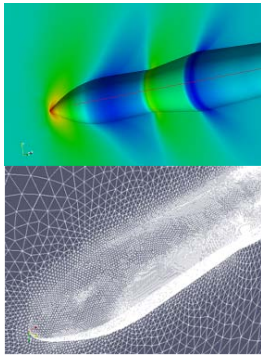




Computational Fluid Dynamics and Numerical Aerodynamics

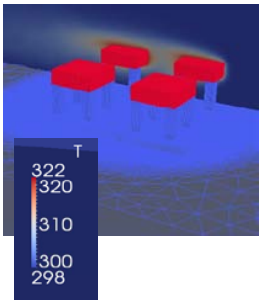
Supersonic flows in external aerodynamics



Supersonic flow simulations are of vital importance to the aerospace engineering community making the use of high performance computing strategies invaluable. Incompressible flow designs are capable of being physically tested (e.g. A tow tank for ships or wind tunnel for subsonic aircraft) at a reasonable cost, but for designs such as hypersonic and supersonic aircraft, CFD simulations may provide the best option due to the high cost and energy demands (and difficulty) of testing in supersonic and hypersonic wind tunnels.

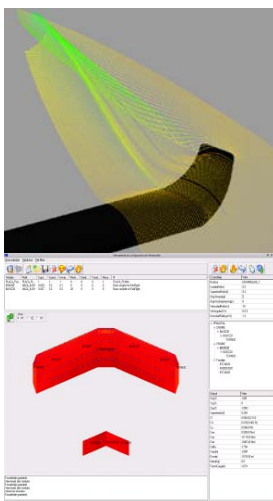
An important research work is under development trying to generate reliable simulations of supersonic flows around rocket's fairing. This capability, coupled with a shape optimization model, should be able to look for the most efficiency geometry for the flying conditions encountered by a nanosatellite launcher.

Heat transfer in forced convection



Heat transfer analysis is just one of the capabilities of the CFD codes with a broad range of applications. As a remarkable effort, some simulations have been conducted in order to predict performance features of the wind sensor of the REMS station, onboard the Curiosity rover on Mars, able of measure Martian wind speed and direction as a function of the heat evacuated from small heated dices.

Low speed aerodynamics



Low speed aerodynamics applies to objects moving through fluids of constant density, typically when object speed is below 0.3 Mach. It is a relatively simple flow that involves a lot of industrial design problems. Numerical modelling is a very useful tool as it helps to reduce wind tunnel tests during the design process, which implies lower development costs.

CFD solutions has been applied not only for aerodynamic design, an important effort is conducted in order to increase the CFD skills of undergraduate, as it is an excellent tool in order to enhance student knowledge of fundamental concepts.

Alternative numerical methods, like vortex lattice, have also been embedded in computer programs, helping to estimate aerodynamic characteristics of new designs.