Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Direct numerical simulations of curvature effects on shear layer transition over airfoils[1] WEI ZHANG, WAN CHENG, ADNAN QAMAR, WEI GAO, RAVI SAMTANEY, King Abdullah University of Science and Technology — Shear layer transition and subsequent turbulent flow development over the leeward section of airfoils are affected by the surface curvature in terms of its associated effects, such as laminar flow separation, adverse pressure gradient, and the interactions between separated flow and wake vortices, etc. We present direct numerical simulations (DNS) of shear layer transitions over two airfoils, NACA 4412 and NACA 0012-64, at 10 deg. angle of attack, and $Re_c = 10^4$ based on uniform inflow velocity and chord length. The two airfoils chosen are geometrically almost the same with identical maximum thickness along with chordwise position but different cambers and hence different curvature. The curvature effects on the flow are presented by the unsteady evolution patterns of laminar flow separation; shear layer detachment, breakdown to turbulence, turbulent boundary layer reattachment and vortex shedding, and quantitative results on the development of turbulent boundary layer are emphasized. This DNS database is generated with an energy conservative fourth-order incompressible Navier-Stokes code with $O(10^9)$ mesh points.

[1]Supported by a KAUST funded project on large eddy simulation of turbulent flows. The IBM Blue Gene P Shaheen at KAUST was utilized for the simulations.

Ravi Samtaney
King Abdullah University of Science and Technology

Date submitted: 31 Jul 2013 Electronic form version 1.4