**ISTITUTO ITALIANO
DI TECNOLOGIA
DYNAMIC LEGGED SYSTEMS**

Contact detection and localization in legged robots

Keywords

Contact detection, contact localization, state estimation, legged robots.

1   Description

The Dynamic Legged Systems Lab (**DLS**) is one of the world leading research laboratories on quadruped robots. Our team is currently looking for a highly motivated student to conduct studies on algorithms for leg collision detection and localization. The accuracy of such information has direct impact on the locomotion performance and robustness, with strong impacts also on the algorithms responsable to estimate the robot world position and velocities [1]. Therefore, precisely detecting where contacts happen is of high relevance for the robot navigation quality on natural and unstructed environments. In this project the student will have the opportunity to: do scientific development with state-of-the-art algorithms; simulate proposed algorithms on the DLS software framework (using Gazebo/ROS); and experimentally test them on the real robot HyQ [2] (see figure on the top-right).

2   Tasks

- Study, simulate and compare different techniques for contact detection and contact localization

- Implement leg collision detection algorithms on the real robot

- Design benchmark setups, perform experiments and evaluate experimental data

- Assess the impact of the algorithms on the accuracy of the robot state estimation

3   Requirements

At the moment of application, the candidate must have earned at least a bachelor degree in computer science, systems and control, robotics, mechanical engineering, electrical engineering, or related.
    Further requirements include:

- Strong knowledge on robot direct and inverse kinematics

- Good programming skills in Matlab/Simulink

- Good programming skills in C++

- Strong communication skills (written and spoken) in English language

- Strong team player

- Willingness to integrate into a multidisciplinary, dynamic, international research group

- Hands-on experience in robotic systems is a big plus

4 Duration

Minimum 6 months, with the possibility of extension depending on achieved results.

5 How to apply

To apply send an e-mail including your detailed CV, university transcripts and cover letter outlining motivation, experience and qualifications for the position to **victor.barasuol@iit.it** and **geoff.fink@iit.it**. Please, state "[Intern2019] Contact Detection Position" in the subject of the e-mail.

References

[1] M. Camurri, M. Fallon, S. Bazeille, A. Radulescu, V. Barasuol, D. G. Caldwell, and C. Semini, "Probabilistic contact estimation and impact detection for state estimation of quadruped robots," *IEEE Robotics and Automation Letters*, vol. 2, pp. 1023–1030, April 2017.

[2] C. Semini, *HyQ – Design and Development of a Hydraulically Actuated Quadruped Robot*. PhD thesis, Istituto Italiano di Tecnologia (IIT) and University of Genova, 2010.