



Aerospace Design with Unsteady Fluid Dynamics Simulation

Aerospace engineering requires the highly accurate numerical simulation of complex physical phenomena – particularly unsteady, turbulent & separated aerodynamic flow.

This information is used in combination with analysis from structures, thermal and acoustic specialists to design whole aircraft, and sub-components such as undercarriage, nacelles and thrust reversers.

Challenges

The unsteady effects in complex aircraft components such as engines, nacelles and thrust reversers are a combination of many different features of the design – slightly changing one element generally changes the way the whole system performs, and the interactions can be quite nonlinear. In addition, the physical phenomena driving the interactions tend to span several orders of magnitude of length scale – from pressure fluctuations the size of the component down to the micro-scales within turbulent boundary layers. Affordably capturing all of these effects without sacrificing accuracy is a major challenge for existing computational fluid dynamics (CFD) technology.

Solution

Based on cutting-edge research into next-generation high order methods by Dr Peter Vincent and his team at Imperial College London, The Centre for Modelling & Simulation (CFMS) and its technology partners Zenotech and ARA have been developing a new code base for high fidelity aerospace CFD.

The software – which integrates so-called high order flux construction into a general industrial-strength toolset delivers the advantages of improved performance and – critically – scalability on modern many core hardware, with the flexibility of standard methods and workflow integration.

Benefits

The software developed has already been deployed on live programmes within aerospace, and validated against world-class international workshops designed to test the turbulence modelling and robustness of the global aerospace simulation software. In line with Aerospace Technology Institute (ATI) and Innovate UK grant funding received, CFMS are able to provide the commercial capability free of charge to UK-based academic research organisations.

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