IOWA STATE UNIVERSITY
Department of Mechanical Engineering

Damage Prediction in Aerospace Composite Structures using Dynamically-Data-Driven Simulations

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Seminar host: Ming-Chen Hsu

Abstract

In recent years, there has been a significant increase in the use of Unmanned Aerial Vehicles (UAVs) by the US military. UAVs are expected to fly a large number of long (48+ hours) missions, and operate without failure. Furthermore, in order to increase the durability of these vehicles and decrease weight, composite materials are currently experiencing a widespread adoption, both in the military and civilian aircraft design. As a result, in order to decrease costs associated with the operation, maintenance, and, in some cases, loss of these vehicles, it is desirable to have a Dynamically Data-Driven Application System (DDDAS) framework that can reliably predict the onset and progressions of structural damage in geometrically and materially complex aerospace composite structures operating in the environments typical of UAVs.

This talk will focus on computational methods for progressive damage modelling in full-scale aerospace composite structures with emphasis on UAVs. The numerical methodologies for advanced geometry modelling based on Isogeometric Analysis (IGA) and progressive damage modelling in multilayer fiber-reinforced composites will be presented. Several validation tests will be presented, including fatigue damage in CX-100 wind turbine blade and crash-landing of the UAV.

Dr. **Artem Korobenko** is an assistant professor in the University of Calgary, Department of Mechanical and Manufacturing Engineering. He is a recipient of J.W. Fulbright Fellowship and a member of American Society of Mechanical Engineering (ASME), US Association of Computational Mechanics (USACM), International Association of Computational Mechanics (IACM) and Engineering Mechanics Institute (EMI). He is a vice-chair for Committee on Fluid-Structure Interaction (CFSI) of the Applied Mechanics Division (AMD) of ASME. Dr. Korobenko has a BEng (with great honour) in aerospace engineering from National Aerospace University “Kharkov Aviation Institute” in Ukraine (2009), MSc in mechanical engineering from Clemson University, (2011) and PhD in structural engineering with a specialization in computational science from the University of California, San Diego (2014). He is working on development of high-fidelity multidisciplinary methods for the analysis and design of complex systems in wind energy, civil, aerospace and offshore/marine engineering using large-scale computing. Current research topics include fluid-structure interaction (FSI), dynamically-data-driven simulations (DDDS), damage modelling in aerospace composite structures, atmospheric flow modelling over complex terrains, numerical modelling of compressible reactive flows and cavitation flows around propellers.

This seminar counts towards the ME 600 seminar requirement for Mechanical Engineering graduate students.

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