

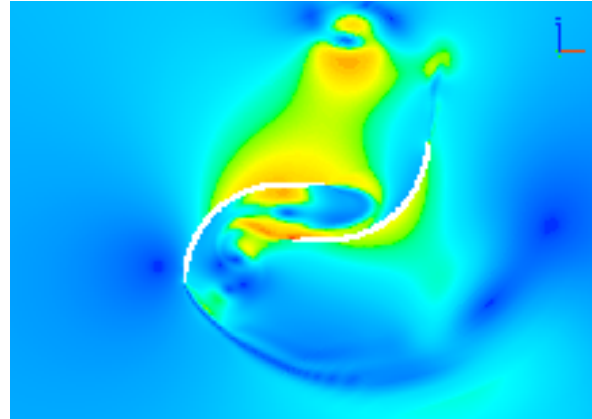
CFS Engineering SA is a consulting company located in the Business Park (PSE) of the Swiss Federal Institute of Technology Lausanne (EPFL). The mission of CFS Engineering is to:

Offer services for the numerical simulation of Fluid and Structural Mechanics engineering problems.

Numerical simulation of complex engineering problems is becoming increasingly important during the design phase, requiring highly specialized knowledge and tools. Computational Fluid Dynamics (CFD) can substantially cut costs of trial-and-error experimentation. CFS Engineering has the knowledge and the numerical simulation tools to work with its customers to better understand the physics of engineering problems, with the ultimate goal of improving product design and/or performance.

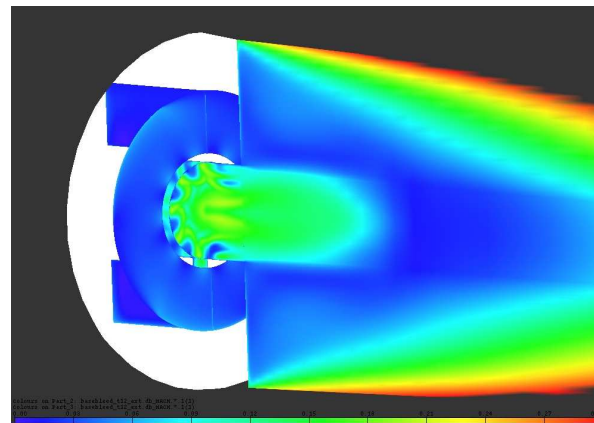
Mixing and Chemically Reacting Flows

Mixing (often encountered in food or polymer processing) and flows with chemical reactions occurring can be highly complex and difficult to model, especially when they occur in turbulent environments.



Numerical simulation of rotating blades mixing a fluid

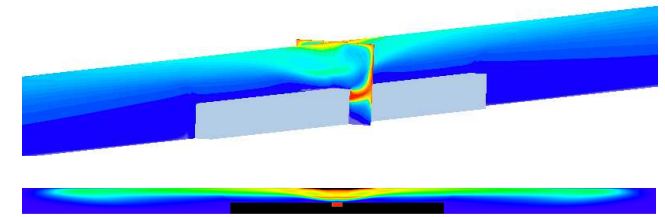
CFS Engineering has the know-how to attack problems of this nature, incorporating client-based rheological models or chemical reactions into our code. Common rheological models such as Bingham, Power-Law and Herschel-Bulkley have already been implemented in our code.



Chemically reacting base-bleed for aircraft flying at Mach 3

Diffusive Flows

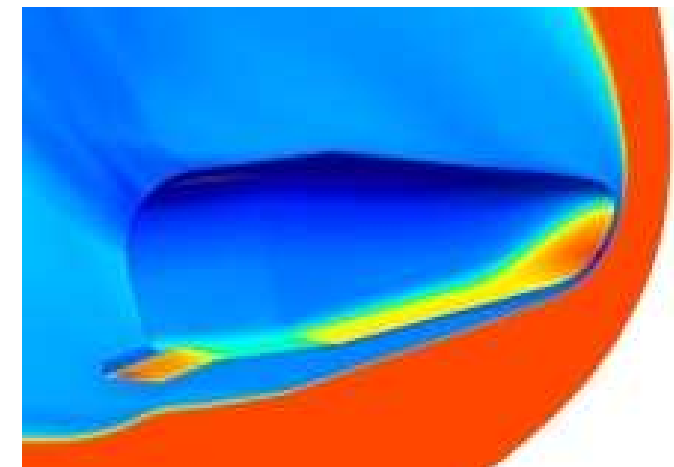
CFS Engineering can model low-speed diffusive flows where convection is minimal. These types of flows occur in smoke or carbon monoxide propagation for example. Simulations of this nature can help to determine the best locations for detectors and emergency exits.



Two views of smoke propagation from a train on fire into a long tunnel

Heat Transfer

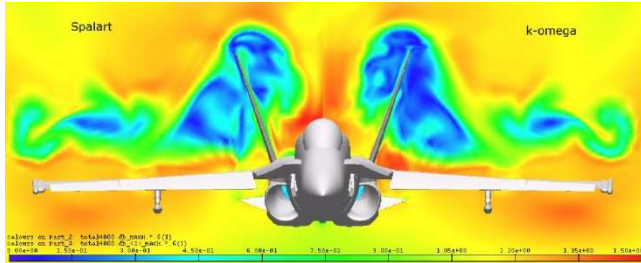
With or without chemical reaction, heat transfer can be an important factor for a variety of applications including civil engineering, transportation, and mechanical or electric devices.



