In recent years, there has been much interest in biology to develop new sensing and control technologies for use in flight control systems. One bioinspired concept of particular interest is the microscale distributed flow sensor array, which is an analogue to mechanosensor arrays distributed over wing surfaces of many animals including birds and bats and are implicated in stable and controlled flights even during unsteady wind conditions. In this work, a fixed-wing micro aerial vehicle is simulated in AVL, and the surface pressure pattern is constructed using the information sampled by an array of onboard micro-scale pressure sensors. The relationships between the pressure field pattern, free-stream airspeed, angle of attack and side slip angle are analyzed. A nonlinear robust controller is designed that regulates the difference between the desired and actual pressure field patterns, and its asymptotic stability is proven. It is shown in simulation that both disturbance rejection and command tracking capabilities are achieved using this method for pitching motion controls. The disturbance rejection properties of the controller verify the use of the real-time flow information images can be viable for controlling the pitch moment of MAV. The ability to control the aircraft using flow sensors embedded will allow for MAV platforms to obtain more stable and agile flight patterns and enable them to be used for a variety of new applications where stability is essential for success.

Major: Mechanical Engineering

Educational Career:
Bachelor's of Mechanical Engineering, BS, 2012, Arkansas State University
Master's of Mechanical Engineering, MS, 2015, University of Central Florida

Committee in Charge:
Yunjun Xu, Chair, Mechanical & Aerospace Engineering
Andrew Dickerson, Mechanical & Aerospace Engineering
Benjamin Dickinson, AFRL
Kuo-Chi Lin, Mechanical & Aerospace Engineering

Approved for distribution by Yunjun Xu, Committee Chair, on March 12, 2018.

The public is welcome to attend.