Aerospace Engineering Seminar

Aircraft Behavior under Adverse Weather: Aerospace Icing Phenomenon

Dr. Haiyang Hu

School of Engineering, Aerospace Engineering Department, Worcester Polytechnic Institute, MA

September 9, 2026 at 2 pm EST **Fuller Labs PHL Perreault Hall - Lower Section**

Zoom link: https://wpi.zoom.us/j/94279973447 **Passcode**: 159129

Abstract

Aircraft and aero-engine icing is a significant weather-related hazard to flight safety in cold environments. Ice accretion on critical aircraft surfaces—including wings, propellers, aero-engine fan and compressor blades, and aerodynamic sensors—can result from the impingement of supercooled water droplets and/or ice crystals in clouds. The resulting ice accumulation can substantially alter aerodynamic characteristics and degrade aircraft and engine performance, posing a serious threat to flight safety.

In this seminar, the speaker will present a series of experimental investigations into dynamic ice accretion and unsteady heat-transfer processes associated with aircraft and aero-engine icing, with particular emphasis on inlet guide vane (IGV) icing induced by supercooled water droplets and ice-crystal icing within aero-engines. Leveraging the unique capabilities of the Icing Research Tunnel, comprehensive experimental studies have been conducted to characterize the critical microphysical and thermodynamic processes governing ice accretion under various icing conditions.

Various advanced experimental diagnostic techniques, including Particle Image Velocimetry (PIV), Digital Image Projection (DIP), and high-speed infrared (IR) thermography, have been developed and employed to quantify droplet and ice-crystal impingement dynamics, unsteady heat transfer during ice accretion, dynamic solidification processes over test surfaces, and the transient behavior of wind-driven water runback flows. In addition, the anti-/de-icing performance of various state-of-the-art hydro-/ice-phobic coatings and functional surfaces has been quantitatively evaluated across a broad range of icing conditions, from dry rime to wet glaze icing.

The findings from these studies provide new insights into the fundamental physics governing aircraft and aero-engine icing, contribute experimental data to validate and improve icing-accretion models, and support the development of more effective anti- and de-icing strategies for safer and more efficient aircraft and aero-engine operations in cold-weather environments.

Dr. Haiyang Hu is an assistant professor in the Aerospace Engineering Department at WPI. He earned his Ph.D. from the Department of Aerospace Engineering at Iowa State University in 2021. His current research interests focus on developing advanced experimental diagnostic techniques/platforms and exploring their applications in active/passive flow control, aircraft performance in adverse weather, non-thermal plasma, and UAV/UAM/UAS.

Cellular Flow Control Design for Mixing Based on the Least Action Principle

Prof. Weiwei Hu

Department of Mathematics, Franklin College of Arts and Sciences at University of Georgia

September 16, 2026 at 2 pm EST **Fuller Labs PHL Perreault Hall - Lower Section**

Zoom link: https://wpi.zoom.us/j/91359694481 **Passcode**: 938937

Abstract

We consider a novel approach for the enhancement of fluid mixing via pure stirring strategies building upon the Least Action Principle (LAP) for incompressible flows. The LAP is formally analogous to the Benamou–Brenier formulation of optimal transport, but imposes an incompressibility constraint. Our objective is to find a velocity field generated by Hamiltonian flows that minimizes the kinetic energy while ensuring that the initial scalar distribution reaches a prescribed degree of mixedness by a finite time.

Weiwei Hu is a Professor of Mathematics at the University of Georgia. She previously held faculty positions at Oklahoma State University and the University of Southern California (non-tenure-track). She was also a postdoctoral fellow at the Institute for Mathematics and its Applications (IMA), at the University of Minnesota. She received her Ph.D. in Applied Mathematics from Virginia Tech in 2012.

Her research focuses on the control and optimization of systems governed by partial differential equations, including mathematical fluid dynamics, flow-transport systems, model reduction, and scientific machine learning. Her research has been supported by the NSF and U.S. Department of Defense. She holds editorial roles with the IEEE Control Systems Society and serves on technical committees related to distributed parameter systems. In 2024, she received a Humboldt Research Fellowship for Experienced Researchers.

