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A framework approach integrating high-fidelity analysis methods for gradient-based design optimization of aircraft

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A framework approach is presented for gradient-based multidisciplinary optimization (MDO) of aircraft by means of high-fidelity analyses. It takes advantage of both the HPC ecosystem *FlowSimulator* and the framework *OpenMDAO* [1]. The prior relies on the central *FlowSimulator Data Manager (FSDM)* and a number of simulation plug-ins well-established in aeronautics industry, such as the DLR CFD code *TAU* with its discrete-adjoint complement, an elasticity-based mesh deformation approach, finite-element structure-mechanics analyses and methods for the transfer of surface loads and deformations together with a CAD-based shape parametrization. The latter implements an automated computation of multidisciplinarily coupled gradients of cost and constraint functionals. Using the suggested framework approach, an existing procedure for the static aeroelastic design optimization of a generic transport aircraft in trimmed cruise conditions [2] is reorganized and restructured hierarchically. The modular framework integration of MDO components, which allows for an automated reverse-mode gradient accumulation, will be described and discussed in the presentation showing the practical value of the HPC framework approach for the static aeroelastic optimization case at hand. Special attention will be given to software architecture, consistency and performance issues, such as in-memory data handling in parallel MDO computations and scalability of the suggested MDO framework approach.

REFERENCES

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