

What is CFD?

CFD is a numerical modelling technique, using algorithms to solve the Navier-Stokes equations which govern fluid flow and heat-transfer.

Depending on the required level of complexity, CFD simulations can be carried out using either 1-D, 2-D or 3-D models which are typically used to solve problems involving heat transfer, turbulence modelling, multiphase flows and fluid-structure interactions.

Our CFD capabilities using high performance servers allow us to carry out complex simulations. Typically our workflows involve the optimisation of conceptual designs through to formulation and modelling of complete 3D structures.

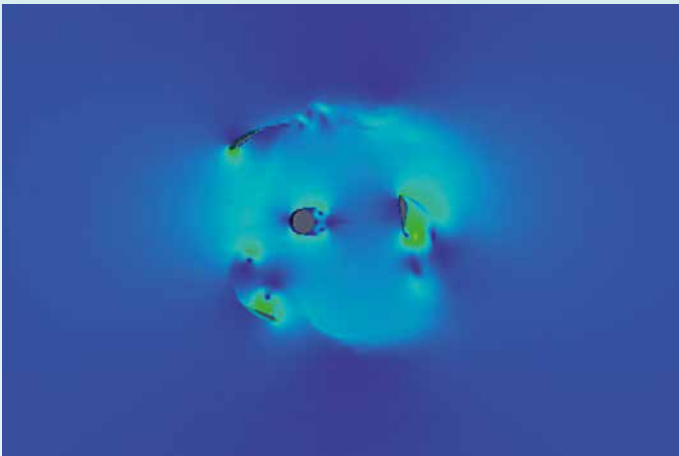


Figure 3 Turbulent flow through a Darrieus turbine, modelled in 2D with a rotational reference frame



Figure 4 Rendering of relative air velocity over an aircraft approaching landing

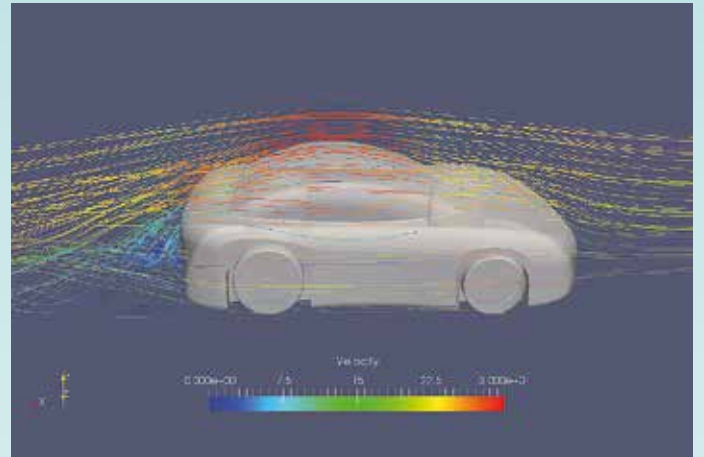


Figure 1 3D turbulent fluid flow over simplified geometry of a car

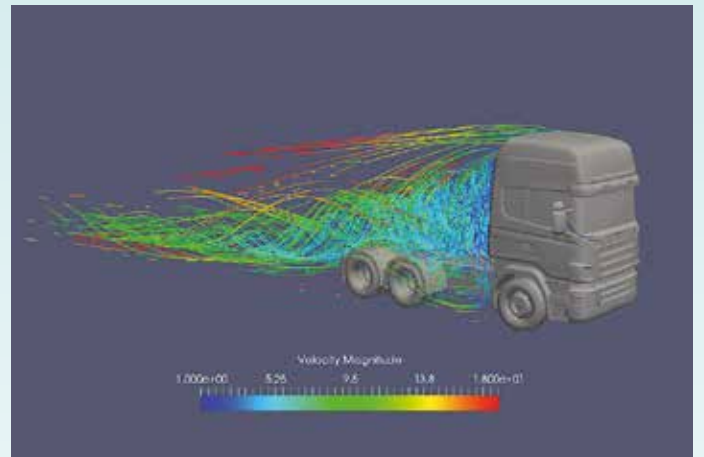


Figure 2 3D turbulent fluid flow demonstrating pressure stagnation behind a Scania lorry

Benefits of CFD adoption

Using CFD at the design stage can result in valuable insights into fluid mechanics performance allowing the optimisation of geometry prior to manufacture of a physical prototype. The overall time and expense of product development can thereby be greatly reduced.

