Bioinspired Control of Micro Air Vehicles in Gusty Environments Exploiting Unsteady Aerodynamic Effects for Enhanced Stability

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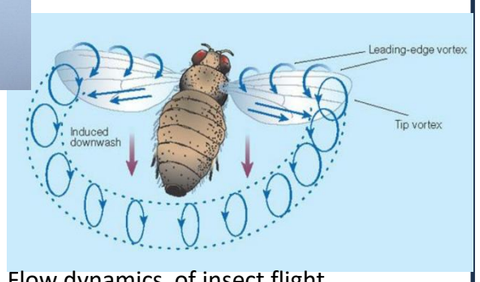
Research Overview

Micro Air Vehicles are small UAVs whose performance is often compromised in turbulent air. Insects exhibit remarkable agility and stability at these scales, effortlessly navigating gusty environments through rapid wing kinematics and dynamic control. This research leverages those principles by exploring flapping-wing MAVs to enhance stability and manoeuvrability in challenging conditions. The goal is to improve MAV control and efficiency.

Dragonfly in flight GETTY IMAGES



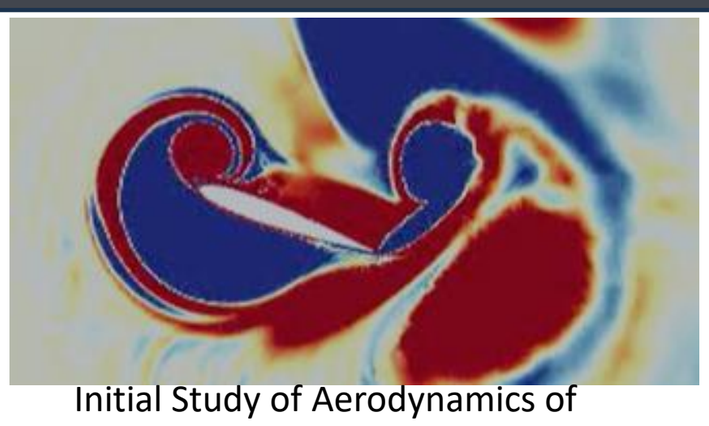
Flow dynamics of insect flight
Naira Woo February 2, 2022

Industry Relevance

- **Search & Rescue:** Reliable MAVs can access hazardous or remote areas.
- **Environmental Monitoring:** Low-disturbance aerial platforms for wildlife and habitat observation.
- **Infrastructure Inspection:** Agile MAVs for urban and industrial environments.

Methods & Technologies

- **Selection Matrix:** Identify optimal wing designs and flapping kinematics.
- **CFD & Aeroelastic Simulation:** Model LEV dynamics, gust response, and wing flexibility.
- **Wind Tunnel Testing:** Validate models using custom gust generators.



Initial Study of Aerodynamics of Flapping wing

Opportunities

- **Bioinspired Control Algorithms:** Leverage insect flight mechanics for autonomous stability.
- **Energy Efficiency Gains:** Reduce power consumption
- **Scalable MAV Platforms:** Potential for commercial and industrial deployment.

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