

PROFILE

Researcher associate at The University of Edinburgh and Alan Turing fellow.
Strong background in numerical optimization and control, and significant hands-on experience on legged robots.

RESEARCH INTERESTS

Robotics planning and control in legged robots, rigid-body dynamics and perception (watch [results on legged locomotion](#)).

Artificial Intelligence optimal control, numerical optimization, and machine learning. (watch [results of optimal control solvers](#)).

EDUCATION

Ph.D. in Bioengineering and Robotics January 2014 - April 2017
Istituto Italiano di Tecnologia & Università degli Studi di Genova.

- [Thesis](#): Planning and Execution of Dynamic Whole-Body Locomotion on Challenging Terrain.
- [Advisor](#): Dr. Ioannis Havoutis, Dr. Claudio Semini and Prof. Darwin G. Caldwell

M.Sc. in Mechatronic Engineering GPA 4.85/5 September 2009 - June 2013
Mechatronic Group at Simón Bolívar University, Venezuela (2-year program)

- [Thesis](#): Learning from Demonstration using Dynamic Movement Primitives in Excavator Robots (Outstanding Mention).
- [Advisor](#): Prof. Gerardo Fernández-López

WORK EXPERIENCE

University of Edinburgh - Alan Turing Institute

Research Associate

October 2019 - to date

- Multi-contact optimal control for loco-manipulation tasks.
- Model predictive control on legged robots.
- Project manager of Crocoddyl team (University of Edinburgh, LAAS-CNR, INRIA and MPI Tuebingen).
- Working on EU MEMMO and OrcaHub projects.
- Machine learning in legged locomotion

LAAS - CNRS

Postdoc Researcher

November 2017 - October 2019

- Efficient differential dynamic programming algorithm for multi-contact motion control in humanoid robots [4].
- Using memory of motion for real-time multi-contact motion control.
- Developing of the fastest optimal control toolbox for legged robots called Crocoddyl [1].
- Force feedback in optimal control [3].
- Working on EU MEMMO project.

Istituto Italiano di Tecnologia

Research Fellow

January 2014 - November 2017

- Novel motion planning and control methods for legged locomotion on challenging terrain [2,5-11].
- Envisioning the software framework for perception, planning and control for quadrupedal robots [2].
- Developing of a software toolbox (called **DWL**) for easy prototyping (c++ with Python bindings) optimization, robotics, planning, control and visualization.

	Simon Bolivar University Lecturer April 2012 - March 2014 <ul style="list-style-type: none"> • Teaching control system for undergraduate students. • Developing of a general purpose software for Model Predictive Control.
	Academic Assistant September 2009 - April 2012 <ul style="list-style-type: none"> • Teaching and preparation activities in control system lab for undergraduate engineering students. • A learning from demonstration approach for backhoe operations [12,15-16].
SKILLS	Robotics and Computer Science <ul style="list-style-type: none"> ▪ Motion planning, trajectory optimization and optimal control. ▪ Whole-body control, rigid-body dynamics and torque-control. ▪ Numerical optimization: nonlinear, stochastic, convex and mixed-integer optimization. ▪ State estimation, terrain mapping and computer vision. Mechatronics and Software <ul style="list-style-type: none"> ▪ C++, Python and Matlab (more than 8 years of experience). ▪ Robot middle-wares (ROS, LCM, YARP) and real-time systems (Xenomai). ▪ Open-source (OpenCV, PCL, Octomap, Pinocchio, Gazebo, Bullet, etc). ▪ Revision control tools (GIT, SVN and HG). ▪ Linux and OSX development environment. Soft-skills <ul style="list-style-type: none"> ▪ Self-motivation, self-confidence, optimism and divergent thinking. ▪ Questioning, introspection and organization. ▪ Open to feedback, idea exchange and persuasion. ▪ Mentoring, public speaking and humour.
LANGUAGES	English (fluent), Spanish (native), Italian (fluent), French (beginner)
PROJECT PORTFOLIO	MPC for robotics 2013 - to date <ul style="list-style-type: none"> ▪ Contact Robot COnTrol by Differential DYnamic programming Library (Crocodyl) (read this article). ▪ Open-source library for Model Predictive Control (MPC) over ROS. Legged locomotion 2014 - 2017 <ul style="list-style-type: none"> ▪ Motion planning for legged locomotion on challenging terrain. ▪ Terrain mapping for legged motion planning and control. Software framework for robotics 2014 - 2018 <ul style="list-style-type: none"> ▪ Envisioned DLS lab software framework: simulation, control, planning, perception and communication. ▪ Legged locomotion toolbox: “Dynamic Whole-body Locomotion (DWL)” library. ▪ Real-time control interface with ROS and Xenomai. ▪ Visualization tools (e.g. whole-body state plugin). Autonomous backhoe machines 2010 - 2012 <ul style="list-style-type: none"> ▪ Learning from Demonstration for autonomous execution of backhoe tasks. ▪ Control and state estimator. ▪ 3D terrain mapping and perception.
ACADEMIC VISITS	Visiting researcher 2016 Agile and Dexterous Robotics Lab (ADRL) , ETH Zurich, Switzerland.

