CEASIOMpy: A Modular and Open-Source Python Environment for Aircraft Design – A Tool for Rapid Evaluations

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In today's fast-paced world, the demand for quick results has become a driving force in many fields, including engineering. In aircraft design, where multiple processes such as simulation, optimization, and analysis must be integrated, achieving faster results is not just about speeding up individual simulations. It's about streamlining workflows and automating complex design processes. CEASIOMpy is designed to meet this need by facilitating rapid evaluations through modular workflows that integrate aerodynamics, structural analysis and other key components of the aircraft design process, significantly reducing the time and effort required for manual tasks.

CEASIOMpy is a robust, open-source Python environment designed for aircraft design. Originally developed as a MATLAB tool under the European SIMSAC project, it has evolved significantly with the support of initiatives such as AGILE. It now has enhanced functionality and a modular architecture. CEASIOMpy uses the Common Parametric Aircraft Configuration Schema (CPACS) model to manage a wide range of data, including aircraft geometry and performance characteristics.

Key modules include the Aerodynamics module for low- and medium-fidelity simulations, the Geometry & Mesh module for aircraft geometry and mesh generation, and the Structural module for low-fidelity fluid-structure interaction (FSI) analysis. In particular, the AeroFrame module combines the Vortex Lattice Method (VLM) with a BEAM structural model to provide fast, low-fidelity results within minutes.

CEASIOMpy has demonstrated its capabilities in collaborative projects, such as generating Euler and hybrid meshes in minutes for the Low Boom Aircraft Common Research Model (LARM), as shown in Figures 1a and 1b, in partnership with Airinnova and the Chinese Aeronautics Establishment (CAE). It is also being used in the European COLOSSUS project for low-fidelity analysis of a seaplane model, demonstrating its versatility and effectiveness in addressing diverse design challenges.

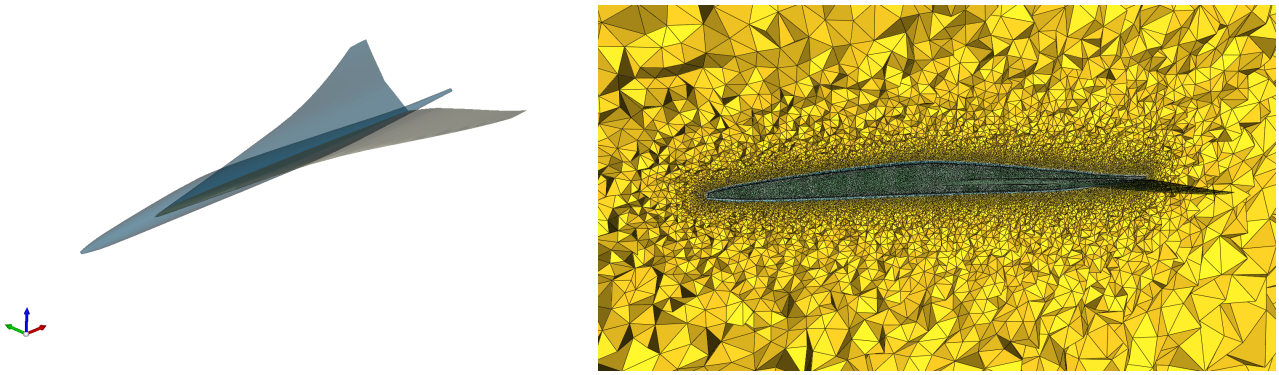

Figure 1a 1b: LARM model and hybrid mesh generated using CEASIOMpy

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(Collaborative System of Systems Exploration of Aviation Products, Services and Business Models)

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