PhD Course
Optimization-Based Robot Control
Andrea Del Prete

8, 10, 12, 15, 17, 19 July 2019

Seminar room, h. 10:30 – 12:30
Polo F. Ferrari 2, via Sommarive 9 - Trento

Content: The course provides an overview of state-of-the-art techniques for the dynamic control of robotic systems, with a specific focus on legged robots (bipeds and quadrupeds) and robot manipulators. The course covers both theory and implementation, relying on the Python language and some existing libraries for robot visualization, multi-body dynamic computation, and trajectory optimization.

The course is split in two parts, covering the following topics:

PART 1
- Modeling of multi-body systems (recap)
- Modeling of legged robots
- Inverse-Dynamics Control (aka Computed Torque, or Feedback Linearization)
- Task-Space Inverse Dynamics (TSID), aka Operational-Space Control, Stack of Tasks
- QP-based TSID (with inequality constraints)
- Implementation exploiting an existing C++ library with Python bindings

PART 2
- Linear Inverted Pendulum Model (LIPM)
- Center of Mass Trajectory Generation with LIPM
- Foot-step Planning
- Implementation in Python (exploiting existing library)
- Connecting Part 2 with Part 1 to get a legged robot walking in simulation

Exam: The final exam consists of answering a few open questions by writing short Python scripts.

ECTS: 2

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