INVITED TALKS

RSS'19 workshop

December 1st 2017

Workshop on Numerical optimization for Online multi-contact Motion Planning and control, Freiburg, Germany

- [Title: Highly dynamic maneuvers computed by feasible-prone.](#)

Oxford Research Institute

December 1st 2017

University of Oxford, Oxford, UK

- [Title: Motion planning for legged locomotion on challenging terrain.](#)

Gepetto Team

April 28th 2017

LAAS, CNRS, Toulouse, France

- [Title: Planning and execution of dynamic whole-body locomotion on challenging terrain.](#)

AWARDS

- Master thesis with Outstanding Mention. Simón Bolívar University. 2013.

PUBLICATIONS

- [1] **C. Mastalli**, R. Budhiraja, W. Merkt, G. Saurel, B. Hammoud, M. Naveau, J. Carpentier, S. Vijayakumar and N. Mansard, [Crocodyl: An Efficient and Versatile Framework for Multi-Contact Optimal Control](#). (under-review).
- [2] **C. Mastalli**, I. Havoutis, M. Focchi, D. G. Caldwell and C. Semini, [Motion planning for quadrupedal locomotion: coupled planning, terrain mapping and whole-body control](#). (under-review).
- [3] **C. Mastalli***, S Fahmi*, M. Focchi, C. Semini, [Passivity Based Whole-body Control for Quadruped Robots: Experimental Validation over Challenging Terrain](#). IEEE Robotics and Automation Letters (RAL), 2018.
- [4] R. Budhiraja, J. Carpentier, **C. Mastalli**, N. Mansard, [Differential Dynamic Programming for Multi-Phase Rigid Contact Dynamics](#). IEEE International Conference on Humanoid Robots (ICHR), 2018.
- [5] M. Focchi, R. Orsolino, V. Barasuol, **C. Mastalli**, D. G. Caldwell and C. Semini, [Heuristic Planning for Rough Terrain Locomotion in Presence of External Disturbances and Variable Perception Quality](#). Springer Tracts in Advanced Robotics (STAR), 2018.
- [6] **C. Mastalli**, M. Focchi, I. Havoutis, Buchli, Jonas D. G. Caldwell and C. Semini, [Trajectory and Foothold Optimization using Low-Dimensional Models for Rough Terrain Locomotion](#). IEEE International Conference on Robotics and Automation (ICRA), 2017.
- [7] B. Aceituno-Cabezas, **C. Mastalli**, H. Dai, M. Focchi, A. Radulescu, D. G. Caldwell, J. Cappelletto, J. C. Grieco, G. Fernandez-Lopez and C. Semini, [Simultaneous Contact, Gait and Motion Planning for Robust Multi-Legged Locomotion via Mixed-Integer Convex Optimization](#). IEEE Robotics and Automation Letters (RAL), 2017.
- [8] R. Orsolino, M. Focchi, **C. Mastalli**, H. Dai, D. G. Caldwell, and C. Semini, [Application of Wrench based Feasibility Analysis to the Online Trajectory Optimization of Legged Robots](#). IEEE Robotics and Automation Letters (RAL), 2018.
- [9] **C. Mastalli**, I. Havoutis, M. Focchi, D. G. Caldwell and C. Semini, [Hierarchical Planning of Dynamic Movements without Scheduled Contact Sequences](#). IEEE International Conference on Robotics and Automation (ICRA), 2016.

- [10] **C. Mastalli**, I. Havoutis, A. W. Winkler, D. G. Caldwell and C. Semini, [On-line and On-board Planning and Perception for Quadrupedal Locomotion](#). IEEE International Conference on Technologies for Practical Robot Applications (TEPRA), 2015.
- [11] A. W. Winkler, **C. Mastalli**, I. Havoutis, M. Focchi, D. G. Caldwell and C. Semini, [Planning and Execution of Dynamic Whole-Body Locomotion for a Hydraulic Quadruped Robot on Challenging Terrain](#). IEEE International Conference on Robotics and Automation (ICRA), 2015.
- [12] **C. Mastalli** and G. Fernandez-Lopez, [A Proposed Architecture for Autonomous Operations in Backhoe Machines](#). International Conference on Intelligent Autonomous Systems (IAS), 2015.
- [13] R. Jamisola and **C. Mastalli**, [Bio-inspired holistic control through modular relative Jacobian for combined four-arm robots](#). International Conference on Advanced Robotics (ICAR), 2017.
- [14] N. Certad, **C. Mastalli**, J. Cappelletto and J. C. Grieco, [Extracting Points Features from Laser Rangefinder Data Based on Hough Transform](#). IEEE Andean Regional Conference (ANDESCON), 2014.
- [15] **C. Mastalli**, D. Ralev, N. Certad and G. Fernández-López, [Asymptotic Stability Method for PID Controller Tuning in a Backhoe Machine](#). Dynamic and System Conference, 2013.
- [16] **C. Mastalli**, J. Cappelletto, R. Acuña, A. Terrones and G. Fernández-López, [An Imitation Learning Approach for Truck-Loading Operations in Backhoe Machines](#). International Conference on Climbing and Walking Robots and The Support Technologies for Mobile Machines (CLAWAR), 2012.

PEER-REVIEW ACTIVITIES TMECH, RAL, ICRA, IROS, Humanoids, ASME Dynamic and System Conference.

WORKSHOP ORG. **Robotics: Science and Systems 2019**
 R. Orsolino, **C. Mastalli**, M. Focchi and N. Mansard. [Workshop on Numerical optimization for Online multi-contact Motion Planning and control](#)