Cross-Solver Cloud-based Tool for Aeronautical FSI Applications

Fortissimo Experiment Facts:
- Industry Sector: **Aerospace**
- Country: **Italy**
- Software Used: **SU2, RBFmorph, OpenFOAM**

ORGANISATIONS INVOLVED

RINA CONSULTING SPA (end-user) (formerly D'Appolonia SpA) is an Italian engineering consulting company providing a wide range of high-quality tailored solutions in the Energy, Marine, Certification, Transport & Infrastructure, Industry sectors.

UTV and NTUA (Application Experts), University of Rome "Tor Vergata" and the National Technical University of Athens provided expertise in numerical optimization and mesh morphing.

CNR (HPC Expert and Application Expert) an Italian research centre Consiglio Nazionale delle Ricerche provided expertise in cloud technology.

CINECA is an HPC provider and host centre.

THE CHALLENGE

For an aircraft production cycle, the ability to reduce production costs decreases rapidly during the first phases of the project. In fact, 80% of the development cost and 70% of the life cycle cost of a product are determined during its conceptual design phase. Considering this, the need to reduce the research and development (R&D) investigation time is significant. Consequently, powerful design tools are essential to shorten the time to acquire physical knowledge about the aircraft components and so to reduce production costs.

THE SOLUTION

The RBF4AERO platform is a toolbox which tackles all the aspects related to aircraft numerical design and optimization. It does this by making the CFD model parametric through an innovative shape optimization tool based on a high-performance meshless morphing technique.

The experiment performed the successful adaptation of the RBF4AERO platform to work on cloud-based HPC. This adaptation was applied to the optimization of a component of a real aircraft using computational models relevant to the aeronautical sector. The Consortium benefitted from the technical collaboration with Piaggio Aerospace, an important worldwide stakeholder in the design and manufacturing of mid-size business aircraft. Piaggio Aerospace provided the models to set-up the optimization of the shape of the P180 Avanti EVO vehicle.

BUSINESS IMPACT

Improving aircraft performance has a clear economic value.

In this experiment the RBF4AERO platform was used on an industrial case demonstrating its capability to solve a wide range of real world aeronautical aero-elastic optimizations in a reliable and cost-efficient manner. This achievement
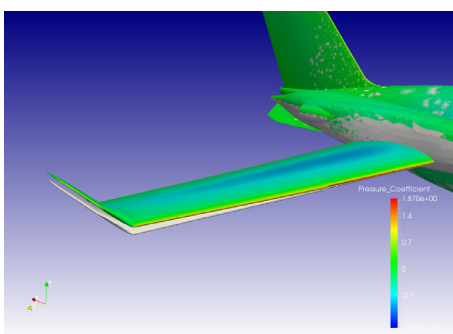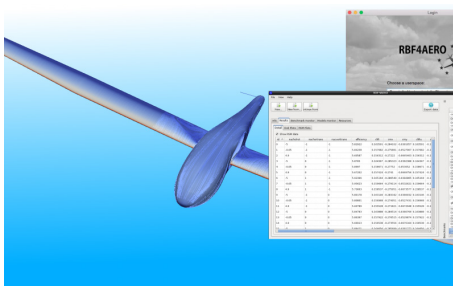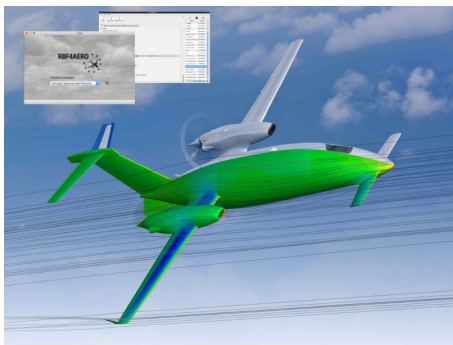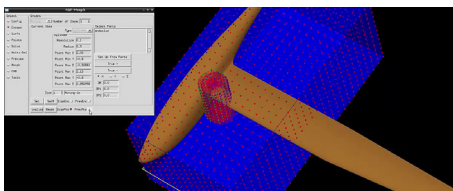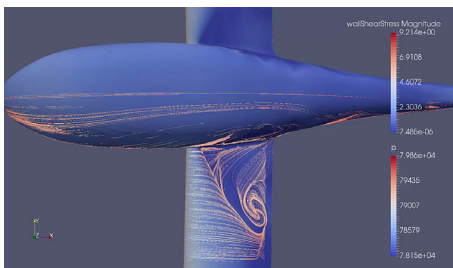
was realised through the generation of a computational mesh aligned with the requirements dictated by a worldwide mid-size business jets stakeholder, the generation of consistent shape modifications of industrial significance and the demonstration of the feasibility of a fully coupled fluid-structure interaction computation with CAE models characterised by non-matching external surfaces.

BENEFITS

- RINA CONSULTING estimates an increased turnover of €100,000 one year after the finalization of the experiment and a total accumulated of at least €400,000 over three years
- RINA estimates an increase of at least 2 qualified jobs over three years.

  The service will allow RINA to lower its current hourly rate by up to 10% and so reach new clients.
- NTUA estimates an increase by 5% in the revenues coming from FSI related projects in the next three years.

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 more than 100 partners including Manufacturing Companies, Application Developers, Domain Experts, IT Solution Providers and HPC Cloud Service Providers from 14 countries. These partners are engaged in over 90 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 Horizon 2020 and is part of the I4MS Initiative.