

PROFILE	Researcher at Gepetto Team, LAAS-CNRS. Strong background in optimization and control, and significant hands-on experience on torque-controlled legged robots.
RESEARCH INTERESTS	<b>Robotics</b> multi-contact planning and control, legged locomotion and perception for motion planning and control. <b>Artificial Intelligence</b> optimal control, trajectory optimization, and reinforcement learning. (watch this <a href="#">video</a> for more details about my research interest).
EDUCATION	<b>PhD in Bioengineering and Robotics</b> January 2014 - April 2017 Istituto Italiano di Tecnologia & Università degli Studi di Genova. <ul style="list-style-type: none"><li>▪ Thesis title: <a href="#">Planning and Execution of Dynamic Whole-Body Locomotion on Challenging Terrain</a>.</li><li>▪ Advisor: Dr. Ioannis Havoutis, Dr. Claudio Semini and Prof. Darwin G. Caldwell</li></ul> <b>M.Sc. in Mechatronic Engineering</b> GPA 4.85/5 September 2009 - June 2013 Mechatronic Group at Simón Bolívar University, Venezuela (2-year program) <ul style="list-style-type: none"><li>▪ Thesis title: Learning from Demonstration using Dynamic Movement Primitives in Excavator Robots (Outstanding Mention).</li><li>▪ Advisor: Prof. Gerardo Fernández-López</li></ul> <b>B.Sc. in Mechanical Engineering</b> GPA 7.49/9 September 2003 - December 2008 Antonio José de Sucre National Experimental Polytechnic University, Venezuela, (5-year program) Graduated rank 1 <sup>st</sup> /34. Acknowledgements as the best internship thesis.
WORK EXPERIENCE	<b>LAAS - CNRS</b> <b>Postdoc Researcher</b> November 2017 - to date <ul style="list-style-type: none"><li>• Efficient differential dynamic programming algorithm for multi-contact motion control in humanoid robots [3].</li><li>• Using memory of motion for real-time multi-contact motion control.</li><li>• Force feedback in optimal control [2].</li></ul> <b>Istituto Italiano di Tecnologia</b> <b>Research Fellow</b> January 2014 - November 2017 <ul style="list-style-type: none"><li>• Novel motion planning and control methods for legged locomotion on challenging terrain [1,5-10].</li><li>• Envisioning the software framework for perception, planning and control for quadrupedal robots [1].</li><li>• Developing of a software toolbox (called <a href="#">DWL</a>) for easy prototyping (c++ with Python bindings) optimization, robotics, planning, control and visualization.</li></ul> <b>Simon Bolivar University</b> <b>Lecturer</b> April 2012 - March 2014 <ul style="list-style-type: none"><li>• Teaching control system for undergraduate students.</li><li>• Developing of a general purpose software for Model Predictive Control.</li></ul> <b>Academic Assistant</b> September 2009 - April 2012

- Teaching and preparation activities in control system lab for undergraduate engineering students.
- A learning from demonstration approach for backhoe operations [11,14-15].

## **Industrias Climáticas**

### **Design Engineer**

March 2009 – September 2009

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

## **SKILLS**

### **Robotics and Computer Science**

- Motion planning, trajectory optimization and optimal control.
- Whole-body control, rigid-body dynamics and torque-control.
- Non-linear, stochastic, convex and mixed-integer optimization.
- Supervised learning, learning from demonstration and reinforcement learning.
- State estimation, terrain mapping and computer vision.

### **Mechatronics and Software**

- Hydraulic and pneumatic systems, mechanical design.
- Signal processing, digital electronics, IO, and computer architecture.
- 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).
- CAD tools (SolidWorks, Inventor, AutoCAD, MSC Nastram, ANSYS)
- Linux and OSX development environment.

### **Soft-skills**

- 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 (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 Predictive Control \(MPC\)](#) over ROS.

### **Autonomous backhoe machines** 2010 - 2012

- Learning 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.

