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Direct-Drive Voice Coil Resonant Flapper for Flapping Wing Micro Air Vehicles and Flapping Fin AUVs

A resonant direct-drive flapping wing/fin flapper offers high efficiency, superior maneuverability, and stealth for versatile Micro Air and Autonomous Underwater Vehicle applications in monitoring, reconnaissance, and search and rescue operations.

Micro Air Vehicles (MAV) are size restricted, autonomous vehicles classified as Unmanned Air Vehicles (UAV). MAVs can be divided into two categories, motor-driven linkage and piezoelectric cantilever mechanisms. Linkage mechanisms are successful in larger scale applications, operating at high efficiency. However, they are subject to limitations such as fixed output kinematics without additional mechanisms, asymmetry in the kinematics without additional variable speed control, parasite structural vibration due to asymmetric acceleration and the linkage system operating at high frequency, and no elastic component in the system to preserve wing kinetic energy, which lowers efficiency.

Researchers at Purdue University have developed a resonant direct-drive flapping wing/fin voice coil flapper. This technology is a synergetic integration of a novel voice coil motor, spring energy storage element, and wing/fin system. For energy efficiency and to achieve a resonant system, the flapping wing/fin is directly driven by a spring element. It is designed for versatile use in both Flapping Wing Micro Air Vehicles and Flapping Fin Autonomous Underwater Vehicles. The flapper is optimized to generate reciprocating flapping motion at different scales for various applications such as environmental monitoring, conducting reconnaissance, surveillance, and search and rescue in confined or limited spaces. This technology offers less noise, higher efficiency, and superior maneuverability and response over traditional fixed wing or rotorcraft air vehicles and rotary propeller under water vehicles. This is vital for reducing the environmental impact during environmental monitoring and increasing the stealth during reconnaissance.

Technology ID
2014-DENG-66873

Category
Aerospace & Defense/Autonomous Systems (UAVs & AVs)
GreenTech/Environmental Remediation & Pollution Control

Authors
Xinyan Deng
Jian Zhang

Further information
Parag Vasekar
psvasekar@prf.org

View online

Advantages:

-Less noise

-Higher efficiency

-Superior maneuverability and response

-Reduced environmental impact

-Increased stealth

Potential Applications:

-Environmental monitoring

-Reconnaissance, surveillance, and search and rescue in confined or limited spaces

TRL: 3

Intellectual Property:

Provisional-Patent, 2014-12-15, United States | Utility Patent, 2015-12-15, United States | CON-Gov. Funding, 2021-01-11, United States

Keywords: Flapping Wing Micro Air Vehicle, Flapping Fin Autonomous Underwater Vehicle, resonant direct-drive flapper, voice coil motor, spring energy storage, UAV, AUV, environmental monitoring, reconnaissance, search and rescue