Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Large Eddy Simulation for Oscillating Airfoils with Large Pitching and Surging Motions ONKAR SAHNI, REED CUMMING, STEVEN TRAN, ALEXANDER KOCHER, MANE, RPI — Many applications of interest involve unsteady aerodynamics due to time varying flow conditions (e.g. in the case of flapping wings, rotorcrafts and wind turbines). In this study, we formulate and apply large eddy simulation (LES) to investigate flow over airfoils at a moderate mean angle of attack with large pitching and surging motions. Current LES methodology entails three features: i) a combined subgrid scale model in the context of stabilized finite element methods, ii) local variational Germano identity (VGI) along with Lagrangian averaging, and iii) arbitrary Lagrangian-Eulerian (ALE) description over deforming unstructured meshes. Several cases are considered with different types of motions including surge only, pitch only and a combination of the two. The flow structures from these cases are analyzed and the numerical results are compared to experimental data when available.

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Date submitted: 14 Nov 2016 Electronic form version 1.4