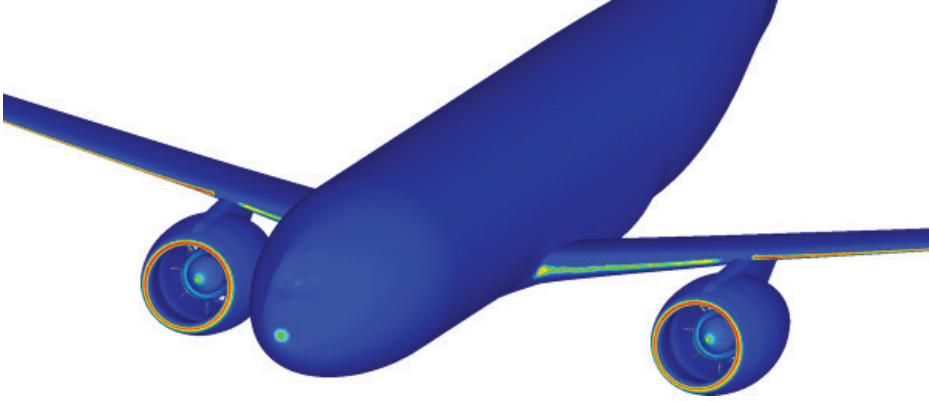
ANSYS®

FENSAP-ICE™

FAST, ACCURATE AIRCRAFT ICING ASSESSMENT TO ENSURE SAFETY AND SPEED IN-FLIGHT ICING CERTIFICATION

ANSYS



FENSAP-ICE has many automated functions that considerably reduce hands-on interaction and increase ice shape accuracy, especially in glaze ice conditions.

Fast, Accurate Aircraft Icing Assessment to Ensure Safety and Speed In-Flight Icing Certification

The most advanced and versatile 3-D simulation system for in-flight icing simulation of aircraft, helicopters, jet engines, UAVs, instruments and probes. Unifies CFD for aerodynamics and icing.

Thanks to its unique, innovative features, FENSAP-ICE has established itself as the premier, comprehensive in-flight icing simulation system, and is in use worldwide at leading aerospace companies.

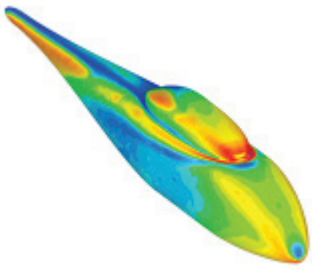
FENSAP-ICE is composed of fully integrated analysis modules managed by a powerful graphical interface whose features greatly enhance user-friendliness, increase robustness and speed, and enable the simulation of a broad range of applications, from external flows to multistage turbomachinery, for both water droplets and ice crystals.

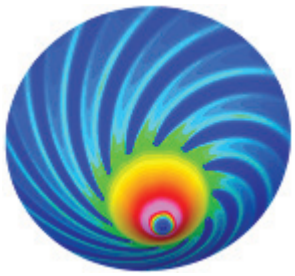
Features include:
- DROP3D droplet impingement module
- ICE3D ice accretion and shape module
- CHT3D conjugate heat transfer module
- OptiGrid anisotropic mesh adaptation tool

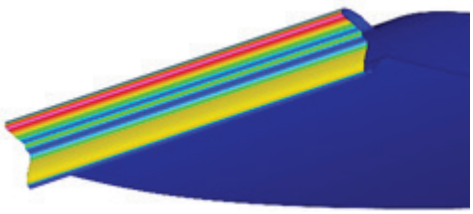
Together, the system enables aircraft designers to analyze and optimize aircraft performance for the supercooled water droplet icing environments of Appendix C and also SLD. mesh displacement of iced geometries for sequential accretion layers and a rotating frame of reference for the analysis of turbomachines, rotors and propellers.

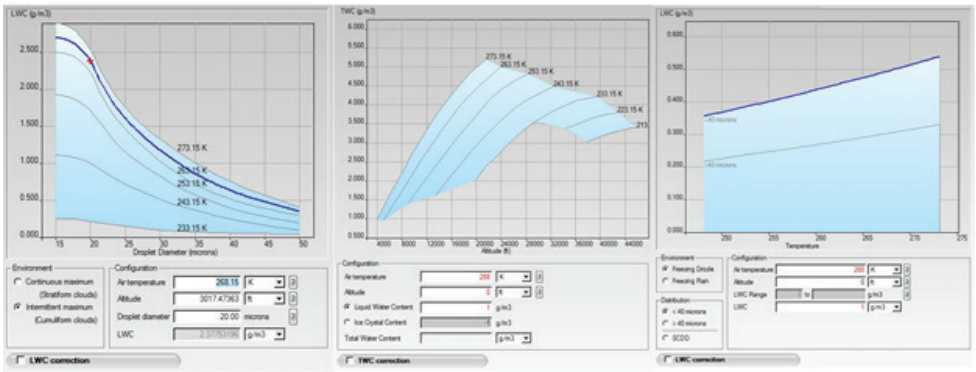
The software takes advantage of high performance computing parallel architectures to speed results for large-scale calculations. FENSAP-ICE can run on both Windows and Linux platforms (including large HPC clusters).

