Use of Empirical Mode Decomposition for Closed-Loop Separation Control on a Natural Laminar Flow Airfoil

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Location: 358 Willard Bld.

Coffee and donuts will be provided

Abstract: Experiments were conducted at a Reynolds number of 1 × 10^6 on an NLF 0414F airfoil with surface-embedded pulsed blowing slots. Pulsed blowing was used to mitigate separation across the trailing-edge region of the airfoil, which occurs in off-design conditions. Results from open-loop separation control revealed that actuation was highly effective when performed at the frequencies corresponding to natural instabilities within the flow field. An Empirical Mode Decomposition (EMD) technique was used on unsteady surface pressure measurements to perform real-time identification of the unsteady flow structures indicative of separation. A closed-loop separation control scheme was developed, where the EMD results were used to regulate the blowing frequency and amplitude in order to produce the desired performance from the airfoil. Other extensions and uses of EMD for signal analysis and time-resolved flowfield decomposition are also discussed.

Bio: Prof. Ansell is currently an Assistant Professor in the Department of Aerospace Engineering at the University of Illinois at Urbana-Champaign. He received his BS in Aerospace Engineering from Penn State University and his MS and PhD from the University of Illinois. He is currently an active member of the AIAA Applied Aerodynamics Technical Committee, and his recent awards include the AIAA William T. Piper General Aviation Systems Award and the AFOSR Young Investigator Award. His research interests include subsonic and transonic aerodynamics, unsteady flows, flow control, and advanced measurement processing techniques.