Energy Systems

Energy conversion, Condensation in multi-stage flash condensers, Thermal management in electronics, Combustion efficiency

Aero-Hydrodynamics

Land based vehicles, Aerospace vehicles, Yacht sails aerodynamics, Submarine hydrodynamics
Energy Systems

Ascomp services group is involved in the modelling of fluid flows in the broad energy segment, be it in the conventional or in the renewable contexts. TransAT simulations in the conventional-energy segment involves detailed fluid flow and heat transfer with mass transfer processes, including gas and steam turbines, heat exchangers, combustion chambers, etc. The TransAT Suite products are also used in the renewable energy segment, including the design of more efficient combustion systems.

Energy Conversion

In the field of energy conversion, TransAT is employed in various industrial projects in areas as broad as wind and hydro power, thermal management in energy storage systems and steam and gas turbines. While in the classical compressor-turbine rotating machinery they typically focus on minimizing viscous losses and increasing efficiency, in the steam turbine segment, however, recent key TransAT-based studies involve simulating condensing flows in steam turbines by resorting to interface tracking approaches.

Condensation Heat Transfer in Multi-Stage Flash Condensers (MSF)

Seawater desalination has become the only viable way to increase water supply. Multi-stage flash and Multi-effect distillation are the earliest seawater thermal desalination techniques integrated with power generation plants. Other thermal processes have been developed such as solar desalination, freezing and humidification-dehumidification. TransAT simulations were revealed very helpful in designing MSF condensers employed in water desalination plants, thanks to its predictive capabilities for phase change processes.

Thermal Management in Electronics

Thermal management is a major issue in the electronics industry; all the more since the technology produces novel solutions featuring reduced size components operating at higher speeds. Standard cooling techniques fail to cope with the heterogeneous temperature distributions in the circuits, with reduced capacity to remove ‘sudden’ large amount of heat generated by hot spots. TransAT is used for alternative techniques like ‘digital microfluidics’ based on two-phase flow cooling.

Combustion efficiency

Advanced CFD simulations are now conducted to help infer subtle modifications to various combustion processes to minimize exhaust gas volumes and the generation of noxious gases. To be at the forefront of the combustion simulation technology, our developers implemented a hierarchy of reaction models into TransAT, ranging from Infinitely Fast Chemistry to Finite Rate Chemistry, using for the former EDC models, and for the latter a Flamelet based approach.
The aerodynamics of space aircrafts serves the analysis of structural integrity, stability, performance and trajectory of the vehicle.

Modern CFD tools should be capable to analyze the perturbations to the flow that could be brought by potential carried stores beneath the wings, provided the main issues are resolved first: efficient meshing and advanced turbulent flow simulation using scale resolving techniques capable to predict the detached eddy structures from/around the components.

Flow around yacht sails is complex, in particular the Genoa; sailing downwind is a simpler flow problem to model. But various issues are still open, such as the prediction of the leading edge separation of both sails, the re-attachment of the boundary layer downstream, the trailing edge separation on the suction side of the Genneker because of the retarding pressure gradient. TransAT solves these flows in an unsteady manner providing a faithful picture of real conditions.

CFD has also been employed to predict the flow past submarines, with the objective to determine the forces and moments on the hull. While main-stream CFD focus on the flow structure, today design engineers using TransAT are interested in the hydrodynamics of vessels operating near the free surface. Be it for sub-sea or at surface, real design improvements have been achieved using TransAT, thanks to its smart meshing, the scale-resolving strategies for high-Re flows, and the interface tracking techniques required for wave-hull interactions.

**Aero - Hydrodynamics**

The aerodynamics of land-based and aerospace vehicles, together with hydrodynamics of ships and amphibian structures are target application areas for CFD: from the design of automotive exterior to the complete vehicle aerodynamics analysis, and from HVAC systems to engine heat-up. TransAT remains at the leading edge for the design of ships and submarines, requiring advanced turbulence and multiphase flow models combined with smart meshing techniques.

**Land based vehicles**

Grid generation in CFD requires up to 70% time of the simulation process. Although unstructured grids have helped invert the tendency, these techniques still need BFC meshing of boundary layers. The IST/BMR functionality of TransAT has solved the grid generation problem for external flows, whereby all sorts of geometries are mapped into a Cartesian grid. Aerodynamics problems are now solved rather simply. Apart from meshing, transient resolved-scale simulations are now acknowledged to deliver valuable flow information critical for the design.

**Aerospace vehicles**

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**Yacht sails aerodynamics**

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**Submarine hydrodynamics**

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