COURSE: Anthropomorphic robotics

LECTURERS:

- Prof. Giorgio Metta : senior scientist @ Istituto Italiano di Tecnologia
  assistant professor @ DIST University of Genova.
- Prof. Francesco Nori: team leader @ Istituto Italiano di Tecnologia.
- Ing. Ugo Pattacini: PhD @ Istituto Italiano di Tecnologia .
- Ing. Matteo Fumagalli: research fellow @ Istituto Italiano di Tecnologia.

Lecturers can be contacted via email name.surname@iit.it, e.g. francesco.nori(AT)iit.it. Appointments can be fixed during the entire week but needs to be arranged with the lecturer first.

COURSE RELATED INFORMATION

All the official communications regarding the course (cancelled lessons, scheduling of the exams, etc. etc.) are communicated on the mailing list (robotica(AT)liralab.it). Subscriptions to the mailing list are organized by Francesco Nori (francesco.nori(AT)iit.it); requests can be posted here: http://courses.liralab.it/listinfo.

EXAMS GUIDELINES

Passing the exam requires successfully attending the classwork, which consists of two parts:

1. Practical part (24 points): typically 1 exercise consisting in computing the dynamic equation of a kinematic chain;
2. Theoretical part (6 points): typically 3 theoretical questions concerning the topics presented during the lectures.

The evaluation of the classwork is valid for one year. If the student attends more and one classwork, the valid classwork will be the last one.

EXAMS

Class-works are scheduled into three classes: ordinary, extraordinary and special sessions.

1. Ordinary class-works:
   a. 2 in the exam session February-March;
   b. 2 in the exam session June-July;
   c. 1 in the exam session September.
2. Extraordinary class-works: can be scheduled practically on demand during the entire year if there is a number of participants higher than 5.
3. Special class-works: for extremely particular needs, typically strict “laurea” or bureaucratic deadlines, it is possible to sustain an extraordinary classwork with less than 5 participants. These special class-works need to be scheduled with one of the lecturers.

TEXTBOOK

- “L. Sciavicco and B. Siciliano. Robotica Industriale. Modellistica e controllo di manipolatori, seconda edizione. McGraw-Hill. 2000. ISBN 88-386-0874-1”,

Or the English version:

- “Modelling and Control of Robot Manipulators, 2nd Edition", ISBN/ISSN: 1-85233-221-2 , (2000) Springer-Verlag, London, UK”.

PROGRAMMA DELLE LEZIONI

2. Chapter 2. Kinematics: the relationship between the joint positions and end-effector position.
   2.1. The Denavit-Hartenberg convention.
   2.2. The direct kinematic equation.
   2.3. The inverse kinematics problem.
3. Chapter 3. Differential kinematics: the relationship between the joint velocities and the end-effector velocities.
   3.1. The Jacobian: geometric and analytical.
   3.2. The redundancy problem.
   3.3. Statics: the static relationship between torques at the joints and forces at the end-effector.
4. Chapter 4. Dynamics: the relationship between torques at the joint and system position, velocity and acceleration.
   4.1. The Newton-Euler method for computing the system dynamics.
   4.2. The Lagrange method for computing the system dynamics.
   4.3. Properties of the dynamic models and dynamic parameters.
5. Chapter 5. Trajectory planning: computing joint trajectories from end-effector trajectories.
   5.1. Point to point trajectories.
   5.2. Path motions.
6. Chapter 6. Motion control: computing torques for executing a given trajectories.
   6.1. Decentralized control.
   6.2. Centralized control.