UCL Université catholique de Louvain

# LMECA2732

2012-2013

# Introduction to robotics

| 4.0 credits | 30.0 h + 15.0 h | 2q |
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| Teacher(s) : | Ronsse Renaud ; |
| Language : | Anglais |
| Place of the course | Louvain-la-Neuve |
| Prerequisites : | LELEC2811 Instrumentation and sensors,<br>LINMA1510 Linear Control (optional),<br>LMECA2755 Industrial automation (optional) |
| Main themes : | Robotics is a field requiring the integration of multiple expertises. Robot design requires indeed integrating a mechanical structure, one or several actuators, one or several sensrs, and a controller governing the robot behavior. This controller has also to be implemented by using the dedicated IT tools.<br>Historical robotics applications were mostly developed for the industry, in the late 70s. The goal of industrial robotics is automatization of fabrication processes, targeting the increase of productivity.<br>From more than one decade, robotics further penetrated other application fields, characterized by unpredictable environments (while an industrial operation zone is usually unchanging and predictable). Therefore, these robots have to adapt their behavior in response to changes in the interactions with the environment. Such applications are:<br>- Mobile robots (wheeled and legged robots), evolving on unknown and potentially irregular terrains.<br>- Surgical robots, assisting the surgeon to reach difficult body regions, to perform very accurate gestures (out of standard human capacities), etc'<br>- Rehabilitation robots, assisting patients with motor deficits to recover part of their autonomy.<br>- Companion robots, providing various services like load transport, guide in a museum, etc' to one or several persons.<br>The goal of this course is to provide a global vision of robotics challenges to Master students, both in classical applications (industrial robotics) and in more avant-gardist applications. |
| Aims : | The aim of this course is to provide a global vision of the technical developments and challenges related to robotics. After this course, students will get a global overview of these techniques, and associated benefits, both in an industrial context and in a context to provide services to the society. Some concepts will further be validated through a couple of laboratories.<br>*The contribution of this Teaching Unit to the development and command of the skills and learning outcomes of the programme(s) can be accessed at the end of this sheet, in the section entitled "Programmes/courses offering this Teaching Unit".* |
| Evaluation methods : | Written exam (in French or English).<br>All material provided in the textbook and during the oral courses is supposed to be known for the exam. |
| Teaching methods : | Lecturing, with slides support. |
| Content : | Introduction: robotics history; technico-econominal motivations; robot classification.<br>Change of coordinates and associated problems: geometrical, kinematic, and dynamic models (direct/inverse); homogenous transformations; singularities.<br>Parallel robots, mobile robots, humanoid robots, medical robots: specificities, associated components (actuators/sensors) and controllers.<br>Concepts introduced during the course will be illustrated with two laboratories:<br>- One giving the students a chance to steer and program a real industrial robot.<br>One giving the students a chance to steer and program a small humanoid robot. |
| Bibliography : | A textbook will be provided to students.<br>Potential bibliographic references (complementing the textbook) will be communicated later. |
| Cycle and year of study : | > Master [120] in Electro-mechanical Engineering<br>> Master [120] in Mechanical Engineering<br>> Master [120] in Mathematical Engineering |
| Faculty or entity in charge: | MECA |