Tobia Marcucci

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I am a PhD student at the Computer Science and Artificial Intelligence Laboratory (CSAIL) at MIT, working under the supervision of Russ Tedrake and Pablo Parrilo. Since November 2022 I am visiting Stanford University to collaborate with Stephen Boyd. My research sits at the intersection of convex and combinatorial optimization, with applications to robotics, motion planning, and control. Specifically, I study optimal decision making in circumstances where discrete and continuous choices have to be taken simultaneously. I work on these problems on a mathematical and numerical level: I design efficient problem formulations and fast solution algorithms.

Education

 Massachusetts Institute of Technology PhD student with Russ Tedrake and Pablo Parrilo Major: Computer science (System Science and Control Engineering) Minor: Mathematics (Abstract Algebra) 	6/2018 to 9/2023 (estimated)
GPA: 4.8/5 • Stanford University	11/2022 to 7/2023
Visiting PhD student with Stephen Boyd • Massachusetts Institute of Technology Visiting PhD student with Russ Tedrake	1/2017 to 11/2017
o Research Center "E. Piaggio" and Istituto Italiano di Tecnologia PhD student with Antonio Bicchi (uncompleted, moved to MIT)	9/2015 to 1/2018
O University of Pisa Master's Degree in Mechanical Engineering Graduation grade: 110/110 cum laude	12/2013 to 9/2015
GPA: 30.0/30 • University of Pisa Bachelor's Degree in Mechanical Engineering Graduation grade: 110/110 GPA: 27.2/30	11/2010 to 11/2013
Publications Under Review	
o Motion Planning around Obstacles with Convex Optimization Tobia Marcucci, Mark Petersen, David von Wrangel, and Russ Tedrake	2022
 Under review in Science Robotics (preprint arXiv:2205.04422) Shortest Paths in Graphs of Convex Sets Tobia Marcucci, Jack Umenberger, Pablo A. Parrilo, and Russ Tedrake Under review in SIAM Journal on Optimization (preprint arXiv:2101.11565) 	2021
Journal Publications	
 Warm Start of Mixed-Integer Programs for Model Predictive Control of Tobia Marcucci and Russ Tedrake 	Hybrid Systems 2020
 IEEE Transactions on Automatic Control A Two-Stage Trajectory Optimization Strategy for Articulated Bodies win Contact Sequences Tobia Marcucci, Marco Gabiccini, and Alessio Artoni IEEE Robotics and Automation Letters 	th Unscheduled 2017

Conference Publications

Tobia Marcucci and Russ Tedrake ACM International Conference on Hybrid Systems: Computation and Control Approximate Hybrid Model Predictive Control for Multi-Contact Push Recovery in Complex Environments Tobia Marcucci, Robin Deits, Marco Gabiccini, Antonio Bicchi, and Russ Tedrake IEEE International Conference on Humanoid Robots Parametric Trajectory Libraries for Online Motion Planning with Application to Soft Robots Tobia Marcucci, Manolo Garabini, Gian Maria Gasparri, Alessio Artoni, Marco Gabiccini, Antonio Bicchi International Symposium on Robotic Research Towards Minimum-Information Adaptive Controllers for Robot Manipulators Tobia Marcucci, Cosimo Della Santina, Marco Gabiccini, and Antonio Bicchi IEEE American Control Conference Extended Abstracts Approximate Explicit Model Predictive Control for Push Recovery Using Mixed-Integer Convex Optimization Robin Deits, Tobia Marcucci, Lucas Manuelli, Twan Koolen, and Russ Tedrake Dynamic Walking Feaching Experience Feaching Experience Feaching assistant: Underactuated Robotics Graduate course taught by Russ Tedrake at MIT - Gave two lectures (available on the class YouTube channel) - Developed the exercises in the class lecture notes Robot Mechanics Graduate course taught by Marco Gabiccini at University of Pisa - Gave multiple lectures Optimal Control: from Calculus of Variations to Numerical Optimization Summer 202 PhD course taught by Manolo Garabini at the University of Pisa - Gave multiple lectures Optimal Pobot Manipulation Graduate course taught by Marso Gabiccini at University of Pisa - Lecture material available at https://github.com/TobiaMarcucci/optimal_control_pisa Intelligent Robot Manipulation Graduate course taught by Manolo Garabini at the University of Pisa Decision and Control Blending Combinatorial and Continuous Optimization SIAM Conference on Optimization Dythinal planning and control fusing offline and online algorithms IEEE International Conference on Robotics Spotlights) Autonion Planning around Obstacles with Convex Optimi			
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	Motion Planning around Obstacles with Convex Optimization:		
	Stanford University (SystemX Robotics Spotlights)	2/	202
	Cornell University (Verifiable Robotics Group)	,	

o Istituto Italiano di Tecnologia (iCub Research Lines) [recording]

9/2022

o Presented by Russ Tedrake: Seminar at The Robotics Institute (CMU) [recording], Seminars on Computational Geometry and Robotics (Tel Aviv University) [recording], Keynote at WAFR 2022 [recording], Seminar at Contextual Robotics Institute (UCSD), Seminar at GRASP on Robotics (University of Pennsylvania) [recording]

Shortest Paths in Graphs of Convex Sets:

o Stanford University (Linear Algebra and Optimization Seminars)	1/2023
o Joint Mathematics Meetings (SIAM mini-symposium in combinatorial optimization)	1/2023
o International Conference on Optimization and Decision Science (Session on path and routing	8/2022
problems in industry)	
o Université Catholique de Louvain (Cyber-Physical Systems Laboratory)	5/2022
o IMT School for Advanced Studies Lucca	12/2021
 Stanford University (Autonomous Systems Laboratory) 	11/2021
 University of California Berkeley (MPC Laboratory) 	11/2021
o California Institute of Technology (AMBER Laboratory)	11/2021
 Massachusetts Institute of Technology (Embodied Intelligence Submissions Seminars) 	9/2021
o Presented by Pablo Parrilo: Semi-Plenary at ICCOPT 2022	
Others:	

Others:

 Control through Contacts via Approximate Explicit Model Predictive Control IEEE International Conference on Robotics and Automation Workshop on optimal planning and control fusing offline and online algorithms 5/2019

Invited Posters

Shortest Paths in Graphs of Convex Sets:

o ICERM workshop on Linear and Non-Linear Mixed Integer Optimization (Brown University)	2/2023
o ORIE Young Researchers Workshop (Cornell University)	10/2022

Awards

SIAM Student Travel Award

2023

Grass Instruments Company Fellow

9/2018 to 5/2019

Service

2017 Co-chair

Session "Robotics I"

IEEE American Control Conference

Reviewer

International journals and conferences, including: IEEE Transactions on Automatic Control (TAC), IEEE Control Systems Letters (CSS), International Journal of Robotics Research (IJRR), IEEE Transactions on Robotics (TRO), IEEE Robotics and Automation Letters (RAL), and Journal of Optimization Theory and Applications (JOTA)

Miscellaneous Academic Achievements

- Grade of A+ in more than half of the classes taken in the PhD at MIT
- o Grade of A+ in all the classes taken for the minor in mathematics in the PhD at MIT
- o Highest GPA among the students enrolled in 2013 in the master program in Mechanical Engineering at the University of Pisa
- o Only student enrolled in 2010 in Mechanical Engineering at the University of Pisa to complete bachelor and master within 5 years (approximately 90% of the students take more than 6 years)