<b>ACADEMIC VISITS</b>	<b>Visiting researcher</b> Agile and Dexterous Robotics Lab (ADRL), ETH Zurich, Switzerland.	2016
<b>INVITED TALKS</b>	<b>Oxford Research Institute</b> University of Oxford, Oxford, UK <ul style="list-style-type: none"> <li>▪ <u>Title</u>: Motion planning for legged locomotion on challenging terrain.</li> </ul> <b>Gepetto Team</b> LAAS, CNRS, Toulouse, France <ul style="list-style-type: none"> <li>▪ <u>Title</u>: Planning and execution of dynamic whole-body locomotion on challenging terrain.</li> </ul>	December 1st 2017  April 28th 2017
<b>AWARDS</b>	<ul style="list-style-type: none"> <li>▪ Master thesis with Outstanding Mention. Simón Bolívar University. 2013.</li> <li>▪ Best internship thesis. Antonio José de Sucre National Experimental Polytechnic University. 2008.</li> </ul>	
<b>PEER-REVIEW ACTIVITIES</b>	TMECH, RAL, ICRA, IROS, Humanoids, ASME Dynamic and System Conference.	
<b>PUBLICATIONS</b>	<ol style="list-style-type: none"> <li>[1] <b>C. Mastalli</b>, I. Havoutis, M. Focchi, D. G. Caldwell and C. Semini, <a href="#">Motion planning for quadrupedal locomotion: coupled planning, terrain mapping and whole-body control</a>. (under-review).</li> <li>[2] S Fahmi*, <b>C. Mastalli*</b>, M. Focchi, C. Semini, <a href="#">Passivity Based Whole-body Control for Quadrupedal Locomotion on Challenging Terrains</a>. (under-review).</li> <li>[3] R. Budhijara, J. Carpentier, <b>C. Mastalli</b>, N. Mansard, <a href="#">Differential Dynamic Programming for Multi-Phase Rigid Contact Dynamics</a>. IEEE International Conference on Humanoid Robots (ICHR), 2018.</li> <li>[4] M. Focchi, R. Orsolino, V. Barasuol, <b>C. Mastalli</b>, D. G. Caldwell and C. Semini, <a href="#">Heuristic Planning for Rough Terrain Locomotion in Presence of External Disturbances and Variable Perception Quality</a>. Springer Tracts in Advanced Robotics (STAR), 2018.</li> <li>[5] <b>C. Mastalli</b>, M. Focchi, I. Havoutis, Buchli, Jonas D. G. Caldwell and C. Semini, <a href="#">Trajectory and Foothold Optimization using Low-Dimensional Models for Rough Terrain Locomotion</a>. IEEE International Conference on Robotics and Automation (ICRA), 2017.</li> <li>[6] B. Aceituno-Cabezas, <b>C. Mastalli</b>, H. Dai, M. Focchi, A. Radulescu, D. G. Caldwell, J. Cappelletto, J. C. Grieco, G. Fernandez-Lopez and C. Semini, <a href="#">Simultaneous Contact, Gait and Motion Planning for Robust Multi-Legged Locomotion via Mixed-Integer Convex Optimization</a>. IEEE Robotics and Automation Letters (RAL), 2017.</li> <li>[7] R. Orsolino, M. Focchi, <b>C. Mastalli</b>, H. Dai, D. G. Caldwell, and C. Semini, <a href="#">Application of Wrench based Feasibility Analysis to the Online Trajectory Optimization of Legged Robots</a>. IEEE Robotics and Automation Letters (RAL), 2018.</li> <li>[8] <b>C. Mastalli</b>, I. Havoutis, M. Focchi, D. G. Caldwell and C. Semini, <a href="#">Hierarchical Planning of Dynamic Movements without Scheduled Contact Sequences</a>. IEEE International Conference on Robotics and Automation (ICRA), 2016.</li> </ol>	

- [9] **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 (TE-PRA), 2015.
- [10] 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.
- [11] **C. Mastalli** and G. Fernandez-Lopez, [A Proposed Architecture for Autonomous Operations in Backhoe Machines](#). International Conference on Intelligent Autonomous Systems (IAS), 2015.
- [12] 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.
- [13] 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.
- [14] **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.
- [15] **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.

## 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).