Abstracts

Biomimetics Research on Flying Insects for Developing High Performance, Small-Sized Actuator

by

Hiromu HASHIMOTO

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Abstract

This paper describes the development of high-performance, small-sized actuators based on the vibration mechanism of flying insects’ wings. At first, the three-dimensional observation of flight muscles in some kinds of winged insects such as bees, dragonflies, and cicadas are presented. In the 3-D observation of flight muscles, sequential sections through thoraces are sliced at the thickness of 30 μm by the rotating knife and taken photos by camera with three-dimensional internal structure microscope automatically and repeatedly. The 3-D images are reconstructed by a computer based on the digital data after recording. From the 3-D observation, it is confirmed that the winged insects can classified into three groups at least by the differences of morphology of flight muscles. Then, relation between morphology of flight muscles and function of wings are examined experimentally. In the indirect-flight-muscle type of insects, the deflections of thoracic exoskeleton are measured under the static load. The obtained load-deflection diagrams show linear relation between them. In the direct-flight-muscle type of insects, the ultra high speed video camera is used to record the wing motion under the free flight conditions by making use of their nature of high sensitivity to light. The frequencies of wing vibration are determined from the analyses of recorded data on videotapes. It is found that the vibration frequencies depend on the wing mass in the case of losing weight and independent on it in the case of gaining weight. Finally, the application of these knowledges based on the biological experiments to the development of driving circuit and mechanism for small-sized actuator is presented.

Keywords: Biomimetics, Winged Insects, Vibration Mechanism, Flight Muscles, Morphology, 3-D Observation, Small-Sized Actuator

*1 Professor, Department of Mechanical Engineering.

Studies on the Tokai University System of Lean Burn Engine and a Racing Car for Le Mans

by

Yoshimasa HAYASHI, Naoto NAKAMARU

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Abstract

A promising result was obtained with the preliminary test of a new type engine system that can clear away problems with stratified charge lean burn engine currently being commercialized and having a potential to improve fuel economy. This engine system centers around a brand new practical technology that provides stable ignition and fast burn of homogeneous pre-mixed air-fuel mixture and is composed of a super charged system that can achieve lean burn for full operating range and of a unique device to activate catalyst. This study is subsidized by the Kanagawa High-Technology Foundation.

On the other hand, as a measure to promote an education on actual “MONOZUKURI” (manufacturing), a prototype car, TOP’03 (Tokai Original Proto’03), is also being studied aiming to participate in the Le Mans 24 Hours in 2003. The car is installed with YR45 engine of which fundamental design was done by Tokai University under a research trust. This 4.5 liter, V8, NA (Natural Aspiration) engine produces 600hp with an air restrictor that satisfies racing regulation. Fundamental chassis layout was completed as a graduation study of the students. The necessary fund will be provided by external sponsorship and advertising contracts. If this plan comes true it will make the first participant from the academic sector in 70 years history of the Le Mans 24 Hours.

Keywords: Lean burn engine, Homogeneous mixture, Fast burn, Multi point ignition, Gasoline engine, Racing car, Racing engine, Le Mans

*1 Professor, Department of Prime Mover Engineering.
*2 Graduate Student, Course of Mechanical Engineering.