MAE Seminar May 1st, 2015, 10:30am - 11:30am, Location: MDEA, #311 on the UCI Campus Map
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X-HALE: A UAV FOR NONLINEAR AEROELASTIC EXPERIMENTS

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ABSTRACT

Large-span aircraft configurations become dominant when designing for high fuel efficiency and/or high endurance flights. The combination of high aerodynamic efficiency and low structural weight fraction results in inherently very flexible wings. These vehicles may then present large wing deformations at relatively low frequencies, which results in a direct impact into their flight dynamic characteristics. Such effects can have a significant effect on HALE (high altitude long endurance) aircraft and also future commercial transport aircraft. At the University of Michigan, we have been studying this problem both computationally as well as experimentally.

This talk will emphasize the experimental program that has been ongoing to evaluate in flight some of these unusual aircraft behavior that can be predicted by our codes. The unmanned aerial vehicle, known as X-HALE, has been designed and built to be aeroelastically representative of (high-altitude, long-endurance) very flexible aircraft. The objective of this testbed is to collect unique data of the geometrically nonlinear aeroelastic response coupled with the flight dynamics to be used for future code validation and as an inexpensive platform for nonlinear control test and evaluation. The aircraft presents unusual aeroelastic features (e.g., coupled rigid/elastic body instability, large wing deflection during disturbances, etc.) to be characterized in flight. This talk will describe the vehicle development and flight tests, and its current status.

Carlos Cesnik is a Professor of Aerospace Engineering and the Director of the Active Aeroelasticity and Structures Research Laboratory (http://gust.engin.umich.edu) at the University of Michigan. His research interests have focused on computational and experimental aeroelasticity: coupled nonlinear aeroelasticity and flight dynamic response for high-altitude long-endurance (HALE) and hypersonic aircraft, active aeroelastic tailoring, aerothermoelasticity of hypersonic vehicles, active vibration and noise reductions in helicopter rotors, bio-inspired micro air vehicle (MAV) aeroelasticity. His research also spans the field of structural health monitoring (SHM) for damage detection in metallic and composite structures: guided-wave modeling, transducer design, and signal processing. Professor Cesnik is a Fellow of the American Institute of Aeronautics and Astronautics (AIAA) and the Royal Aeronautical Society (RAeS). Before his appointment at the University of Michigan, Prof. Cesnik was the Boeing Assistant/Associate Professor of Aeronautics and Astronautics at MIT, after working as a research engineer at EMBRAER (Brazil). Professor Cesnik has been a private pilot since he was 17 years old, and continues to fly regularly.