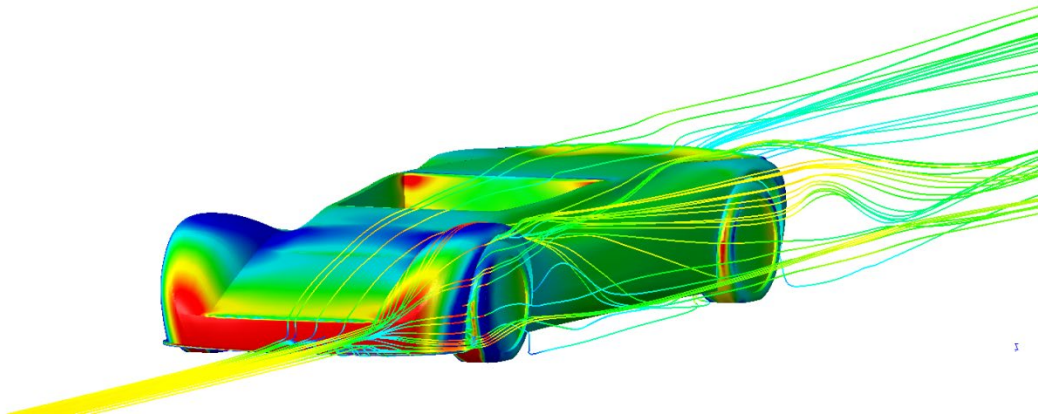


Complex Flow Problems

An Application of Empirical Design, CFD, FSI, Test and Optimisation Methods

White Paper



SUMMARY

GRM provide a wide range of services for Computational Fluid Dynamics (CFD), using numerical methods to analyse and solve problems that involve fluids. GRM are also able to model complex problems involving Fluid Structure Interaction (FSI), enabling the analysis of complex events with moving and deformable structures within fluid domains.

With over 16 years of experience in FSI and CFD across the spectrum of engineering, the result is a refined evolution of analysis and design optimisation methodologies, creating realistic load cases for complex transient events.

Some of these techniques and methodologies are demonstrated in the following projects with Eclipse Sportscars, Alvant and Land Rover BAR, which involved providing real time solutions under extreme time pressure and regulation constraints. GRM provide innovative multi-physics solutions to complex problems for the world's leading companies.

Areas of GRM's CFD Consulting Expertise

- Internal and External Flows
- Turbulent Cases
- Heat Transfer
- Casting Simulation
- Shape Optimisation for CFD
- Fluid Structure Interaction
- Complex Multi-Physics Solutions

Contact us to find out how we can assist your business by providing you with real time, cost effective and efficient solutions - info@grm-consulting.co.uk.

Eclipse Sportscars Diffuser Development

Clive Hudson, CEO of Eclipse Sportscars, had previously experimented with creating a diffuser for the Eclipse SM1 kit car, with varying levels of success. An addition of a diffuser to the Eclipse SM1 was expected to have many benefits to the existing design, providing significant downforce improvements with limited increases in drag.

GRM Consulting was able to help Eclipse with the design of a diffuser guided by CFD. A Design of Experiments (DOE) was created that allowed many combinations of potential solutions to be explored easily and efficiently, and the optimised design to be identified.

The use of DOE allowed many design solutions to be explored in simulation and the best option delivering balanced downforce with minimal drag to be identified. By coupling transient methods into the process, pitch and ride-height sensitivity were explored and the design developed to deliver a robust solution.

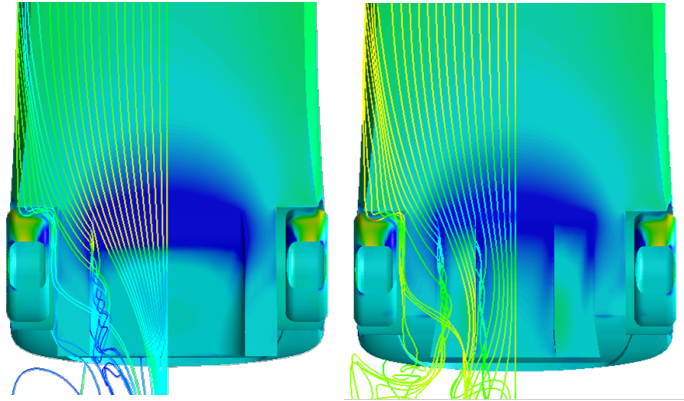


Fig. 1 Initial and GRM optimised diffuser designs.

GRM have over 16 years of experience in solving complex computational fluid dynamics problems.

Our consulting and software teams have evolved methodologies that utilise cutting edge software that will provide real time solutions, reducing design cycles, production stages and time to market. Contact us to find out how we can help your business.

