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SÉMINAIRE
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OPTIMISATION NUMÉRIQUE POUR LA CONCEPTION D'UNE AILE D'AVION :
Rêve ou réalité

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Invité à l'ISAE

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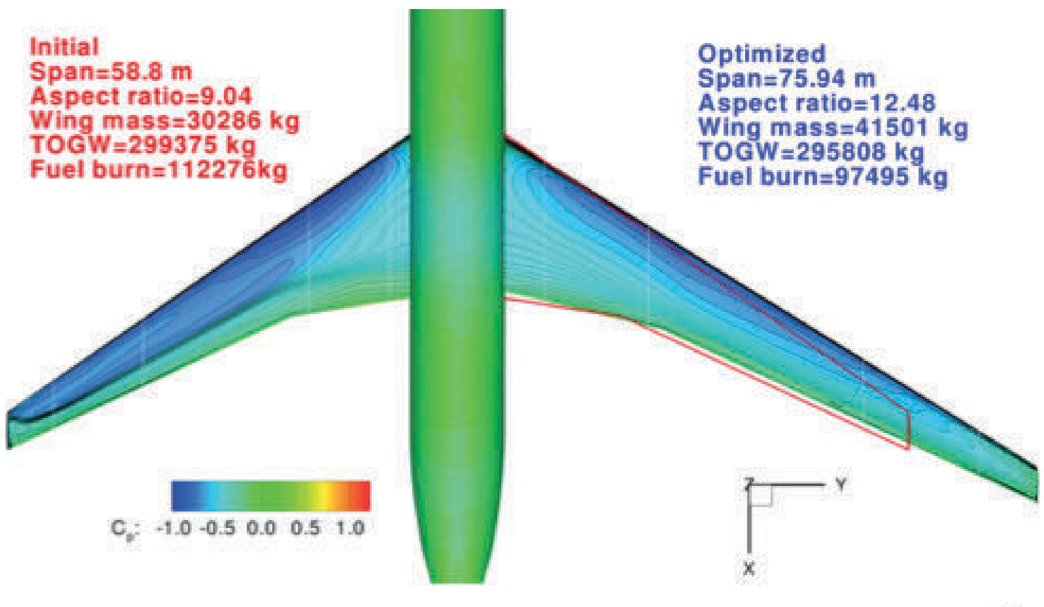

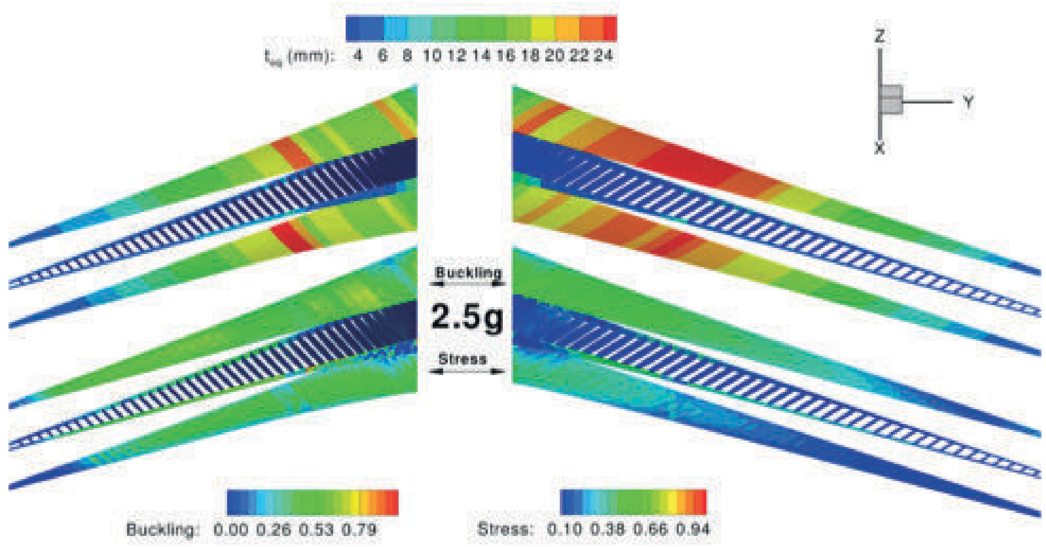

Wing shape is a crucial aircraft component that has a large impact performance. Wing design optimization has been an active area of research for several decades, but achieving practical designs has been a challenge. One of the main challenges is the wing flexibility, which requires the consideration of both aerodynamics and structures. To address this, we proposed the simultaneous optimization of the outer mold line of a wing and its structural sizing. The solution of such design optimization problems is made possible by a framework for high-fidelity aerostructural optimization that uses state-of-the-art numerical methods. This framework combines a three-dimensional CFD solver, a finite-element structural model of the wingbox, a geometry modeler, and a gradient-based optimizer.

This framework computes the flying shape of a wing and is able to optimize aircraft configurations with respect to hundreds of aerodynamic shape and internal structural sizes. The theoretical developments include coupled-adjoint sensitivity analysis, and an automatic differentiation adjoint approach. The algorithms resulting from these developments are all implemented to take advantage of massively parallel computers. Applications to the optimization of aircraft configurations demonstrate the effectiveness of these approaches in designing aircraft wings for minimum fuel burn. The results show optimal tradeoffs with respect to wing span and sweep, which was previously not possible with high-fidelity models.

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