

Marco Ruggia

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Higher Education

- 02.2019 – 02.2022 **MSc Mechanical Engineering ETH, Zürich Switzerland**
Master Thesis: Design and Control of an Aerial Layouting Tool
Grade: **6/6**
Semester Thesis: Trajectory Optimization Methods for Implicit Time-Lag Systems
Grade: **6/6**
Courses: System Identification, Robot Dynamics, Model Predictive Control
Dyn.Prog. and Opt.Ctrl., Recursive Estimation, Intro to Mathematical
Optimization, Computational Mechanics I and II, Computer Vision, Computer
Graphics, Orbital Dynamics
- 09.2014 – 02.2019 **BSc Mechanical Engineering ETH, Zürich Switzerland**
Bachelor Thesis: Design and Analysis of small-scale Angle of Attack sensors
Grade: **5.75/6**
Focus Project: ftero airborne wind energy system
Responsibilities: hover & VTOL transition controller (PX4), sensor embedding
Grade: **5.5/6** (team of 8)
Innovation Project: **1st** place in construction rating (90 teams of 5)
Elective Courses: Bioengineering, Electrical Engineering II, Control Systems II,
Signals and Systems, System Modeling, Computational Methods
- 09.2013 – 06.2014 2 Semester **Human Medicine University Fribourg, Fribourg Switzerland**
- 10.2009 – 06.2013 **Gymnasium Bündner Kantonsschule, Chur Switzerland**
Core Subject: Physics and applied mathematics
Matriculation Project: Simulation of landslides and avalanches (C++/DX9)
Grade: **6/6**

Work Experience

- 09.2023 – ongoing **Lecturer and Researcher at University of Applied Sciences of the Grisons, Chur Switzerland**
- Lecturing and putting together of courses "Land- and Water-based Robotics" and "Robotics and Automation" for a bachelor's degree in "Mobile Robotics"
 - Grant acquisition and project execution of the morphing drone project *flifo* funded by *armasuisse S+T*
- 11.2022 – 07.2023 **PhD candidate at Biomimetics Lab University of Groningen, Netherlands**
- Study of bird kinematics and mechanics including literature research and observations from pigeon dissections
 - Advising of student projects and lab workshop management/expansion
- 07.2022 – 09.2022 **Research assistant at Computational Robotics Lab ETH, Zürich Switzerland**
- Extensive torque response testing of quasi-direct drive motors
 - Programming of unified motor interface driver in CRL codebase (C++)
- 03.2021 – 05.2021 **Research assistant at Computational Robotics Lab ETH, Zürich Switzerland**
- Research into and mathematical derivations of various trajectory optimization methods for implicit time-lag systems (continuation of semester thesis)
 - High performance implementation of these methods (C++)

- 06.2019 – 09.2019 **Internship at Engie Services AG, Oerlikon Switzerland**
- Development of a high-speed data aggregation server for timeseries data to location data aggregation (C++, NoSQL)
 - Development of a Thingsboard-Widget for displaying said data (JS, WebGL)
 - Evaluation of various CNN Frameworks on various low-cost devices
- 09.2018 – 06.2019 **Civilian Service at CC TES Lucerne University, Horw Switzerland**
- Characterization of phase change dispersions (building and operation of a test bench & data analysis)

Publications

C. Lanegger, M. Ruggia, M. Tognon, L. Ott, R. Siegwart. **Aerial Layouting: Design and Control of a Compliant and Actuated End-Effector for Precise In-flight Marking on Ceilings.**
Robotics: Science and Systems 2022

Patents

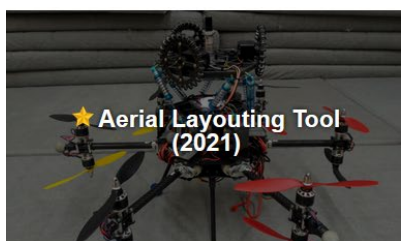
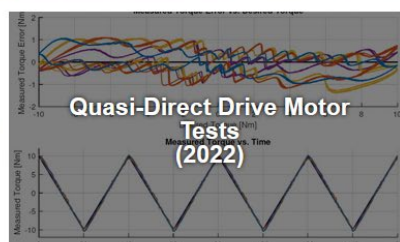
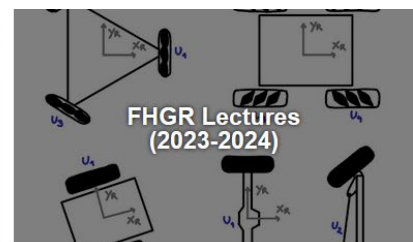
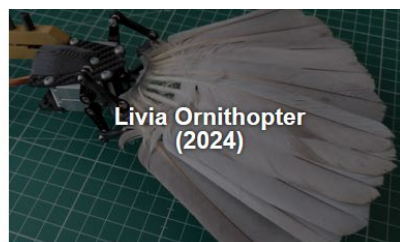
PCT/EP2023/062170, **Construction robot with parallel manipulator** (pending)

Grants

M. Ruggia, C. Bermes, **Passively morphing drone for small gap traversal**, 52'000€, armasuisse S+T grant 2024

Projects

Please visit my website under marcoruggia.ch. There you can find information on my projects:

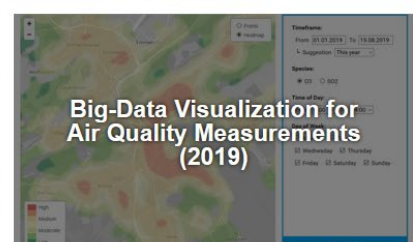
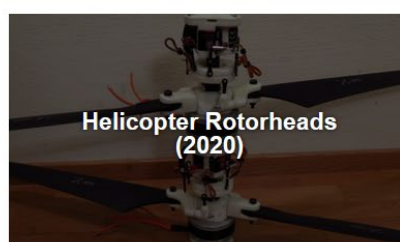


KKT conditions

$$\begin{bmatrix} \frac{\partial L}{\partial x} \\ \frac{\partial L}{\partial u} \\ \frac{\partial L}{\partial \lambda} \end{bmatrix} = \begin{bmatrix} V_x + g_x^T \lambda \\ a_x + g_x^T \lambda \\ g_x \end{bmatrix} + \begin{bmatrix} 0 & V_u & 0 & g_u^T \\ 0 & a_u & 0 & g_u^T \\ g_u & g_u & g_u & 0 \end{bmatrix} \begin{bmatrix} \delta x \\ \delta u \\ \delta \lambda \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$$

$$\rightarrow \begin{bmatrix} V_{xx} & 0 & g_x^T \\ 0 & a_{xx} & g_x^T \\ g_x & g_x & 0 \end{bmatrix} \begin{bmatrix} \delta x \\ \delta u \\ \delta \lambda \end{bmatrix} + \begin{bmatrix} K_x \\ K_u \\ K_\lambda \end{bmatrix} \delta x = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$$

$$\begin{bmatrix} V_{xx} & 0 & g_x^T \\ 0 & a_{xx} & g_x^T \\ g_x & g_x & 0 \end{bmatrix} \begin{bmatrix} \delta x \\ \delta u \\ \delta \lambda \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix} \quad \text{with } \delta u \text{ policy}$$



Projects (continued)

