Abstract Submitted
for the DFD09 Meeting of
The American Physical Society

A Moving Airfoil Controlled by Synthetic Jets[1] SOL KEUN JEE, OMAR LOPEZ, ROBERT MOSER, University of Texas at Austin, ALI KUTAY, JONATHAN MUSE, ANTHONY CALISE, Georgia Institute of Technology — There is a growing interest in synthetic jets in flow controls. Here we consider the use of synthetic jet actuators in active control of an airfoil. An adaptive controller is integrated with a CFD model which includes details of the synthetic jet actuators and detached eddy simulation for turbulent flows at Re=900,000. This integration allows us to investigate a moving airfoil controlled by synthetic jets. Two synthetic jet actuators are mounted on the top and bottom of a NACA 4415 airfoil close to the trailing edge to generate bi-directional aerodynamic moment. Aerodynamic performance is explored using the closed-loop controller to regulate 2-degree-of-freedom motions of the airfoil. The coupled CFD/controller model simulates maneuverings of the airfoil as studied experimentally in wind tunnel tests. Modeling of unsteady aerodynamics with synthetic jets is validated against measurements in the wind tunnel including aerodynamic forces, surface pressure distributions and PIV velocity fields. The coupled model also demonstrates rapid maneuvers on the order of the convecting time scale. The characteristics of the unsteady aerodynamics coupled with the vehicle dynamics and the synthetic jets will be discussed.

[1]This work is supported by AFOSR grant FA9550-05-1-0411.

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Date submitted: 07 Aug 2009 Electronic form version 1.4