ALTAIR CFD – A COMPREHENSIVE SET OF TOOLS FOR FLUID MECHANICS PROBLEMS

The applications of computational fluid dynamics are broad, spanning multiple industries and requiring varying degrees of detail and analysis. For an analyst performing advanced computational fluid dynamics modelling or a design engineer quickly needing to understand fluid or thermal effects on a design proposal, Altair offers a complete set of tools to support each project.

Introducing Altair CFD – Unparalleled Breadth of CFD Solutions Under One Single License

Altair CFD(TM) is a comprehensive set of tools to solve fluid mechanics problems, including complex multiphysics, and the only solution on the market that offers a range of CFD methodologies within a single license. This enables users to solve a wide variety of fluid problems, regardless of industry, level of expertise, or application. Whether you are looking to perform thermal analysis of buildings, predict aerodynamics of vehicles, optimize gearbox oiling, reduce cooling fan noise, or develop innovative medical devices, Altair CFD can help.

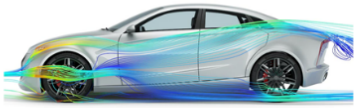
Altair CFD Methodologies

General-purpose Navier-Stokes

Best for thermal and general-purpose applications

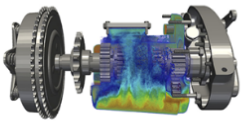
Lattice Boltzmann

Excels with aerodynamics and aero-acoustic problems



Smooth Particle Hydrodynamics

Ideally suited for oiling, sloshing, and mixing



Perform Headlamp Thermal Analysis to Optimize Lamp Design

When designing a headlamp for industries such as agriculture or automotive, identifying the maximum temperature of different components of an efficient headlamp design is highly important. Radiation produced by the bulb is distributed by a reflector and absorbed by nearby surfaces that heat the surrounding air. This heat is transported through the materials via heat conduction, affecting the overall performance of the headlamp. Because of this, engineers need to identify component failures due to overheating early in the design cycle, therefore improving performance, and reducing the need for physical testing.

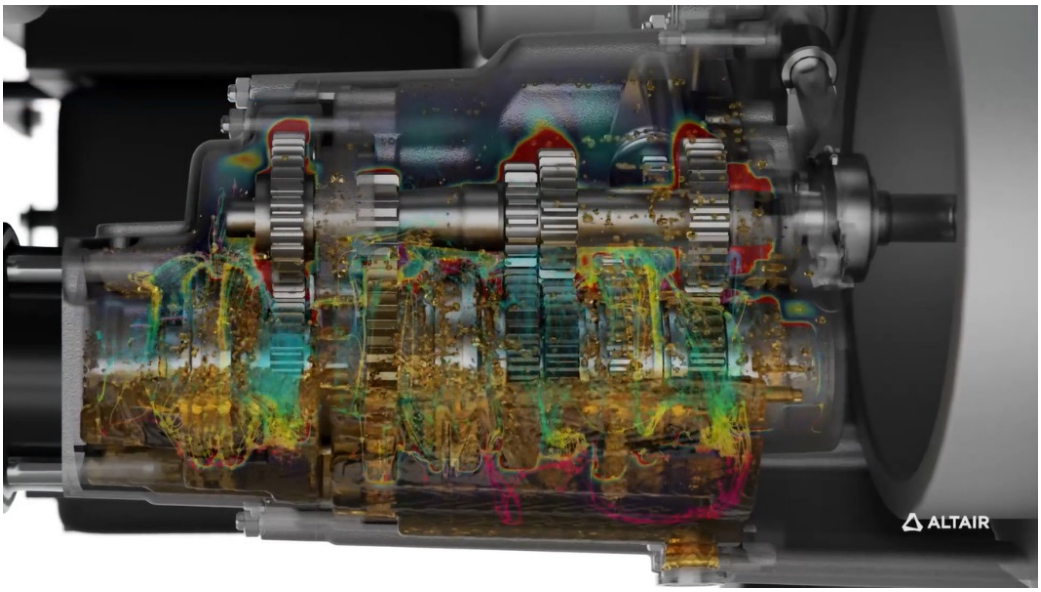
Headlamp thermal analysis using Altair CFD

Our general-purpose Navier Stokes solver is a general-purpose fluids and thermal simulation tool for analysts performing advanced computational fluid dynamics. This tool makes it possible for users to understand the temperature distribution within the headlamp, leading to a more optimized design. Flow fields can be visualized, and a full thermal management investigation can be undertaken to ensure the best design.

Optimize Gearbox Oiling to Improve Efficiency and Reliability

The gearbox is a vital component of many industrial applications, transporting mechanical power and changing the speed factor of motors. For a gearbox to work efficiently, oiling is necessary to prevent mechanical failure that could result in expensive repairs or worse, complete loss of production. Performing a detailed analysis of this process is therefore imperative to ensure the best design possible.

