

# DEPARTMENT OF MECHANICAL & AEROSPACE ENGINEERING

## WILLIAM MAXWELL REED SEMINAR SERIES

### **“Towards the Deployment of Autonomous Unmanned Aerial Vehicles for Remote Sensing of the Arctic.”**

**Christopher Richards, Ph.D.**  
Mechanical Engineering  
University of Louisville

#### **Abstract:**

Deployment of UAVs for remote sensing of the Arctic is currently limited to periods when calm winds exist. In this talk, I will present control methods that soften this requirement by addressing the challenging practical issue: UAVs have propellers that produce a finite amount of thrust to counteract these winds to maintain stable flight. The methods are: 1) novel anti-windup compensation architecture that includes an "anti-integrator" windup static term, 2) a quaternion-based anti-windup design that utilizes the nonlinear rigid body dynamics. I will also present work on the extension of anti-windup for adaptive control and quantized control signals. The talk will conclude with a discussion of how anti-windup compensation will be utilized in an autonomous vehicle guidance control architecture for Arctic research.

#### **Speaker Bio:**

Chris Richards is an Associate Professor in the Mechanical Engineering Department at the University of Louisville. He received his B.S. and M.S. degrees in mechanical engineering from the University of Cincinnati in 1992 and 1993. He received his Ph.D. degree in mechanical engineering from The Ohio State University in 1998. He worked as a Senior Research Engineer for Caterpillar, Inc., Peoria, IL (1998 -- 2001), and was a NASA Faculty Fellow in the Aeroelastic Branch of Dryden (now Armstrong) Flight Research Center, Edwards, CA (Summer 2003, 2004). His research interests include constrained control of aerial and space vehicles, nonlinear system identification, and noise and vibration control.

**Date: Friday, November 18, 2022**  
**Place: Whitehall Classroom Building 110**

**Time: 3:00 PM EST**  
**Contact: Dr. Jesse Hoagg**

Attendance open to all interested persons