FENSAP-ICE has functionalities such as automatic regridding of iced geometries for multiple accretion layers. This reduces human effort considerably and increases ice shape accuracy, especially in glaze ice conditions. It also includes a rotating frame of reference for the analysis of turbomachines, rotors and propellers.









The heat transfer module of FENSAP-ICE, CHT3D, used for bleed air ice protection or electro-thermal systems optimization, can simulate multiple air-solid interfaces and multilayer conduction, with varying physical properties and phase change. FENSAP-ICE is an ideal tool to analyze and optimize electro-thermal system stack-up with all layers, including dielectric, conductors and electric heating.

DROP3D

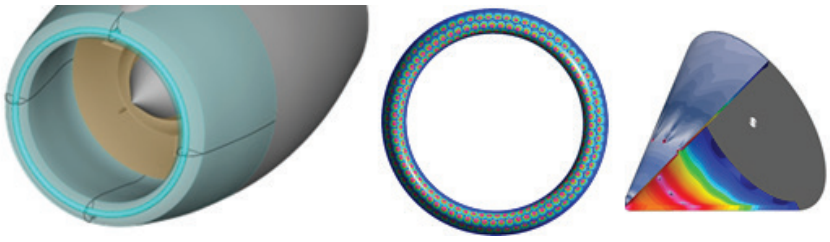
DROP3D, the droplet impingement module of FENSAP-ICE, can handle spatially varying droplet sizes and liquid water content everywhere in the computational domain. This feature enables correct modeling of internal components, of combined internal and external geometries such as air induction systems, and the non-uniformities encountered in the icing cloud. DROP3D computes droplet/ice crystal temperature changes caused by varying airflow temperature, changes in diameter caused by droplet evaporation, change of phase, or the effects of splashing, bouncing and break-up characteristic of Supercooled Large Droplets.

ICE3D

ICE3D can simulate rime and glaze ice accretion on any 3-D geometry, including the effects of runback and evaporation, even on surfaces maintained above freezing by thermal ice protection systems. ICE3D removes the empiricism associated with ice roughness by computing the temporal and spatial variation of roughness of the accreting ice, yielding enhanced ice growth accuracy.

CHT3D

CHT3D is the Conjugate Heat Transfer module. It can simulate both steady-state bleed-air and time-dependent electro-thermal ice protection systems. The airflow domains are separated from the metal or composite skin of the aircraft to provide enhanced flexibility without compromising solution time. This approach uses the most suitable solver for each of the domains, and limits the amount of additional computations required for parametric comparisons. C3D, the heat conduction module, enables the simulation of multilayer materials and their respective phase change, multiple surface or volume heating elements, thermostats and power cycling.



OptiGrid

OptiGrid is a revolutionary, automatic, multivariable anisotropic 3-D mesh adaptation and CAD reconstruction software which helps achieve high-precision CFD simulations on unstructured hybrid grids at the lowest computational cost. OptiGrid can be linked to any commercial or proprietary flow solver through the CGNS format.

OptiGrid starts with an automatic CAD reconstruction from grids generated by any mesh generator. A powerful, user-friendly graphical interface allows users to define the constraints before mesh adaptation.

OptiGrid can also perform mesh smoothing before starting CFD calculation, to set the desired number of grid points and improve surface definition.

OptiGrid assesses the quality of the CFD solution via an a posteriori error estimator based on the truncation error. OptiGrid then systematically modifies the mesh to equalize the solution error in the domain. The grid is automatically adapted by refining, coarsening and swapping edges and moving nodes. All operations are edge-based, and OptiGrid can be coupled to any finite volume or finite element flow code that uses unstructured meshes composed of any combination of tetra, prism and pyramid elements.

OptiGrid does not refine blindly in all three directions, but yields anisotropic meshes, significantly reducing the number of grid points, and capturing with high resolution features such as shocks, boundary layers, wakes, vortices and slip lines.

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