Optimisation in Aeronautics Using Evolutionary Algorithms

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Experience gained so far with evolutionary algorithms will be presented, and reasons why and how those are applied in industrial aerodynamics will be given. It is intended to provide insight in the use of evolutionary algorithms (genetic algorithms and evolutionary strategies) for both shape and performance optimisation in the field of aerodynamics. In general, it will be demonstrated why evolutionary algorithms are chosen as an optimisation means in a complex industrial environment.

The presentation will include discussions both on advantages and disadvantages when using evolutionary optimisation tools for improving basic designs. In accordance to that, all aspects influencing the level of an attainable improvement over the initial design will be discussed - from parameterisation issues, via an adequate use of analysis tools (in aerodynamics) up to the influence of different Pareto selection criteria and influence of mesh resolution when CFD solutions are required.

Application to be shown will (likely) focus on the following aerodynamic cases:

1. Results on multi-point (inverse and direct) design cases will be presented based on an inverse 2D airfoil performance optimisation as well as optimisation of a planform optimisation of the X-31 wing.

2. Additionally, results will be presented and discussed that have been obtained using “simple” pre-design but multi-disciplinary prediction methods for a loiter-time optimisation of a Hale (High altitude long endurance) aircraft – aiming at the need for robust design.

3. Last but not least first results for a multi-disciplinary design study for a UAV (unmanned air vehicle) will be presented.

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