

Program of “Robotics for Bioengineering” (Prof. Fanny Ficuciello) — 2nd term: March–June 2018

Lecture_01 (March 6th) — Introduction to robotics and medical robotics

Lecture_02 (March 8th) — Seminar by Prof. Bruno Siciliano: “Robots Moving Closer to Humans”

Lecture_03 (March 13th) — Pose of rigid body, rotation matrix, composition of rotation matrices, orientation representations (Euler angles, angle and axis, unit quaternion), homogeneous transformations

Lecture_04 (March 15th) — Direct kinematics, Denavit-Hartenberg convention, kinematics of typical manipulator structures

Lecture_05 (March 20th) — Closed chain, parallelogram arm, joint space and operational space, Inverse kinematics problem

Lecture_06 (March 22nd) — Differential kinematics, geometric Jacobian, Jacobian of typical manipulator structures

Lecture_07 (March 27th) — Forefront research at PRISMA Lab and ICAROS Center

Lecture_08 (April 5th) — Kinematic singularities, analysis of redundancy

Lecture_09 (April 10th) — Use of redundancy, inverse differential kinematics, analytical Jacobian

Lecture_10 (April 12th) — Inverse kinematics algorithms, comparison among inverse kinematics algorithms, statics, manipulability ellipsoids

Lecture_11 (April 17th) — Distinguished Lecture by Prof. Oussama Khatib: “The Age of Human–Robot Collaboration”

Lecture_12 (April 19th) — Trajectory planning: joint space, operational space

Lecture_13 (April 24th) — Actuators and sensors, control architecture

Lecture_14 (April 26th) — Direct dynamics and inverse dynamics, operational space dynamic model, dynamic manipulability ellipsoid

Lecture_15 (May 3rd) — Centralized control: PD control with gravity compensation, inverse dynamics control

Lecture_16 (May 8th) — Operational space control: PD control with gravity compensation, inverse dynamics control, comparison among various control schemes

Lecture_17 (May 10th) — Compliance control, impedance control

Lecture_18 (May 15th) — Camera calibration, the visual servoing problem, position-based and image based visual servoing

Lecture_19 (May 18th) — Classification of surgical robots & Seminar by Dr. Satwinder Singh on “Robot-Assisted Laparoscopic Surgery” + NOTES

Lecture_20 (May 22nd) — Teleoperation and haptics

Lecture_21 (May 24th) — Tank theory, semi-autonomous control strategies on the da Vinci robot

Lecture_22 (May 29th) — Seminar by Dr. Huan Liu on “Robotic Prostheses: Classification, Design, Sensing, Actuation”

Lecture_23 (May 29st) — Overview of control principles in upper-limb prostheses

Lecture_24 (May 31th) — Wearable robots: control principles in rehabilitation robotics