# Carlos Mastalli — Curriculum Vitae

LAAS-CNRS, Gepetto Team
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**PRESENT OCCUPATION** Postdoc Researcher at 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, optimization, and machine learning for motor control. (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 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 activities about control system for undergraduate students.

  Courses taught: Control Systems I, Control Systems II and Control Lab.
- 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 Planning, Robot Learning, Whole-body Control, Perception Systems and Machine Learning.
- Programming languages: C++, Python, Matlab, SWIG and object-oriented design (more than 6 years of experience).
- Proficiency in Robot Operating System (ROS), Lightweight Communications and Marshalling (LCM), and Simulation Laboratory (SL).
- Practical experience on real-time systems (i.e. Xenomai).
- Proficiency in OpenCV, PCL, Gazebo and SL.

**Electronic Systems**
- Practical and theoretical knowledge on Signal Processing, Digital Electronics, Power Electronic, Instrumentation, Computer Architecture and Electro-Mechanic Actuators.
- Practical experience in programming electronic hardware on VHDL, PIC Basic Pro and PLC Siemens.

**Mechanical Systems**
- 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.

**Tools for 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.
- Basic knowledge of continuous integration tools (e.g. Travis)
- Ability to independently develop software development plans, including timeliness and test procedures.
- Comfortable with abrupt changes to project deadlines and job responsibilities.

## LANGUAGES SKILLS

**Spanish:** Native Language.
**English:** Proficient in speech, writing and reading.
**Italian:** Proficient in speech, writing and reading.
**Japanese:** Basic level in speech, and reading.

## RESEARCH PORTFOLIO

**Dynamic Legged Locomotion** 2014-2016
Develop of an open-source library called "Dynamic Whole-body Locomotion (DWL)" for dynamic legged locomotion. This library contains different modules such as: rigid body kinematics and dynamics, optimization solvers, path planning solvers, and terrain perception. The library includes python bindings of the core functionalities.

**Software Framework for Locomotion** 2014-2016
Contribute different modules of the DLS lab software framework such as: 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, and a library for locomotion (i.e. DWL).

**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** March-August 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** July - September 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 challenging locomotion: a study of decoupled and coupled approaches. (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).