Altair's Smooth Particle Hydrodynamics solver allows users to efficiently predict fluid flow around complex moving geometry, analyze oil behavior in all drivetrain components, and reduce oil churning loss leading to an optimal design, all whilst reducing the need for expensive physical testing and design costs.

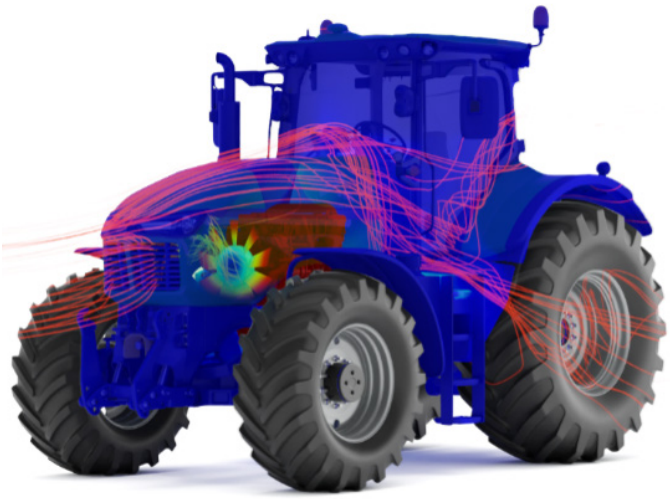


Gearbox oiling to improve efficiency and reliability

Analyze Underhood Thermal Behavior to Maximize Engine Cooling System Performance

Understanding underhood thermal management and air flow is critically important when maximizing engine cooling system performance. Engines that power cars, combine harvesters, or planes need to operate optimally to avoid issues such as air flow hinderances and recirculation which can negatively affect the performance of a cooling system.

Altair's general-purpose Navier Stokes solver is a proven asset for companies looking to explore their designs providing a full range of flow, heat transfer, turbulence, and non-Newtonian material analysis capabilities without the difficulties associated with traditional CFD applications.



Modeling underhood thermal behavior

Accurately Predict the Aero-acoustic Noise of Rotating Fan

Predicting and minimizing rotating fan noise is highly important across a range of industries. Due to government regulations, industrial equipment needs to adhere to a maximum noise level for the protection of workers and to avoid excessive noise in residential areas. Generally, the noise generated from rotating fans are the dominant contributor of equipment operating noise overall. In the automotive industry, the increased electrification of vehicles requires a robust fan noise analysis, preventing excessive operating noise.

Altair's Lattice Boltzmann solver provides ultra-fast predictions of aerodynamic properties, enabling engineers to understand fluid dynamics and investigate innovating structures to improve efficiency, increase users' comfort and deliver safe projects, on time.

To learn more about direct fan noise simulation, watch this presentation.

Perform Cabin Thermal Analysis to Evaluate Performance of Heating and Cooling Devices

Due to the variance of climatic temperature a vehicle can experience, the accurate thermal modelling of a cabin is essential, whether it be the internal temperature for passengers of a car, train, or plane. Additionally, both heating and cooling devices such as air conditioning fans or window defrosting heaters need to be efficiently designed to perform reliably over time.

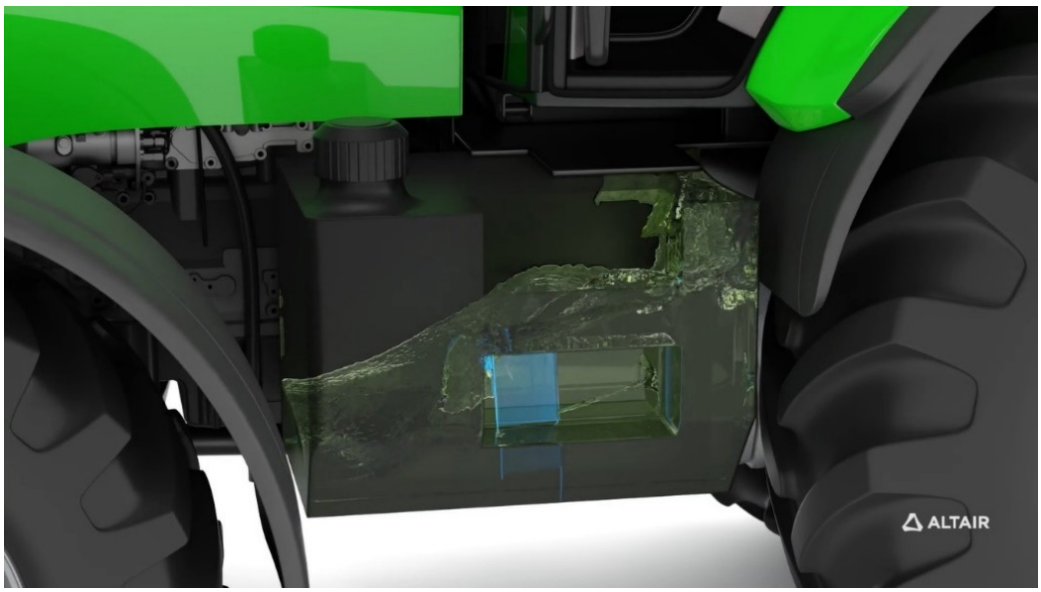
Using Altair's general-purpose Navier Stokes solver makes it possible to realize these designs by accurately simulating the airflow of passenger compartments, including all relevant thermal effects such as convection, conduction, and radiation heat transfer in the cabin.

