



JOHNS HOPKINS  
Center for Environmental  
& Applied Fluid Mechanics

## **SPRING 2022 CEAFM VIRTUAL SEMINAR**

### ***"Aeroacoustics and Aerodynamics of Quiet Owl Flight"***

**Presented by Prof. Justin W. Jaworski**

Department of Mechanical Engineering & Mechanics

Lehigh University

Hosted by Rajat Mittal (MechE)

**Abstract:** Many owl species rely on specialized plumage to mitigate their aerodynamic noise and achieve functionally-silent flight while hunting. One such plumage feature, a tattered arrangement of flexible trailing-edge feathers, is idealized as a semi-infinite poroelastic plate to model the effects that edge compliance and flow seepage have on the noise production. The associated acoustic scattering problem is solved to identify how the noise scales with the flight velocity, where special attention is paid to the limiting cases of rigid-porous and elastic-impermeable plate conditions. Results from this analysis identify new parameter spaces where the porous and/or elastic properties of a trailing edge may be tailored to diminish or effectively eliminate the edge scattering effect and may contribute to the owl hush-kit. In complement to the acoustic analysis, steady and unsteady aerodynamic models including wing porosity are formulated and solved in anticipation of the potential trade-off of aerodynamic performance and acoustic stealth. The aerodynamic analysis yields porous extensions of the classical unsteady aerodynamic functions and further indicates how porosity may be used as a passive gust rejection strategy.



**Bio:** Justin Jaworski received his BSE, MS, and PhD (2009) degrees in mechanical engineering from Duke University, where he was awarded the 2008 Dean's Award for Excellence in Mentoring and supported the research of several undergraduate students with competitive grant awards such as the North Carolina Space Grant and Sigma Xi Grant-in-Aid. Before joining the Mechanical Engineering and Mechanics faculty at Lehigh, he held the postdoctoral appointments of NRC Research Associate at the Air Force Research Laboratory and NSF International Research Fellow at the University of Cambridge. He is a recipient of an AFOSR Young Investigator Award (2015) and an NSF CAREER Award (2019), and his present research efforts include the unsteady, nonlinear aeroelastic analyses of flexible structures for next-generation aerospace and energy applications, as well as the development of mathematical models to figure out how owls fly so quietly.

**Friday, February 25, 2022 at 3:00 PM**

**Zoom Meeting**

**<https://wse.zoom.us/j/93762992307>**