Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Increasing the aerodynamic efficiency of a NACA4412 airfoil with blowing and suction[1] MARCO ATZORI, RICARDO VINUESA, KTH Royal Institute of Technology, Engineering Mechanics, GEORGE FAHLAND, DAVIDE GATTI, ALEXANDER STROH, BETTINA FROHNAPFEL, Karlsruhe Institute of Technology, Institute of Fluid Mechanics, PHILIPP SCHLATTER, KTH Royal Institute of Technology, Engineering Mechanics — Uniform blowing and uniform suction have been studied for a long time as a possible control method in aerodynamic applications. We performed highly-resolved large-eddy simulations (LES) of the turbulent flow around a NACA4412 at Reynolds numbers based on chord length and incoming velocity of $200,000$ and $400,000$, considering multiple control configurations. We found that uniform blowing applied over the suction side of the airfoil reduces the skin friction, but it increases the pressure drag by a higher amount. Furthermore, it reduces lift, resulting in lower aerodynamic efficiency. On the contrary, uniform suction increases the skin friction, but it decreases the pressure drag and increases lift, resulting in higher aerodynamic efficiency (these results are in agreement with experiments carried out by other groups with similar control configurations). Our high-fidelity numerical simulations allow studying the interaction between uniform blowing and suction with the strong adverse pressure gradient, which affects the turbulent boundary layer on the suction side of the airfoil. In the conference contribution, we will summarize the control effect on the aerodynamic properties of the airfoil and the properties of the flow, including the FIK identity and spectral analysis.

[1]Funded by Swedish Foundation for Strategic Research (BD15-0082).

Marco Atzori
KTH Royal Inst of Tech

Date submitted: 02 Aug 2020 Electronic form version 1.4