FLAPPING WING MICRO AIR VEHICLE (FWMAV) PROJECT

UCI Samueli School of Engineering | Department of Mechanical and Aerospace Engineering

fwmavproject.wordpress.com

Background

Advancements in science and technology in recent years have allowed for deeper research and newer applications of the unconventional lift generation utilized in nature by birds and insects. In this quickly developing field of research and development, there is no shortage of new discoveries being made in the understanding of unconventional flight mechanics.

Goal

To develop a micro air vehicle that derives thrust and stability from flapping wing mechanisms and explore the flight dynamics that make such flight possible.

Advisor: Professor Haithem E. Taha

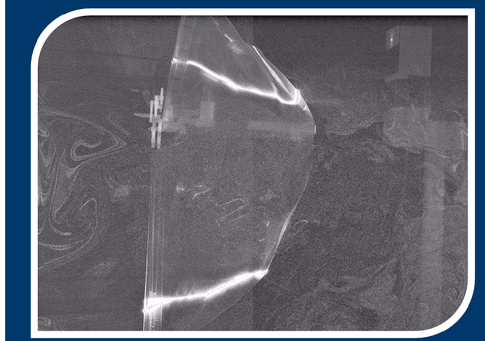
Graduate Managers: Fernando Pablo Quevedo and Dipan Deb

Project Manager: Evan Gillett (ekgillet@uci.edu)

Systems Identification: Alexander Lopez (Team Lead); Kevin Huang; Andrew Iwamoto; Manish Singh; Chris Hyde; Ming Shao; Jeffrey Lin

Quadflapper Team: Nathan Lewis (Team Lead); Harrison Heflin; Philip Trembath; Harris Fu; Thien-An Alex Nguyen; Phillip Adler; Eben Ortiz; Alejandro Aguilera

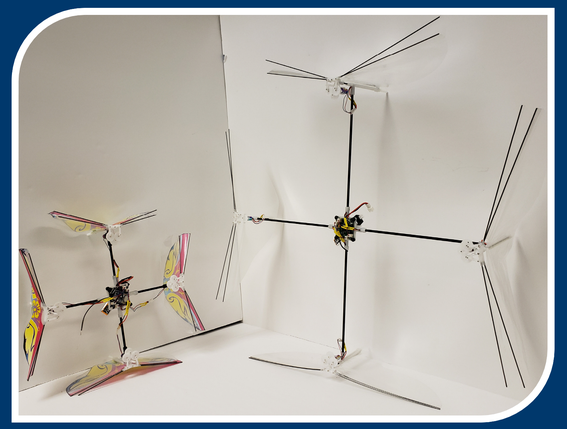
Systems Identification



The Systems Identification Team analyzes the velocity flow field caused by the flapping mechanism using a system known as Particle Image Velocimetry, or PIV. This system uses a laser and photoresistor to sense wing cycles from image reflections to generate velocity field data for comparison.

The team also takes slow motion videos of wing segments and visualizes flow using a fog machine and a plane of laser light. They then analyze the videos frame by frame to monitor the intake and expulsion of air caused by the flapping and clapping motions of the wings.

Quadflapper



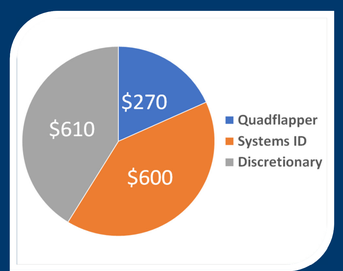
The Quadflapper Team is working to explore the advantages and disadvantages flapping flight dynamics have compared to conventional propeller systems by measuring speed, efficiency, and power consumption.

The experimental setups record the flight of the Quadflapper and an equal weight quadcopter across a set distance to measure their flight velocity.

Additionally, the team is prototyping and testing a UAV that satisfies DARPA's specifications of an MAV, such that its dimensions do not exceed 15 cm in every principle direction.

Budget

	Fall 2019
MAE189 Students	$1,400.00
MAE93 Students	$80.00
Total Funds	**$1,480.00**



Future Plans

Systems Identification: Analysis of thrust and lift components of the mechanism using load cells and system identification of the 2-degree of freedom pendulum setup will be completed in Winter 2020. Motion capture to model the dynamics of the flapping mechanism in Spring 2020.

Quadflapper: Design and assembly of a tethered flight thrust and power consumption fixture and analysis of the dynamics and effects of different gearing systems on thrust generation using an upscaled model will be done in Winter. Experiment data of the MAV will be used to redesign and update specifications toward a finalized model in Spring.