Czech Technical University in Prague
Faculty of Electrical Engineering

Department of Computer Science and Engineering

DIPLOMA THESIS ASSIGNMENT

Student: **Bc. Tomáš Báča**

Study programme: Open Informatics
Specialisation: Artificial Intelligence

Title of Diploma Thesis: **Model predictive control of micro aerial vehicle using onboard microcontroller**

Guidelines:

The main purpose of the thesis is to design, implement and experimentally verify a novel algorithm for stabilization and control of Micro Aerial Vehicle (MAV) along a predefined trajectory. The method will be based on prediction of MAV movement using precisely identified model (Model Predictive Control - MPC). From the beginning of the development, the algorithm will be suited for very limited computational resources onboard of MAV (microcontroller), and for control in real time using only onboard sensors. In addition, a quad-rotor helicopter will be prepared for this task, which includes development of control and communication boards and identification of MAV model. Designed and implemented system will be verified by experiments with real MAV and in numerical simulations. Results will be compared with performance of the current system being used by the Multi-robotic Systems group, which relies on PID controller.

Bibliography/Sources:

[1] Zometa, Pablo, et al. "Implementation aspects of model predictive control for embedded systems." American Control Conference (ACC), 2012. IEEE, 2012.
[2] Currie, Jonathan, and David I. Wilson. "Lightweight model predictive control intended for embedded applications." Dynamics and Control of Process Systems. Vol. 9. No. 1. 2010.
[3] Bouffard, P. On-board Model Predictive Control of a Quadrotor Helicopter: Design, Implementation, and Experiments. TR, University of California, Berkeley, 2012.
[4] Saska, M. - Vonásek, V. - Krajník, T. - Přeučil, L. Coordination and navigation of heterogeneous MAV-UGV formations localized by a ´hawk-eye;-like approach under a model predictive control scheme. International Journal of Robotics Research, Volume 33, Issue 10, pp 1393-1412, July 2014.
[5] Lee, T. - Leoky, M.- McClamroch, N.H. Geometric tracking control of a quadrotor UAV on SE(3), IEEE Conference on Decision and Control (CDC), 2010.

Diploma Thesis Supervisor: Ing. Martin Saska, Dr. rer. nat.

Valid until the end of the summer semester of academic year 2015/2016

L.S.

doc. Ing. Filip Železný, Ph.D.
Head of Department

prof. Ing. Pavel Ripka, CSc.
Dean

Prague, March 25, 2015