Investigation of “Loud” Modes in a High Speed Jet to Identify Noise-Producing Events

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Date: Friday, February 19, 2016
Time: 9:00 – 10:00 AM
Location: 358 Willard Blg.

Coffee and donuts will be provided

Abstract:

Within the fluid mechanics community, the complexity of the flow physics often greatly complicates the nature of the problem. Through various forms of reduced-order modeling, the analysis of such flows is often more tractable. Moreover, the use of these techniques allow for the implementation of flow control, in the context of drag reduction and noise mitigation, as a few examples. Dr. Berger will discuss such concepts in the context of jet noise reduction, in order to gain more insight into the complex flow physics generated by the turbulence. In addition to flow control and reduced-order modeling, optical flow field measurements in the form of particle image velocimetry (PIV) will also be discussed. Time-resolved PIV has been performed to accurately capture the flow physics, as well as the associated time and length scales of the flow. The primary focus of the talk will be related to jet noise reduction via sound source identification. Using proper orthogonal decomposition (POD), “loud” modes in the velocity field were detected through correlations with the far-field acoustics. It was found that the “loudest” velocity mode(s) is (are) in fact NOT the most energetic; indicating that jet noise generation is indeed a more subtle mechanism, from a flow physics perspective. This is consistent with previous work in the field suggesting that noise sources are generated from short time, high-strain events, which are non-linear and highly three-dimensional in nature.

Bio:

Dr. Berger completed his B.S. in Aerospace Engineering and B.A. in Mathematics from Syracuse University in 2009. He then went on to complete an M.S. and Ph.D. in Mechanical and Aerospace Engineering from Syracuse University in 2011 and 2014, respectively, under the
direction of Mark Glauser. The title of his dissertation is “The Effects of Active Flow Control on High-Speed Jet Flow Physics and Noise”. Dr. Berger then went on to complete a short post-doctoral research position with Melissa Green at Syracuse University, focusing on low-dimensional modeling for understanding the flow physics of bio-inspired propulsors. Most recently, Dr. Berger completed a one year post-doctoral fellowship at the University of Toronto Institute for Aerospace Studies (UTIAS), under the direction of Philippe Lavoie. This research focused on skin-friction drag reduction via flow control on a turbulent boundary layer. Dr. Berger has presented his work at various technical conferences, workshops and symposiums, as both an invited and keynote lecturer, on an international level. Dr. Berger began in the Flow Acoustic Department at ARL/Penn State in January of 2016, under the direction of Mike Jonson.