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%)

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.