.

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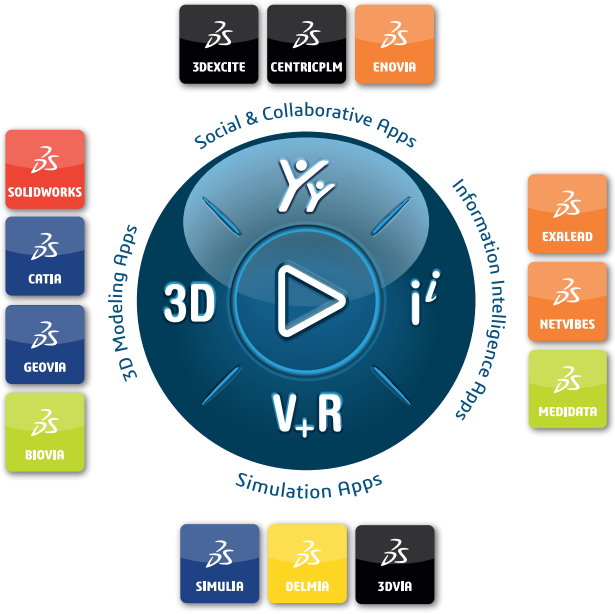

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