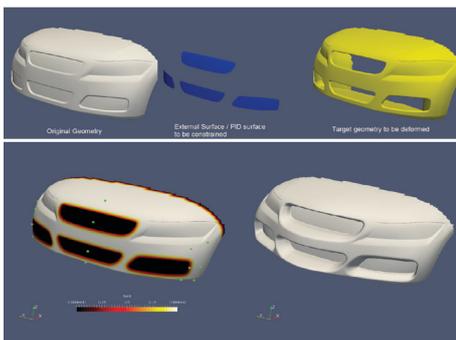
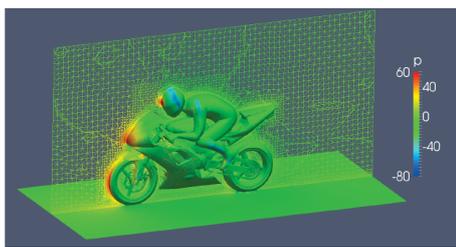
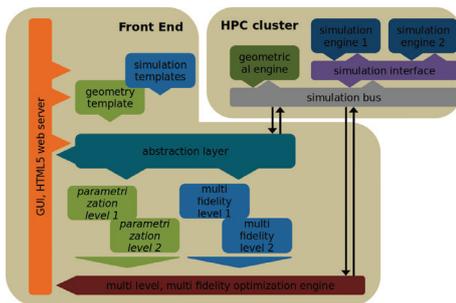
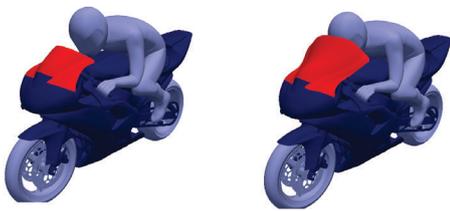


## Cloud-based shape optimisation in manufacturing

### Fortissimo Experiment Facts:

- Segment: Automotive
- Application Domain: Design optimization
- Application: Camilo



### The Company

Over the last two decades, numerical simulation has become a key enabler for innovation in manufacturing. The capability to simulate the features of a new product, without the need to build a physical prototype, has lowered both cost and time to market and enabled the design of better products.

Automobili Lamborghini, is an Italian manufacturer of luxury sports cars and SUVs. The company is owned by the Volkswagen Group through its subsidiary Audi. Founded in 2006, OPTIMAD is an Italian SME active in shape and topology optimisation in the engineering sector. The objective of this experiment was to demonstrate that by combining High-Performance Computing (HPC) and optimisation software, there is an opportunity to change current design practices and bring automatic shape optimisation (ASO) to a wider audience of manufacturing SMEs. The goal was to develop and implement an HPC-cloud-based platform that gave the inexperienced user the possibility to optimise automatically the shape of a particular mechanical system. The aim was to test this solution using practical test cases from the end-user Lamborghini.

### The Challenge

There are several issues associated to the use of automatic shape optimization. It takes significant computational power, because many simulations need to be evaluated. Only specialised engineers with an in-depth knowledge of the product can set up a viable ASO procedure. Several different software packages need to be interfaced and integrated into a single platform. The challenge facing this experiment was therefore to develop a platform which combined Cloud-based HPC resources with in-house computing capabilities, to develop an intuitive user interface providing an integrated solution for non-expert users and to create a one-stop-shop for end-users who are only occasional users of ASO.

### The Solution

The SOUTH platform, which provides an integrated environment, granting access to the necessary optimization software and to adequate computing resources, both in-house and Cloud-based HPC, has been developed. An easy-to-use graphical user interface has been designed with an optimal trade-off between easiness of use and flexibility. While there is a high degree of automation, the user retains the possibility of interacting with the optimisation process by stopping it and investigating partial solutions. This permits the user to exploit his own expertise and effectively steer the optimisation towards the optimal design. An inexperienced user in terms of optimization, but experienced in terms of numerical simulation, can easily and autonomously set up an optimization run.

The SOUTH platform constitutes an innovative and cost-effective approach to making shape-optimisation software available to small and medium-sized enterprises, which do not employ this software on an everyday basis, which cannot afford to have permanent in-house expertise in optimisation and which cannot afford the necessary computing resources. Furthermore, the SOUTH platform allows Lamborghini to scale-out during productivity peaks to avoid bottlenecks due to limited in-house capacity. The possibility to deal with simulation peaks in this way enables much more cost-effective computing to be performed.

### Fortissimo Experiment Partners:

- Automobili Lamborghini (End-user)
- OPTIMAD (ISV)
- University of Strathclyde (Application Expert)
- CINECA (HPC Provider)

### More Information:

[www.fortissimo-project.eu](http://www.fortissimo-project.eu)

E-Mail: [info@fortissimo-project.eu](mailto:info@fortissimo-project.eu)



## The Benefits

Lamborghini has its own HPC resources. However, having its environment duplicated on a supercomputing class HPC centre has the following benefits: a reduction in overall development time of 40%; the opportunity to use better simulation tools; and the capability of dealing with peaks in the demand for computer resources by using Cloud-based HPC. The use of SOUTH reduces the effort for a typical optimisation from 2.25 person months to 2.0 days and the elapsed simulation time from 3 months to less than 10 days. Although the number of cpu hours required rises from 120K to 160K, the overall reduction in cost is ~ €18K. Generally, considering the average design activity in the company, yearly cost savings are expected to range from €140K to €200K.

Until now, OPTIMAD has provided automatic shape optimization mainly as a consultancy service with typical cost to the end-user of ~ €20K to €40K per optimisation. Through the SOUTH platform, the same service may be delivered with typical costs of ~ €8K to €12K whilst keeping the same profit margins. This will permit OPTIMAD to offer a more competitive and attractive service to the market. It is estimated that in the first year through the use of SOUTH in its consultancy service, the increase in revenue for OPTIMAD will be ~ €75K with a net profit of ~ €22K. By deploying SOUTH as a scalable SaaS using Cloud-based HPC resources, OPTIMAD expects further revenues in the first year of operation to be €150K with a net profit of €37K.

Both CINECA and the University of Strathclyde expect to benefit from the availability of SOUTH in their research activities and in the sale of computer cycles to support their commercial and teaching activities.

## The Fortissimo Project

Fortissimo is a collaborative project that enables European SMEs to be more competitive globally through the use of simulation services running on a High Performance Computing cloud infrastructure. The project is coordinated by the University of Edinburgh and involves 123 partners including Manufacturing Companies, Application Developers, Domain Experts, IT Solution Providers and HPC Cloud Service Providers from 14 countries. These partners are engaged in 53 experiments (case studies) where business relevant simulations of industrial processes are implemented and evaluated. The project is funded by the European Commission within the 7th Framework Programme and is part of the I4MS Initiative.

**I4MS** Fortissimo is part of I4MS ICT Innovation for Manufacturing SMEs: [www.i4ms.eu](http://www.i4ms.eu)



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