AEROSPACE ENGINEERING AND ENGINEERING MECHANICS
COLLEGE OF ENGINEERING AND APPLIED SCIENCE

SUMMER RESEARCH OPPORTUNITIES FOR UNDERGRADUATE students

FOR APPLICATION YEAR: 2023

PROJECT TITLE: <u>Simulation and Testing of Newly Developed Control and Sensors in Regular and Bio-inspired Robotics and UAVs</u>

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Project Description

Project Description: Our research has led to new kinds/designs of control systems based on what is called "extremum seeking control." This kind of control systems allow for real-time optimization enabling bodies (such as robots and UAVs) to reach their optimized objectives in real-time with few information compared to most kind of other controls. Recently, we were able to show that these very simple control techniques (extremum seeking control) can actually explain how some biological organisms may be conducting their dynamic optimization.

We published results on that in very top journals and were highlighted in the news by the society of industrial and applied mathematics (SIAM) for solving the decades-long mystery of Albatross and soaring birds flight method. UC summarized these highlights in their news as well in an easily accessible way: https://www.uc.edu/news/articles/2022/12/uc-aerospace-engineers-explain-how-albatrosses-harness-ocean-winds-to-sail-energy-free.html

These newly developed systems will need to be tested on robots and possibly UAVs in the Modeling, Dynamics and Control Lab (MDCL): https://sites.google.com/view/uc-aeem-mdcl/home. We need help in multiple domains, so the person joining from the UPRISE group will help with one or more of the following: (i) running simulations to test codes made for implementing the new controls, (ii) help in assembling robots/UAVs/sensors or simulation of bio-inspired phenomena, and (iii) helping in running the experiments in the testing room with motion capturing and data collection. In addition, the student will have the opportunity to learn a lot about coding (via MATLAB), robotic operating systems, control systems and sensors.