Scuola Superiore
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Centro di Eccellenza per
l'Ingegneria dell'Informazione,
della Comunicazione e della Percezione

etis
Real-Time Systems Laboratory

## Review of the thesis
## RAMA – a Low Cost Modular Control System for Unmanned Aerial Vehicles
*presented by Ondrej Spinka for Ph.D. dissertation in Control Engineering and Robotics*
*at the Faculty of Electrical Engineering, Czech Technical University in Prague*

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### Relevance to current needs of the scientific community

The thesis addressed a very relevant topic, since today Unmanned Aerial Vehicles can be useful in many application fields, such as emergency services, agriculture, surveillance, movie making, and traffic monitoring. In particular, small and light vehicles are of special interest, since they have more affordable costs and can fly in much more restricted areas.

### Fulfillment of the main objectives

The purpose of this work was to build a relatively cheap, light, open and modular research platform, allowing to test various hardware and software solutions, data acquisition and control algorithms. The main objectives of the thesis have been fulfilled, since

1. a rotorcraft-based UAV has been designed and developed with the necessary on-board hardware and software components;

2. the basic control laws have been developed and analyzed;

3. a set of flight experiments have been carried out to prove the feasibility of the proposed solutions.

### Appropriateness of the methods

After a deep state-of-the-art analysis, the most appropriate methods have been adopted for developing both hardware and software modules. Also the control aspects of the thesis are technically sound and robust. The control scheme was designed, implemented and tested. Moreover, flight tests demonstrated the feasibility of proposed solutions.

## Main results and contributions of the work

The main contribution of this thesis is the development of a modular, distributed and relatively novel hierarchical architecture for controlling the UAV. This architecture allows achieving graceful degradation and reconfiguration, as well as simple hardware/software maintenance and testing.

A particularly interesting aspect is that RAMA is an open-source project, making it appealing for the academia community. Finally, the whole project is well documented through a dedicated website.

## Importance of the work for further development of science

The system realized in this thesis represents a first step toward the development of more sophisticated autonomous vehicles that can be used for a set of application domains. Moreover, the thesis provides a general platform that can be used by future researchers to run experiments on specific subsystems, test new control strategies and resource management algorithms, including operating systems mechanisms and energy-aware policies.

## Creativeness of scientific work

The thesis certainly satisfies the conditions of a creative scientific work in several aspects, including the control issues and the hardware/software architecture.

**The author of the thesis proved to have an ability to perform research and to achieve scientific results. I do recommend the thesis for presentation with the aim of receiving the Degree of Ph.D.**

Sincerely,

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