Autonomous Systems Lab



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Estimation of Actuation Configuration for a Multi-Actuated Blimp

**Kurzbeschreibung / Short Description**

To enhance the control of a multi-actuated blimp, its dynamics should be known as good as possible. The goal of this thesis is to find an appropriate filter and a suitable procedure to estimate the actuation configuration starting from an initial guess. Sensor measurements of e.g. an IMU should be considered. Further, the influence on the control performance should be analyzed for the used parameters. The solution should cover the current blimp configuration of *Project Skye*, which is a spherical blimp with 4 rotatable thrusters that are arranged as a tetrahedral on the hull with theirs thrust directed tangentially to the hull. Solutions for more general configurations should be analyzed.

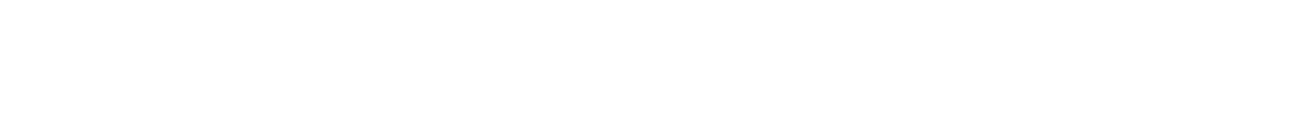
Typ / type Semester’s Thesis

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**Stichworte / Key Words**



Estimation, System Identification, Actuation, Blimp,

**Umfeld / Context**

The thesis will be conducted within the Skye project, which has to goal to develop and enhance a safe, agile and long endurance aerial vehicle that is capable of entertain people and doing aerial imaginary.

**Arbeitspakete / Work Packages**

* Literature research
  + Similar projects: e.g. M. Doniec, C. Detweiler, D. Rus, *Estimation of Thruster Configurations for Reconfigurable Modular Underwater Robots*, Computer Science and Artificial Intelligence Laboratory, MIT
  + Filtering: e.g. Extended Kalman Filter
  + System Identification
  + Nonlinear Observability: e.g. R. Hermann, A. J. Krener, *Nonlinear Controllabilty and Observability*, IEEE Transaction on Automatic Control, 1977
* Generic model for multi-actuated blimp
  + Based on Skye Model, J. Weichart: *Agile Blimp Modeling and Simulation Environment*. BSc thesis, 2012
* Parameter influence
  + Robustness of Controller
  + Influence of model parameter errors, e.g. direction thrust, position of thrust, scale of thrust, time delay, dynamics
* Filter design
  + Define states
  + Define filter
    - Online versus preflight algorithm: How is input chosen?
    - Recursive Bayesian estimation (EKF), alternative Batch optimization?
* Implement MATLAB simulation
  + Must be portable to C to apply on the real system