Weekly CEAFM Seminar: Spring 2018

JOHNS HOPKINS
Center for Environmental
& Applied Fluid Mechanics

Date: **Friday, March 9, 2018**

Time: 3:00 PM

Location: Gilman Hall # 132

Speaker: **Prof. Paul Durbin** (Iowa State University)

Title: ***"Simulation of Turbulent Flow over Bumps: Some Experience with Data-Driven Modeling"***

Abstract

Data on flow over bumps of increasing height were created by large eddy simulations. The purpose was to investigate why Reynolds averaged closure models become inaccurate in strong adverse pressure gradient and in separated flow. For many years, it has been hoped that high-fidelity, simulation data would lead to improvement of the predictive accuracy of RANS models. A stumbling block has been that models contain variables that are peculiar to the formulation, and have no clear physical meaning. A method proposed by Karthik Duraisamy, with whom we are in collaboration, is to introduce a variable model coefficient and optimize the prediction of data. Then one has a solution for all the model variables. We consider this to be a data extraction method, and explore whether that is valid. For instance, an eddy viscosity field is obtained by optimization and compared to the original RANS model. Usually the most important change is found to be quite near the wall. While the method has inherent non-uniqueness, the extracted data do not suffer, overly, from it. Transforming data into model improvements remains a challenge. Machine learning methods are being explored; decision tree-based methods will be discussed as a modern version of zonal modeling.