

# THE WILLIAM E. BOEING DEPARTMENT OF **AERONAUTICS & ASTRONAUTICS**

... welcomes ...

## **CARLOS E. S. CESNIK**

UNIVERSITY OF MICHIGAN

### *Numerical and Experimental Studies on Flexible Aircraft*



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 highlight some of the efforts at the University of Michigan to better understand the impact of large deformations on the aeroelastic characteristics of these flexible vehicles. Emphasis will be given to an experimental program that has been ongoing to evaluate in flight some of these unusual aircraft behaviors 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.



**WILLIAM E. BOEING**  
DEPARTMENT OF AERONAUTICS & ASTRONAUTICS  
UNIVERSITY of WASHINGTON

**Monday, May 22, 2017 @ 4:00pm**  
Johnson Hall. Rm 102 | UW Seattle

**Visitor RSVP:**  
<https://goo.gl/forms/W0g9bjD4bFPLWFi2>

# THE WILLIAM E. BOEING DEPARTMENT OF **AERONAUTICS & ASTRONAUTICS**

*... Distinguished Guest Speaker ...*



## **CARLOS E. S. CESNIK** UNIVERSITY OF MICHIGAN

*Professor of Aerospace Engineering*

*Director, Active Aeroelasticity and Structures  
Research Laboratory (A2SRL)*

Carlos Cesnik is a Professor of Aerospace Engineering and the Director of the Active Aeroelasticity and Structures Research Laboratory 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. Professor Cesnik has been a private pilot since he was 17 years old, and continues to fly (more-or-less) regularly.

---

*The William E. Boeing Chair's Distinguished Seminar Series brings scholars of national and international reputation who have made an impact in the field of aerospace engineering and beyond. This seminar series will cover a diversity of topics of current interest to those in academia, industry and the general public. It is our hope that these monthly seminars will encourage an exchange of ideas and bring aerospace engineering and science to the forefront.*

---



**WILLIAM E. BOEING**  
DEPARTMENT OF AERONAUTICS & ASTRONAUTICS  
UNIVERSITY of WASHINGTON

**Monday, May 22, 2017 @ 4:00pm**  
Johnson Hall. Rm 102 | UW Seattle

**Visitor RSVP:**  
<https://goo.gl/forms/W0g9bjD4bFPLWFi2>