The implementation of CFD can be used to determine pressures and loadings which then allow us to assess the static, fatigue and vibration characteristics of structures to be checked via a Fluid-Structure Interaction (FSI) approach. As such, Jesmond Engineering is able to offer a complete design service to develop and optimise structures.

What is FEA?

Finite Element Analysis (or Methodology) is a numerical modelling technique using geometries, static or dynamic loads, environmental conditions, material properties and constraints to evaluate structural responses such as stress and strain in a virtual environment.

At Jesmond Engineering we have extensive experience conducting finite element analyses, ranging from simplified 2-D models to complete 3-D aircraft structures. Cases typically include:

- Linear and non-linear analyses
- Geometric non-linearity (e.g. gaps and contacts)
- Non-linear material response
- Dynamic analysis, normal modes
- Frequency response
- Random vibration

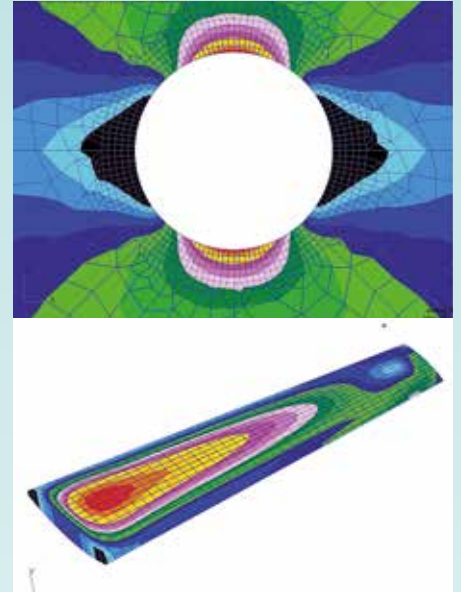


Figure 5 Stress analysis on a hole (top) in an aerofoil section (bottom)

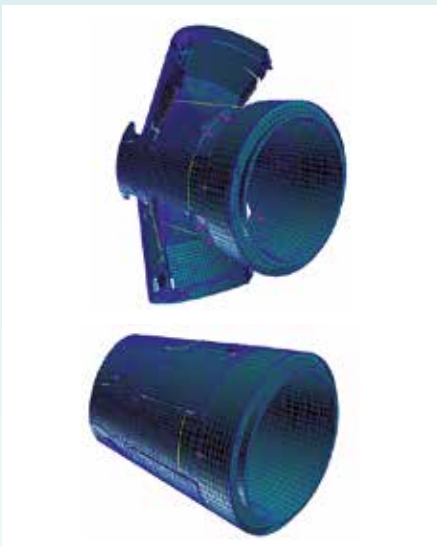


Figure 6 FEM of an aircraft engine thrust reverser with the doors deployed (top) and stowed (bottom)

Benefits of FEA adoption

Due to the ever-increasing performance and efficiency required in modern engineering structures, FEA is becoming an increasingly necessary analytical tool. Key benefits of adoption include:

- Significant reduction in design costs: Designs can be parameterised for remodelling to determine an optimal design specification.
- Significant reduction in production costs: fundamental design characteristics can be reliably modelled without unnecessary expenditure on prototype iterations.
- Significant reduction in testing costs: FEA allows the ability to demonstrate compliance with safety standards without costly and time consuming real-world testing.

FEA may be conducted hand-in-hand with CFD analysis, utilising CFD derived temperatures, loads and pressures for a comprehensive structural assessment.