

STS 03

Unsteady Simulation of High-Lift System Aerodynamics

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Session Abstract

Keywords: *High-lift aerodynamics, unsteady CFD, validation, high-lift system design*

The aerodynamics of high-lift systems on transport aircraft still poses high challenges on the capabilities of numerical simulations. While the demand on accurately predicting stall onset is still not achieved to a sophisticated level, new challenges arise with the progress on active flow control technologies and load control.

Previous issues of this STS have concentrated on progress in European projects performing and using high-level validation experiments for steady flows at stall onset. This issue of the STS is intended to provide insight into a dedicated project for validation of unsteady CFD methods for dynamic high-lift system aerodynamics simulation.

The project UHURA, running from September 2018 to August 2022, has been focusing on the unsteady flow behaviour around high-lift systems and will first time deliver a deeper understanding of critical flow features at new types of high-lift devices of transport aircraft during their deployment and retraction together with a validated numerical procedure for its simulation. UHURA performed detailed experimental measurements in several wind tunnels to obtain a unique data set for validation purposes of Computational Fluid Dynamics (CFD) software, including detailed flow measurements by Particle Image Velocimetry (PIV) and other optical measurement technologies. Advanced CFD methods promising significant improvements in the design lead time have been applied and validated against this database to obtain efficient and reliable prediction methods for design. The session intends to provide a conclusive overview on the project's results with focus on the simulation technologies.

The following papers and speakers are foreseen:

A Validation Program for Dynamic High-Lift System Aerodynamics

Jochen Wild, Henning Strüber, Frédéric Moens, Bart v. Rooijen & Hans Maseland

Krueger High-Lift System Design Optimization

Emiliano Iuliano, Domenico Quagliarella & Jochen Wild

Lessons Learnt from Chimera Method Application to a Deploying Krueger Device

Apurva Hasabnis, Hans Maseland, Frédéric Moens, Aleš Prachař & Jochen Wild

Scale-resolved simulations of the deployment and retraction of a Krueger high-lift device

Stefan Wallin, Matteo Montecchia, Peter Eliasson & Aleš Prachař

Lattice Boltzmann simulation of a deploying Krueger device

Jorge Ponsin & Carlos Lozano