Carlos Mastalli — Robotics Researcher

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

PRESENT OCCUPATION

Postdoc Researcher at Gepetto Team, LAAS-CNRS.

PROFILE

Researcher with strong background in optimization and control, and significant hands-on experience on torque-controlled legged robots.

RESEARCH INTERESTS

Robotics whole-body motion planning and control, legged locomotion and perception for motion planning.
Artificial Intelligence optimal control, trajectory optimization, and reinforcement learning. (see 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

Research Fellow April 2017 - November 2017
Dynamic Legged Systems lab, Department of Advanced Robotics, Istituto Italiano di Tecnologia, Italy

- Research and development about motion planning and control methods for legged locomotion on challenging terrain.
- Develop of 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.

Lecturer April 2012 - March 2014
Mechatronic Group, Process and Systems Department, Simón Bolívar University, Venezuela

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

Academic Assistant September 2009 - April 2012
Process and Systems Department, Simón Bolívar University, Venezuela

- Teaching and preparation activities in Control Labs for undergraduate students in Electrical, Chemical and Electronic Engineering.

Design Engineer March 2009 – September 2009
Design and Development Department, Industrias Climáticas, Venezuela
- Design and installation of air-conditioned machines, e.g. evaporative, condenser, compact and chillers units.

Classroom Assistant 2005-2008
Mechanical Engineering Department, Antonio José de Sucre National Experimental Polytechnic University, Venezuela
- Worked as an classroom assistant in activities of Applied Mathematics course for Mechanical Engineering students.

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.
- Practical experience in programming electronic hardware: VHDL and μ-controllers.

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)

RESEARCH PORTFOLIO

Dynamic legged locomotion 2014 - 2017
Develop of different motion planning methods for legged locomotion on rough terrain. It also includes a terrain mapping algorithm for foothold and motion planning, and control.

Software framework for locomotion 2014 - 2018
Contribute different modules of the DLS lab software framework such as: toolbox for legged locomotion (the "Dynamic Whole-body Locomotion (DWL)" library), real-time control through ROS and SL, robot descriptions for simulation and control (e.g HyQ,

HyQ2Max, HyA, and Centaur), planning and simulation abstractions, communication interfaces through ROS and LCM.

MPC for robotics 2013
Develop of an open-source library of Model Predictive Control (MPC) over ROS. This MPC framework is developed to solve the different control problems in robotics.

Robot learning in backhoe machines 2010 - 2012
Develop of a robot learning approach, i.e. learning from demonstration, to make autonomous tasks in backhoe machines. Other components are developed for autonomous backhoe machines: control system, localization system and perception system.

Design a waste compactor machine 2008
Design and automation of a waste compactor machine to PEPSI-COLA VENEZUELA C.A., the project involved the design of: compression chamber and hydraulic unit (hydraulic circuits, reservoir and manifold), and automation of the machine with a PLC.

ACADEMIC VISITS

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

ACADEMIC HONOURS

- Master thesis. Approved with Outstanding Mention. Simón Bolívar University. 2013.
- Acknowledgement as the best internship thesis. Antonio José de Sucre National Experimental Polytechnic University. 2008.

INVITED TALKS

Oxford Research Institute December 1st 2017
University of Oxford, Oxford, UK
- Thesis title: Motion planning for legged locomotion on challenging terrain.

Gepetto Team April 28th 2017
LAAS, CNRS, Toulouse, France
- Thesis title: Planning and execution of dynamic whole-body locomotion on challenging terrain.

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] **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.

[3] 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.

[4] R. Orsolino, M. Focchi, **C. Mastalli**, H. Dai, D. G. Caldwell, and C. Semini, A New Feasibility Metric for Trajectory Optimisation of Legged Robots using Wrench Polytopes. (under-review).

[5] **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.

[6] **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.

[7] 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.

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

[9] 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.

[10] **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.

[11] **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).