Mario A. Gomez Andreu

M.Sc. Student in Robotics, Systems and Control

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Education

09/2023 – Ongoing

ETH Zürich, Switzerland
M.Sc. in Robotics, Systems and Control
- Current GPA: 5.82/6 (excellent)

09/2020 – 08/2023

Technical University of Darmstadt, Germany
B.Sc. in Computer Science
- Graduated with GPA: 1.15/1.0 (top 2.24%)

09/2012 – 06/2020

Lichtenberggymnasium Darmstadt
Abitur (German High School Diploma)
- Graduated with 1.2/1.0
- Intensive Courses: Mathematics, Computer Science

Research Experience

03/2024 – ongoing

Trajectory Planning on 3D Gaussian Splats
RSL @ ETH Zürich
- Developed **FOCI, a novel algorithm for trajectory optimization on 3D Gaussian Splatting (3DGS) maps**, enabling orientation-aware planning for mobile robots in complex environments.
- Designed and implemented the **GPU-accelerated collision computation module** based on overlap integrals between Gaussian distributions, allowing fast and fully differentiable trajectory optimization enabling **a** 320**-fold speedup compared to sequential implementations**.
- Validated the method through **real-world and simulated experiments with the ANYmal quadruped robot**, demonstrating efficient planning in highly detailed 3DGS environments with hundreds of thousands of Gaussians.

04/2024 – 09/2024 | **Modelling for Universal Soft Lasso Gripper** [1]
RSL @ ETH Zürich

- Co-authored a research paper on **rope-based robotic manipulation**, contributing the **full simulation framework** modeling the manipulator's physical behavior and object interactions.
- Designed and implemented a **kinematic chain simulation in IsaacGym** to replicate the rope loop's dynamics and validate grasping behavior across a wide range of scenarios and orientations.
- Evaluated the simulation's fidelity against physical trials, demonstrating accurate performance under quasi-static and contact conditions, and enabling future control development in simulation.

04/2023 – 08/2023 | **Optimization Based Motion Planning for Robotic Juggling** [2]
IAS Lab @ TU Darmstadt

- First author of a research paper **extending robotic juggling from uniform patterns to arbitrary siteswap sequences** using novel motion planning and contact constraints.
- Developed a **bi-level planning framework** combining ball trajectory prediction with robot motion optimization to robustly execute toss juggling with varying throw heights.
- Demonstrated **full pattern coverage and stability for all vanilla siteswap juggling sequences** (up to 9-throws) in simulation, including random transitions and long-horizon execution.

09/2022 – 03/2023 | **Robotic Tactile Exploration** [3]
IAS Lab @ TU Darmstadt

- Contributed to an **active sampling framework for object hardness classification** using vision-based tactile sensors (VBTS), evaluated on both robotic and human-collected datasets.

Work Experience

09/2024 – 03/2025 | **Gravis Robotics AG, Zurich**
Internship

- Developed and implemented a **delay-aware Model Predictive Control (MPC) strategy** to improve latency handling in the control systems of automated excavators using **C++ and Python**
- Designed and integrated a **collision-aware trajectory planner**, enabling safe and efficient arm movements in complex environments.
- Achieved a **20% increase in motion speed** validated by comprehensive simulation and real-hardware testing of the improved system.

05/2022 – 11/2022 | **HS Analysis GmbH, Karlsruhe**
Working student

- Independently developed and integrated a **complete software module** for the automated **evaluation of Lateral Flow Assays** (biological diagnostic tests, e.g., COVID-19 tests) as part of a customer project, from concept to delivery.
- Gained practical experience across the full software development lifecycle, including front-end development with JavaScript/React, Git-based version control, software testing, and scientific literature analysis.

04/2021 – 03/2022 | **University Clinic, Hamburg-Eppendorff**
Research assistant

- Designed and optimized **a tool to translate structured tabular data into graph representations** using Neo4j and SNOMED CT terminology, implemented in Python and JavaScript.
- Adapted internal visualization components and collaborated on enhancing a translation application for graph database use, improving efficiency and robustness.

07/2020 – 03/2021 | **German Cancer Research Center (DKFZ), Heidelberg**
Research Assistant

- Independently developed Tableau dashboard prototypes for the visualization of medical data and supported the creation of scientific data visualizations.

Awards

06/2021 – Ongoing | **German Academic Scholarship Foundation (Studienstiftung des deutschen Volkes)**
Scholarship holder

2023 | **Germany Scolarship (Deutschlandstipendium)**

Skills

Programming	Python, C++, MATLAB
Libraries / Frameworks	PyTorch, TensorFlow, IsaacGym, CasADi, ROS/ROS2
Tools / DevOps	Git, Docker
Simulation	Gazebo, Mujoco, IsaacSim
Languages	German (native), English (fluent), Spanish (fluent)

Publications

[1] Christian Friedrich, **Mario Gomez Andreu**, Gabriel Métois, Fan Shi, Marco Hutter, and Robert Baines. "RoboWrangler: Toward Rope-based Grasping for Mobile Manipulation". In: *IEEE International Conference on Soft Robotics (RoboSoft)*. Accepted for publication. IEEE, 2025.

[2] **Mario Gomez Andreu**, Kai Ploeger, and Jan Peters. "Beyond the Cascade: Juggling Vanilla Siteswap Patterns". In: *2024 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. IEEE. 2024, pp. 2928–2934.

[3] J. Chen, A. Kshirsagar, F. Heller, **M. Gomez Andreu**, B. Belousov, T. Schneider, L. P. Y. Lin, K. Doerschner, K. Drewing, and J. Peters. "Active Sampling for Hardness Classification with Vision-Based Tactile Sensors". In: *German Robotics Conference (GRC)*. 2025.