Cabin thermal analysis

Analyze and Mitigate Tank Sloshing

Tank sloshing can lead to unwanted motion as energy is transferred as a result of moving liquid. This can lead to unstable vehicles whilst in motion, sloshing noise, and structural damage. Being able to measure forces experienced by the tank or vehicle during acceleration, braking, or lane changes is therefore very useful for engineers and designers.

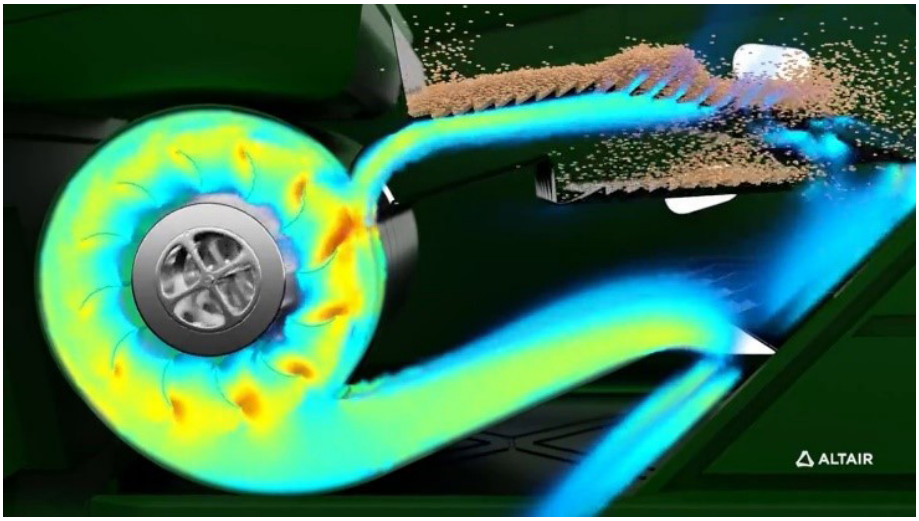
Thanks to our Smooth Particle Hydrodynamic solver, users can accurately simulate the sloshing process, making it possible to make better design decisions and mitigate unwanted motions.



Tank sloshing analysis

Accurately Simulate Particle-fluid Interactions to Optimize Process Efficiency

Many industrial processes in agriculture, pharma, or process manufacturing involve interaction between both fluid and particle phases. Realistic modelling of these complex systems can be done using CFD for fluids and Discrete Element Method (DEM) for particle simulation with Altair EDEM®. Using CFD coupled with EDEM enables engineers to realistically simulate the interaction between fluid and particles to accurately model applications such as fluidized beds or fertilizer spreading for example.



Altair CFD coupled with EDEM to simulate particle-fluid interactions

Harnessing GPU Computing Power

Successfully predicting the behavior of fluids is, unsurprisingly, very computationally expensive. A myriad of parameters and elements needs to be considered and predicted accurately to produce a precise simulation that can be used for real world applications. As a result, running a CFD simulation can take several days using CPU computing power.

However, thanks to Altair's GPU solutions, it's possible to solve extremely quickly by relying on superior processing power, equivalent to thousands of CPU cores. As all three Altair CFD solvers are optimized for use on clusters of GPUs for faster and more efficient simulations regardless of the scale and complexity, a drastic increase in simulation processing speed is possible.

Furthermore, Altair® Unlimited® offers companies the ability to provision GPU hardware on the cloud with services such as Google Cloud Platform. All of Altair's CFD solvers are optimized for use on clusters of GPUs for faster and more efficient simulations regardless of the scale and complexity. Thanks to Altair's turnkey on-premises and cloud-based appliances, users can access this processing power remotely, enabling companies to dynamically scale their infrastructure.

Utilizing GPUs to accelerate numerical simulation delivers significant increases in speed and throughput. This means more opportunities to explore and fine-tune designs, make decisions faster based on more accurate results, and consequently, considerably reduce time-to-market. Harnessing the computational capabilities of the graphics processing unit (GPU) is one of the cornerstones of Altair's mission to empower designers.

Working with Altair

Altair CFD provides an unparalleled breadth of CFD solutions under a single license. This collection of powerful, intuitive, and scalable simulation tools, combined with the technology democratization of the unit-based licensing model, allows engineers and designs to access the most appropriate tool for the job, reducing modelling turnaround times and providing users with all needed tools in one, simple to use interface.

With Altair's flexible HPC and cloud computing resources, companies can deliver CFD results to their engineers faster to empower simulation-driven design methods, enable greater access and collaboration via simulation in the cloud, and reduce IT scheduling and administration associated with CFD computing jobs.

To learn more, visit
altair.com/altair-cfd