

# Marco Ruggia

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## Higher Education

02.2019 – 02.2022	<b>MSc Mechanical Engineering ETH, Zürich Switzerland</b> Master Thesis: Design and Control of an Aerial Layouting Tool Grade: <b>6/6</b> Semester Thesis: Trajectory Optimization Methods for Implicit Time-Lag Systems Grade: <b>6/6</b> <i>Courses:</i> 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	<b>BSc Mechanical Engineering ETH, Zürich Switzerland</b> <i>Bachelor Thesis:</i> Design and Analysis of small-scale Angle of Attack sensors Grade: <b>5.75/6</b> <i>Focus Project:</i> ftero airborne wind energy system Responsibilities: hover & VTOL transition controller (PX4), sensor embedding Grade: <b>5.5/6</b> (team of 8) <i>Innovation Project:</i> 1 <sup>st</sup> place in construction rating (90 teams of 5) <i>Elective Courses:</i> Bioengineering, Electrical Engineering II, Control Systems II, Signals and Systems, System Modeling, Computational Methods
09.2013 – 06.2014 10.2009 – 06.2013	2 Semester <b>Human Medicine University Fribourg, Fribourg Switzerland</b> <b>Gymnasium Bündner Kantonschule, Chur Switzerland</b> <i>Core Subject:</i> Physics and applied mathematics <i>Matriculation Project:</i> Simulation of landslides and avalanches (C++/DX9) Grade: <b>6/6</b>

## Work Experience

09.2023 – ongoing	<b>Lecturer and Researcher</b> at <b>University of Applied Sciences of the Grisons, Chur Switzerland</b> <ul style="list-style-type: none"><li>• Lecturing and putting together of courses "Land- and Water-based Robotics" and "Robotics and Automation" for a bachelor's degree in "Mobile Robotics"</li><li>• Grant acquisition and project execution of the morphing drone project <i>flifo</i> funded by <i>armasuisse S+T</i></li></ul>
11.2022 – 07.2023	<b>PhD candidate</b> at <b>Biomimetics Lab University of Groningen, Netherlands</b> <ul style="list-style-type: none"><li>• Study of bird kinematics and mechanics including literature research and observations form pigeon dissections</li><li>• Advising of student projects and lab workshop management/expansion</li></ul>
07.2022 – 09.2022	<b>Research assistant</b> at <b>Computational Robotics Lab ETH, Zürich Switzerland</b> <ul style="list-style-type: none"><li>• Extensive torque response testing of quasi-direct drive motors</li><li>• Programming of unified motor interface driver in CRL codebase (C++)</li></ul>

03.2021 – 05.2021	<b>Research assistant at Computational Robotics Lab ETH, Zürich Switzerland</b>
	<ul style="list-style-type: none"> <li>• Research into and mathematical derivations of various trajectory optimization methods for implicit time-lag systems (continuation of semester thesis)</li> <li>• High performance implementation of these methods (C++)</li> </ul>
06.2019 – 09.2019	<b>Internship at Engie Services AG, Oerlikon Switzerland</b>
	<ul style="list-style-type: none"> <li>• Development of a high-speed data aggregation server for timeseries data to location data aggregation (C++, NoSQL)</li> <li>• Development of a Thingsboard-Widget for displaying said data (JS, WebGL)</li> <li>• Evaluation of various CNN Frameworks on various low-cost devices</li> </ul>
09.2018 – 06.2019	<b>Civilian Service at CC TES Lucerne University, Horw Switzerland</b>
	<ul style="list-style-type: none"> <li>• Characterization of phase change dispersions (building and operation of a test bench &amp; data analysis)</li> </ul>

## Publications

M. Ruggia, C. Bermes, **FLIFO: A passively morphing drone for small gap traversal**, ICUAS International Conference on Unmanned Aircraft Systems 2025

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

## Posters

M. Ruggia, **Livia: A biomimetic robotic bird – The tail mechanism**, Swiss Robotics Day 2024

M. Ruggia, **MOMAV: A highly symmetrical fully-actuated multirotor drone using optimizing control allocation**, Swiss Robotics Day 2024

M. Ruggia, C. Bermes, **FLIFO: A passively morphing drone for small gap traversal**, ARCHE armasuisse S+T Event 2024

## Grants

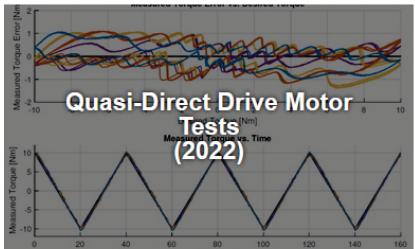
M. Ruggia, C. Bermes, **Passively morphing drone for small gap traversal**, 52'000€, armasuisse S+T grant 2024

## Patents

EP4279221A1, **Construction robot with parallel manipulator**

## Projects

Please visit my website under [marcoruggia.ch](http://marcoruggia.ch). There you can find information on my projects:



$$\begin{aligned} \text{KKT conditions: } & \begin{bmatrix} \partial L / \partial \dot{x}_k \\ \partial L / \partial \dot{u}_k \\ \partial L / \partial \dot{\lambda} \end{bmatrix} = \begin{bmatrix} V_k^T + g_k^T \lambda \\ 0_m \\ 0 \end{bmatrix} + \begin{bmatrix} 0 & V_{kk} & 0 & g_k^T \\ 0_m & 0 & 0 & g_k^T \\ 0 & g_k & g_k & 0 \end{bmatrix} \begin{bmatrix} \dot{x}_k \\ \dot{u}_k \\ \dot{\lambda} \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix} \\ \rightarrow & \begin{bmatrix} V_{kk} & 0 & g_k^T & \star \\ 0 & \Omega_{uu} & 0 & \star \\ 0 & g_k & 0 & \star \end{bmatrix} \begin{bmatrix} \dot{x}_k \\ \dot{u}_k \\ \dot{\lambda} \end{bmatrix} = \begin{bmatrix} V_k^T \\ 0_m \\ 0 \end{bmatrix} + \begin{bmatrix} K_x \\ K_u \\ K_\lambda \end{bmatrix} \dot{x} \end{aligned}$$

Implicit Trajectory Optimization Methods (2021)

