Robotic Butterfly - Bio Inspired Flapping Wing Mechanism

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Introduction
Insects are able to fly by flapping their wings through a series of upstroke and downstroke movement. The air vortex that is generated underneath the wings, produces an upward force which is known as lift.

Bio-inspired Butterfly
- Butterflies, in particular, flap their wings differently from most insects. During the upstroke movement, both the wings meet at the top, resulting in a ‘clapping’ effect being produced.
- Butterflies also have wing areas which are generally larger and consist of vein structures which vary across different species. This difference in wing structure and design affects the aerodynamics of airflow beneath the wings, affecting its maneuverability and flight efficiency.

Vein structure on wings

Methodology
Prototype Design using AutoCAD
CNC Machining & Assembly of Prototype
Performance Measurement & Comparison

Bi-stable click mechanism driven by 7000kv Brushless Micro Motor
Vein-reinforced wings using 10μm Mylar® foils and 0.5mm carbon fibre rods

Data Analysis
To compare the wing and motion characteristics, the following parameters will be recorded and plotted:
- Average Net Thrust
- Power Input
- Frequency of Wing Stroke
- Angle of Wing Stroke

Application
Flapping wing research is conducted with the aim of improving flight efficiency and dynamics, for better mission and payload-carrying capabilities.