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HIGH-ORDER HIGH-FIDELITY SIMULATION OF UNSTEADY SHOCK-WAVE/BOUNDARY LAYER INTERACTION USING FLUX RECONSTRUCTION

N. Goffart[1,*], B. Tartinville[1], C. Hirsch[1] ans S. Pirozzoli[2]

[1] Cadence Design Systems, Chaussée de la Hulpe 187, Brussels B-1170 Belgium
*ngoffart@cadence.com
[2] Department of Mechanical and Aerospace Engineering, Sapienza University of Rome, via Eudossiana 18, 00184 Rome, Italy

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A key limiting aerodynamic phenomenon appearing in aircraft and engine flow fields is the shock-wave/boundary layer interaction (SWBLI). A better understanding of this interaction is essential as more efficient aircraft and engine designs are desired for a sustainable aviation. High-fidelity simulations such as Direct Numerical Simulations and Large-Eddy Simulations (LES) are suitable tools to investigate the complex flow characteristics of SWBLI compared to lower-fidelity methods, especially regarding the unsteady behavior. In this work, a high-order implicit LES of an oblique shock wave reflection on a turbulent boundary layer at Mach 2.3 [1] is performed. The high-order solver is based on the flux reconstruction method, allowing an arbitrary order of accuracy. A particular attention is paid to the shock-capturing technique which consists in a combination of a Laplacian artificial viscosity with the Ducros sensor. The ability of such a solver to accurately predict the flow features is assessed on both steady and unsteady fields. In particular, the typical low-frequency motion of the reflected shock is reproduced. The shock-capturing methodology is proved to be efficient in resolving the shocks without damping the turbulence in the boundary layer. The results obtained give confidence in this solver to study in more details the SWBLI phenomenon and future work is focused on the analysis of the oscillatory turbulent field in the interaction region.

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