CARLOS MASTALLI   ROBOTICS RESEARCHER

https://cmastalli.github.io/,   carlos.mastalli@gmail.com,   (+33) 7 67 58 14 84
Gepetto Team,   LAAS-CNRS,   Citizenship: Italian & Venezuelan

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

Robotics multi-contact planning and control, legged locomotion and perception for motion planning and control.

Artificial Intelligence optimal control, trajectory optimization, and machine learning. (watch this video for more details about my research interest).

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

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 1st/34. Acknowledgements as the best internship thesis.

WORK EXPERIENCE

LAAS - CNRS
     Postdoc Researcher   November 2017 - to date
- Efficient differential dynamic programming algorithm for multi-contact motion control in humanoid robots [3].
- Using memory of motion for real-time multi-contact motion control.
- Force feedback in optimal control [2].

Istituto Italiano di Tecnologia
     Research Fellow   January 2014 - November 2017
- Novel motion planning and control methods for legged locomotion on challenging terrain [1,5-10].
- Envisioning the software framework for perception, planning and control for quadrupedal robots [1].
- 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
- Teaching control system for undergraduate students.
- Developing of a 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.
  - 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
  - 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] S Fahmi*, **C. Mastalli***, M. Focchi, C. Semini, Passivity Based Whole-body Control for Quadruped Robots: Experimental Validation over Challenging Terrain. IEEE Robotics and Automation Letters (RAL), 2018.

[3] R. Budhijara, J. Carpentier, **C. Mastalli**, N. Mansard, Differential Dynamic Programming for Multi-Phase Rigid Contact Dynamics. IEEE International Conference on Humanoid Robots (ICHR), 2018.

[4] 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.

[5] **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.

[6] 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.

[7] 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.

[8] **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.

[9] **C. Mastalli**, I. Havoutis, A. W. Winkler, D. G. Caldwell and C. Semini, Online and On-board Planning and Perception for Quadrupedal Locomotion. IEEE International Conference on Technologies for Practical Robot Applications (TEPRA), 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).