Carlos Mastalli — Robotics Researcher

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Gepetto Team, LAAS-CNRS, Citizenship: Italian & Venezuelan

PROFILE

Postdoc Researcher at Gepetto Team, LAAS-CNRS. Strong background in optimization and control, and significant hands-on experience on torque-controlled legged robots.

RESEARCH INTERESTS

Robotics multi-contact planning and control, legged locomotion and perception for motion planning and control.
Artificial Intelligence optimal control, trajectory optimization, and reinforcement learning. (watch this video for more details about my research interest).

EDUCATION

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

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

B.Sc. in Mechanical Engineering GPA 7.49/9 September 2003 - December 2008
Antonio José de Sucre National Experimental Polytechnic University, Venezuela, (5-year program)
Graduated rank 1^{st}/34. Acknowledgements as the best internship thesis.

WORK EXPERIENCE

LAAS - CNRS

Postdoc Researcher November 2017 - to date

- Develop of a real-time differential dynamic programing algorithm for multi-contact motion control in humanoid locomotion.
- Research in novel methods for receding horizon control and planning for multi-contact locomotion.
- Force feedback in optimal control.

Istituto Italiano di Tecnologia

Research Fellow January 2014 - November 2017

- Develop of novel motion planning and control methods for legged locomotion on challenging terrain.
- Develop and envision software framework for perception, planning and control for quadrupedal robots.
- Develop 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

- Teaching control system for undergraduate students.
- Develop of general purpose software for Model Predictive Control.

Academic Assistant September 2009 - April 2012

- Teaching and preparation activities in control system lab for undergraduate engineering students.

Industrias Climáticas
Design Engineer March 2009 – September 2009

- Design and installation of air-conditioned machines, e.g. evaporative, condenser, compact and chillers units.

TECHNICAL SKILLS

Robotics and Computer Science

- Practical and theoretical knowledge on Robotics, Optimization and Optimal Control (e.g. Ipopt, qpOASES, QuadProg and CMAES), Motion and Path Planning, Whole-body Control, Mapping and Machine Learning.
- Programming languages: C++, Python, Matlab and object-oriented design (more than 7 years of experience).
- Proficiency in Robot Operating System (ROS), Lightweight Communications and Marshalling (LCM), and Simulation Laboratory (SL).
- Practical experience on real-time systems (e.g. Xenomai).
- Proficiency in OpenCV, PCL, Gazebo and Bullet.

Mechatronics

- Practical and theoretical knowledge on Hydraulic and Pneumatic Systems, Mechanical Design.
- Proficiency in standard mechanics software: SolidWorks, Inventor, AutoCAD, MSC Nastram, ANSYS, Working Model 3D, MAPLE and Simulink.
- Theoretical knowledge on Mechanical Fatigue and Heat Transfer.
- Practical and theoretical knowledge on Signal Processing, Digital Electronics, Power Electronic, Instrumentation, Computer Architecture and Electro-Mechanic Actuators.

Software and Project Management

- Proficiency in Linux, OSX and Window based development environment.
- Proficiency in revision control system like GIT, SVN, and HG.
- Proficiency in software for object-oriented design like DIA.
- Ability to independently develop software development plans, including timeliness and test procedures.
- Comfortable with abrupt changes to project deadlines and job responsibilities.

LANGUAGES

English (fluent), Spanish (native), Italian (fluent), Japanese (basic)

PROJECT PORTFOLIO

Dynamic legged locomotion 2014 - 2017

- Motion planning for legged locomotion on challenging terrain.
- Terrain mapping for legged motion planning and control.

Software framework for locomotion 2014 - 2018

- 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).

MPC for robotics 2013

- Open-source library for Model PredictiveControl (MPC) over ROS.

Autonomous backhoe machines 2010 - 2012

- Lerning from Demonstration for autonomous execution of backhoe tasks.

- Control and state estimator.
- 3D terrain mapping and perception.

Design a waste compactor machine 2008
- Mechanical and hydraulic circuit design.
- Machine automation.

ACADEMIC VISITS

Visiting researcher 2016
Agile and Dexterous Robotics Lab (ADRL), ETH Zurich, Switzerland.

INVITED TALKS

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.
- Best internship thesis. Antonio José de Sucre National Experimental Polytechnic University. 2008.

PEER-REVIEW ACTIVITIES

TMECH, RAL, ICRA, IROS, Humanoids, ASME Dynamic and System Conference.

PUBLICATIONS

[1] **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).

[2] 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 (under-review). (under-review).

[3] **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.

[4] 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.

[5] 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.

[6] **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.

[7] **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.

[8] 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.

[9] **C. Mastalli** and G. Fernandez-Lopez, A Proposed Architecture for Autonomous Operations in Backhoe Machines. International Conference on Intelligent Autonomous Systems (IAS), 2015.

[10] 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.

[11] **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.

[12] **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, pp. 821–830.

EXTRA-CURRICULAR ACTIVITIES

- Member of the international group SGAC-Latin "Latin Space Generation" attached to a program of the United Nations UN (since 2008 until 2012).
- Founder and Head of Technical of the F-SAE Group of Antonio José de Sucre National Experimental Polytechnic University UNEXPO (since 2007 until 2008).