

Fast Aerodynamic Evaluation of Transport Aircraft in Early Phases

Authors : Xavier Bertrand, Alexandre Cayrel

Abstract : The early phase of an aircraft development is instrumental as it really drives the potential of a new concept. Any weakness in the high-level design (wing planform, moveable surfaces layout etc.) will be extremely difficult and expensive to recover later in the aircraft development process. Aerodynamic evaluation in this very early development phase is driven by two main criteria: a short lead-time to allow quick iterations of the geometrical design, and a high quality of the calculations to get an accurate & reliable assessment of the current status. These two criteria are usually quite contradictory. Actually, short lead time of a couple of hours from end-to-end can be obtained with very simple tools (semi-empirical methods for instance) although their accuracy is limited, whereas higher quality calculations require heavier/more complex tools, which obviously need more complex inputs as well, and a significantly longer lead time. At this point, the choice has to be done between accuracy and lead-time. A brand new approach has been developed within Airbus, aiming at obtaining quickly high quality evaluations of the aerodynamic of an aircraft. This methodology is based on a joint use of Surrogate Modelling and a lifting line code. The Surrogate Modelling is used to get the wing sections characteristics (e.g. lift coefficient vs. angle of attack), whatever the airfoil geometry, the status of the moveable surfaces (aileron/spoilers) or the high-lift devices deployment. From these characteristics, the lifting line code is used to get the 3D effects on the wing whatever the flow conditions (low/high Mach numbers etc.). This methodology has been applied successfully to a concept of medium range aircraft.

Keywords : aerodynamics, lifting line, surrogate model, CFD

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