

# SHAPE OPTIMIZATION OF 3D PRINTED HIGH PERFORMANCES AUTOMOTIVE PARTS

## THE CHALLENGE

Despite the clear advantages of Additive Manufacture, current design tools have been developed for traditional manufacturing procedures and are not flexible enough. This limits the potential of 3D printing. CAE tools are able to suggest new shapes and accurately predict the behaviour of components making them a natural choice in the design chain. However, and especially when dealing with complex Computational Fluid Dynamic (CFD) simulations, shape optimization can be a prohibitively expensive task for SMEs. The objective of this case study is the development of an optimisation service. The goal is to demonstrate the validity of such a service by optimising a prospective industrial artefact, a Lamborghini 12-cylinder airbox.

## THE SOLUTION

Numerical grid parameterisation using a mesh morpher avoids the time consuming task of mesh generation (that can take up to 70% of the total analysis cost). Access to CFD simulation through the Fortissimo HPC Cloud allows a further speed-up in calculation times reducing the time to market and to return on investment. Using a collaborative, interactive, cloud interface helps analysts and clients to work together and to be integrated in the value chain, increasing customer satisfaction and building better products more effectively.

The development cost of a new air-box, estimated as 250k€ using a standard approach, can be reduced to 75k€ using the HPC cloud service. Based on a forecast that, over the next two years, HSL will undertake three new air-box optimisations each year and that, compared with traditional CAD methods, there is a cost saving of 175k€ per optimisation, the annual saving is equivalent to 525k€.

## THE BENEFITS

HSL expects that the new service will see the development of a business department with two to three staff, potentially growing to five to six staff after three to four years. For UTIV it is estimated that thanks to the new know-how acquired the relevant department will increase its industrial research services. The economic benefit is estimated to be between 40 to 70k€ per year in a five-year plan. Finally, this case study comprises a success story for CINECA, in the application field of high fidelity CFD, that is estimated to bring in at least two new SME customers per year, with an approximate 5% increase in revenue for commercial services.

Having access to the RBF Morph morphing tool combined with CFD analysis powered by HPC opens a wide range of business opportunities. In parallel with existing rapid prototyping services, HSL can now propose to its clients alternative component designs corresponding to appropriate performance indicators. For HSL, offering a shape optimisation service in parallel with its existing core business of rapid prototyping activities, represents an opportunity to establish customer activity over a range of key R&D areas. HSL is ready to offer the developed tool to a range of existing clients in the automotive industry, anticipating for the next two years, a total revenue growth of 16% per year in that sector.



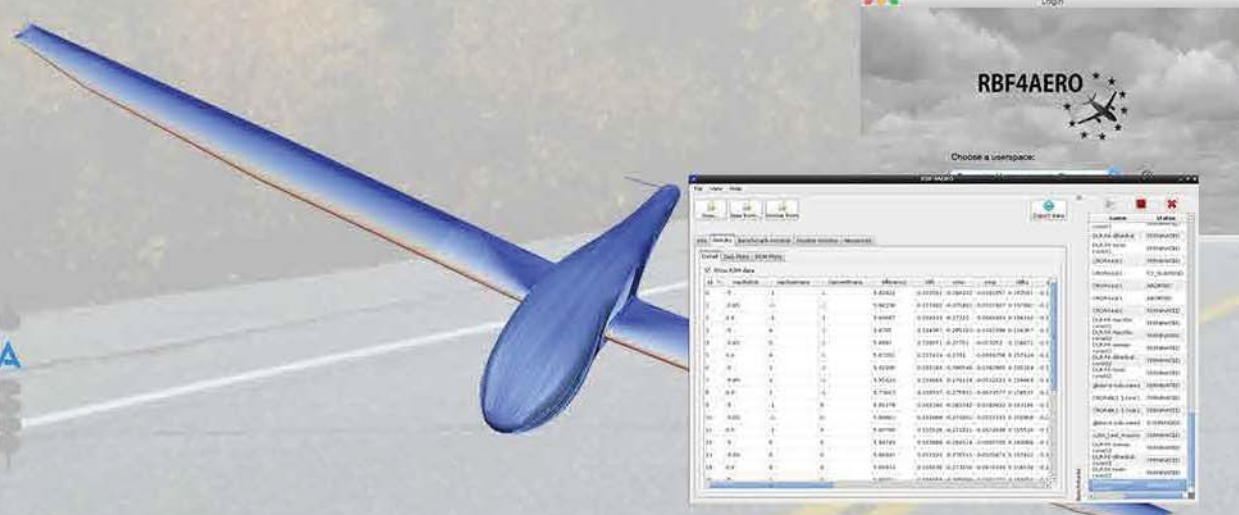
FORTISSIMO



## WE ARE NOW ON FORTISSIMO 2: CROSS-SOLVER CLOUD-BASED TOOL FOR AERONAUTICAL FSI APPLICATIONS



CINECA



hsl



(rbf-morph)™



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