



GCOE CEDI
Osaka Univ.

Global COE program "Electronic Devices Innovation" Global Seminar

BIOMIMETIC AUTOPILOT

Sponsored by Osaka University global COE program "Electronic Devices Innovation" (CEDI)

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Room E6-111, Division of Electric, Electronic and Information Engineering,
Graduate School of Engineering, Osaka University, Suita, Osaka, Japan

Speaker

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Abstract

The autopilot called OCTAVE (Optic flow based Control sysTEM for Aerial Vehicles) is based on the hypothesis made in the 50s according to which an insect could navigate by "maintaining constant the retinal image velocity" seen by the ventral part of its compound eye. By formalizing this hypothesis, we have succeeded in suggesting the generic principle of optic flow regulation. We have validated this principle by implementing it onboard a laboratory-made rotary wing micro-air vehicle. This air-vehicle is equipped with an Elementary Motion Detector (EMD) inspired by electrophysiological discoveries made in our laboratory on housefly's eye. Such EMD is capable of assessing the optical flow generated by the own motion of the aerial vehicle flying over a contrasted scene. We have shown experimentally on the tethered robot that an optic flow regulation loop leads the vehicle to avoid ground obstacles by performing terrain following at a safe distance from the ground, even in the presence of head wind or tail wind. Better still, a simple control signal on the robot's pitch leads to an automatic take off or to an automatic landing. Such performance is outstanding compared to the minimalist processing system implemented onboard, processing which is compatible with the low payload of a micro-air vehicle (natural or artificial) whose mass is inferior to 100 grams. The suggested autopilot proved to be very powerful insofar as it frees aerial vehicles from their traditional bulky and expensive avionics.

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