

Algorithmic Differentiation for an efficient CFD solver

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The benefits of Algorithmic Differentiation (AD) are illustrated in the present paper regarding the development of aerodynamic flow numerical simulation softwares. In refining the architecture of the CFD solver elsA (Cambier et al. [1]), developed jointly by ONERA, Airbus, and Safran, we consider AD as a key technology to cut down development costs of derivatives of interest namely, tangent, adjoint, and Jacobian. The mathematical background making these particular derivatives central in the solver capabilities is recalled. The elsA software architecture is briefly presented as well as the design choices enabling its HPC capability. The impact of these choices on the use of AD is then discussed. To meet the expected efficiency requirements, a Source-Transformation approach of AD is adopted using Tapenade (Hascoët et al. [2]), which added value is demonstrated through a set of experiments and performance measurements presented here. Finally the results of recent large scale simulations performed with the improved version of the elsA software are provided.

REFERENCES

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