FLAPPING WING MICRO AIR VEHICLE (FWMAV) PROJECT

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

Background:
Advancements in electronics and the miniaturization of microcontroller processors have enabled a new class of small unmanned aerial vehicles to be developed, commonly referred to as MAVs. The Flapping-Wing Micro Air Vehicle Project aims to study the mechanics and dynamics of flapping wing propulsion and apply them to these vehicles.

Goals and Objectives:
The goals for FWMAV in Winter 2020 were to design and conduct flight experiments between quadflapper and quadcopter UAVs to compare their velocity and power consumption, to continue iteration on the "Tinyflapper" MAV design, and to design a load cell system to collect lift and thrust data generated by different wing mechanisms.

fwmavproject.wordpress.com

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System Identification & Visualization Team:
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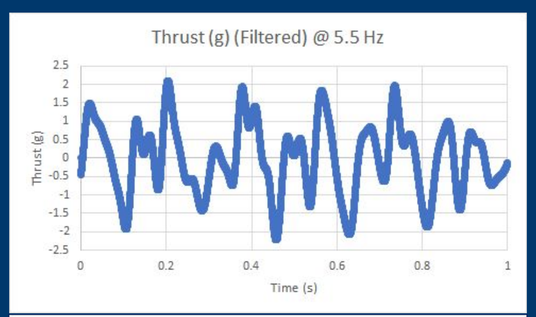
Quadflapper Team:
Harris Fu (Team Lead); Alejandro Aguilera; Harrison Heflin; Alexander Nguyen; Eben Ortiz; Philip Trembath; Andrew Kim

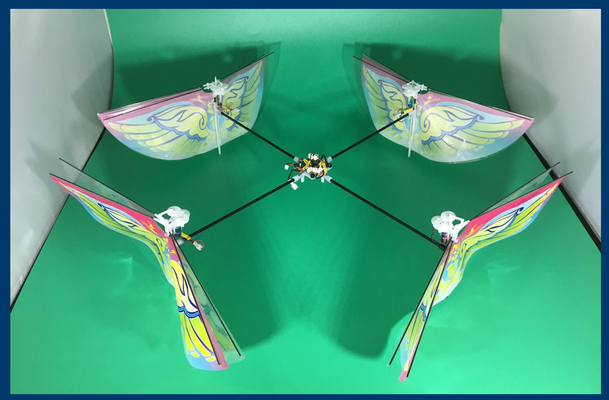
Design Progress and Experimentation - Winter 2020

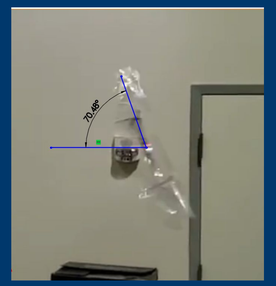
System Identification and Visualization Team



The System Identification and Visualization Team collected thrust and lift data using a high precision load cell to detect small force fluctuations. This data was sent through a hardware filter, amplified, and sent to a DAQ where it was processed electronically. The FFT was then taken to analyze the dominant peaks of the flapping mechanism at varying operation frequencies.

Quadflapper Team





The team also researched in-flight video monitoring, onboard gyroscope data collection, and updated drone flight controller settings to improve data collection and drone performance.

Future Plans:

Use experimental results to quantify the advantage wings provide for drone flight in regards to measured results; and iterate on the Tinyflapper UAV design

Research the dynamics of the mechanism with an upscaled model for large-scale performance, and the feasibility of motion capture software to assist in wing performance measurements

The Quadflapper Team designed a set of experiments to gauge the performance of the Quadflapper drone to a quadcopter of the same power, weight, and motor torque output.

These tests monitored the vehicles' thrust-to-weight, flight angle-of-attack, velocity, and power consumption through a standardized flight path.