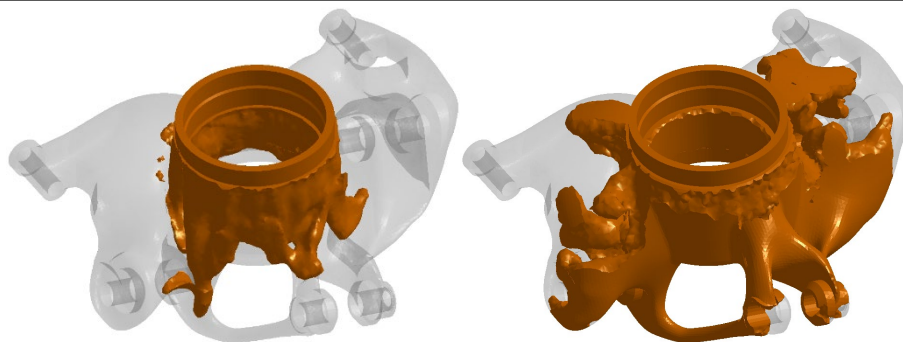


Fig. 2 Simulation of Complex Manufacturing Techniques

GRM recently worked in collaboration with Alvant to understand their casting process, a key highlight of the project being that GRM were able to provide an insight into fluid behaviour that could not be observed in test, and use this understanding to guide the design of future components. GRM Project Engineer, James Burt, presented the findings of one of these recent fluid structure interaction based problems at the 12th European LS-DYNA Conference in Koblenz, Germany.

Structural Engineering in the Fluid Environment of the America's Cup

Competing for the America's Cup is as much a design race as it is a sailing race. The leveraging of advanced technology and techniques in innovative ways has always been central to the design of the yachts. This was the case when America first won the race around the Isle of Wight in 1851, and is still very much the case for the hydro-foiling yachts, designed for the current trophy chase.

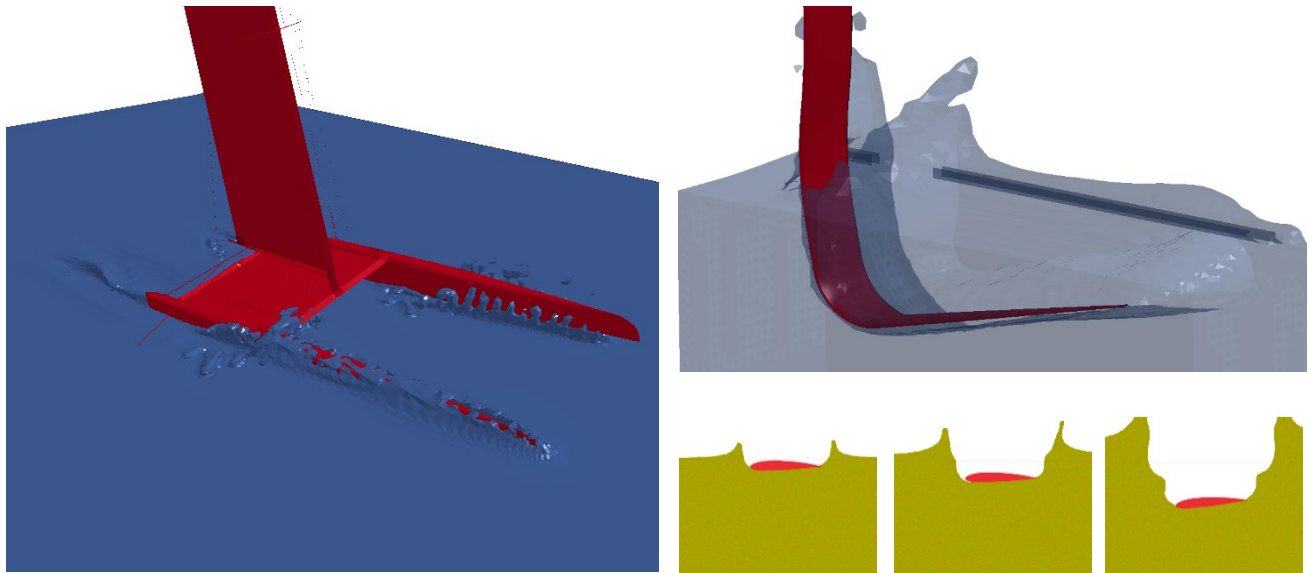


Fig. 3: Fluid Structure Interaction Methodologies Applied to America's Cup by GRM.

The importance of analysis led design with applied CFD and optimisation methodologies cannot be overstated in order to focus on reduction of weight and the production of the most efficient composite hull solution. David Jonson, of the America's Cup team formerly known as Land Rover BAR, consulted with GRM to help deliver cutting edge improvements in racing performance.

LAND ROVER BAR – AMERICA'S CUP

"In the America's Cup, the impact of optimisation is pretty important. It's a competition between teams, so eking out the last bit of performance over and above your competitors is very important. So extracting maximum performance using rational optimisation tools is particularly relevant to us."

David Jonson



The optimisation of components and systems were of vital importance in a race where every detail counts. GRM were happy to employ a wide variety of CFD, FSI and innovative optimisation techniques on the AC35 to help produce an exceptionally engineered vessel.