Aerospace Engineering Seminar

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Reduced order model based iterative learning control for reduced lift fluctuation in wind turbine blades based on CFD models

Prof. Eric Rogers

School of Electronics and Computer Science, University of Southampton, UK

September 30, 2026 at 2 pm EST **Fuller Labs PHL Perreault Hall - Lower Section**

Zoom link: https://wpi.zoom.us/j/93007938481 **Passcode**: 670267

Abstract

The subject of this seminar is aerodynamic load control for wind turbines, which has the potential to increase power extraction efficiency, including economic competitiveness when compared to other sources of alternative energy. The general feasibility of this approach is developments in sensor and actuator technology, which enables their embedding into the rotor blades. Minimizing lift fluctuations due to disturbances is feasible when combined with active control to modify the blade section aerodynamics.

Eric Rogers (Life Member, IEEE) received the M.S. and Ph.D. degrees in control systems from the University of Sheffield, Sheffield, U.K., in 1984, and the D.Sc. degree in research in control systems from The Queen's University of Belfast, Belfast, U.K., in 2004. He is a Professor of Control Systems Theory and Design with the School of Electronics and Computer Science, University of Southampton, Southampton, U.K. He has an extensive record of advisory work for funding agencies and industries in the U.K. and elsewhere. His major research interests include iterative learning control theory and applications in both engineering and health care, multidimensional system theory and applications, long-range autonomy for autonomous underwater vehicles, and flow control. Dr. Rogers is the Editor-in-Chief for International Journal of Control.

Aerospace Engineering Seminar

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Generative Models for Nonlinear Filtering: A Conditional Optimal Transport Approach

Amir Taghvaei

Assistant Professor, William F. Boeing Department of Aeronautics and Astronautics, University of Washington

October 7, 2026 at 2 pm EST **Fuller Labs PHL Perreault Hall - Lower Section**

Zoom link: https://wpi.zoom.us/j/94611920013 **Passcode**: 212088

Abstract

Generative models, including GANs, optimal transport maps, and diffusion models, have achieved remarkable success at sampling from complex high dimensional distributions. The Bayesian update in filtering is itself a conditional sampling problem: given a new observation, transform samples from the predicted distribution into samples from the posterior. This raises a natural question: can generative models be repurposed as filtering algorithms, overcoming the Gaussian assumption of Kalman type filters and the degeneracy of particle filters in high dimensions? In this talk, I focus on one such construction, based on conditional optimal transport theory, in which the Bayesian update is realized as a transport map obtained by solving a conditional Kantorovich problem. I present the algorithm, an error analysis for the estimation of conditional optimal transport maps, algorithmic developments that accelerate computation, and an empirical comparison with filters built from other generative models.

Amir Taghvaei is an Assistant Professor in the William E. Boeing department of Aeronautics and Astronautics at the University of Washington (UW) Seattle. He obtained his Ph.D. degree from University of Illinois at Urbana-Champaign where he was a member of Decision and Control Lab (DCL) in the Coordinated Science Laboratory (CSL). He was a Postdoctoral Scholar with Tryphon Georgiou at University of California, Irvine before joining UW. His research interests lie at the intersection of control theory, machine learning, and physics, with the aim of designing scalable and reliable computational algorithms and understanding fundamental limitations.

Aerospace Engineering Seminar

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Title

Nabin Malakar

Associate Professor, Worcester State University

November 11, 2026 at 2 pm EST **Fuller Labs PHL Perreault Hall - Lower Section**
Zoom link: https://wpi.zoom.us/j/96705155376 **Passcode**:074688

Abstract

Dr. Malakar is an assistant professor in the Department of Earth, Environment and Physics. He has a wide-ranging research interest including societal applications of remote sensing data, land surface temperature, air pollution, application of machine learning to earth sciences etc. Before joining the WSU, he worked in the NASA Jet Propulsion Laboratory/Caltech and developed global Land Surface Temperature and Emissivity products for thermal infrared sensors onboard MODIS Terra, MODIS Aqua, Landsat, and VIIRS satellites.