Temperature on the surface of a space craft with Mach number in the background

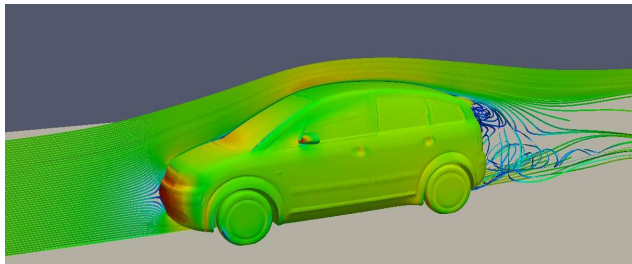
Aerodynamics of Planes, Trains, Automobiles and Boats

CFS Engineering has extensive knowledge of aerodynamic modeling for vehicles of all kinds.



Modeling the flow around an FA-18 using two different turbulence models

CFD can be used in conjunction with or instead of expensive wind tunnel testing, substantially reducing customer cost.



Streamlines and surface pressure for a car driving at 80 km/hr

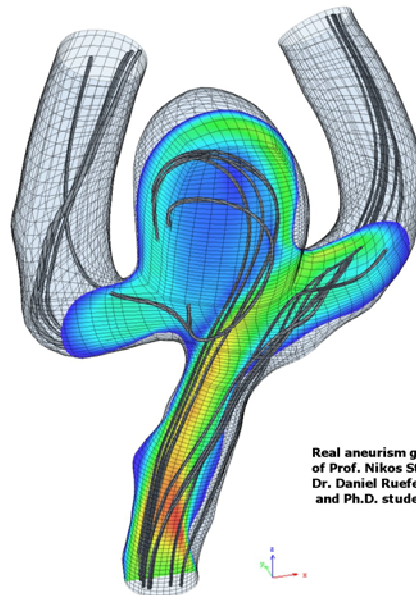


Pressure contours on the surface of a motor yacht

Biomedical Applications

Problems relating to biofluid mechanics in humans are varied. Flow relating to blood in the heart, stents, valves, air flow in the human nose, lungs, and ears, the biomechanics of swimming, and heat transfer related to scalp cooling and thermo-regulation are amongst a few of the areas of interest relating to biofluid mechanics.

Numerical simulations are especially useful for the design of biomedical devices, reducing costs by establishing system performance and identifying critical parameters early in the design sequence. Also, the effectiveness of various surgical procedures can be evaluated *a priori* through simulations. CFS Engineering's in-house software has the capacity to handle physiological flow problems.

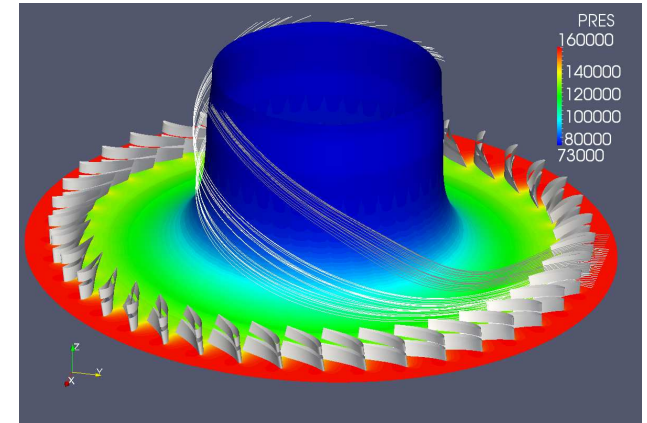


Real aneurysm geometry courtesy of Prof. Nikos Stergiopoulos of LHTC/EPFL, Dr. Daniel Ruefenacht of Neuroradiology/HUG, and Ph.D. student Luca Augsburger

Studying flow patterns, in conjunction with pressure and shear stress distributions provides an important tool for the evaluation of the potential rupture of an aneurysm.

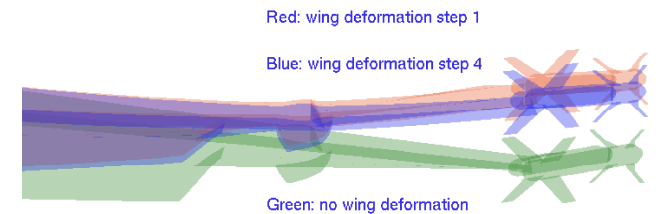
Windmills, Propellers, and Turbomachines

Improving the design of windmills, propellers and turbines/compressors can be achieved using a similar CFD approach.



Pressure contours and streamlines around an axial-radial nozzle with inlet guide vanes

CFS Engineering's experience in complex meshing allows us to attack even the most difficult designs, in addition to handling fluid/structure interactions.



Airplane wing deformation as a result of fluid/structure interaction

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