UCLouvain

lmeca2335

2020

Biorobotics

Due to the COVID-19 crisis, the information below is subject to change, in particular that concerning the teaching mode (presential, distance or in a comodal or hybrid format).

5 credits	30.0 h + 30.0 h	Q2

Teacher(s)	Ronsse Renaud ;
Language :	English
Place of the course	Louvain-la-Neuve
Main themes	Robots are progressively leaving the factories to penetrate inside more uncontrolled environments. This includes our own environment, where they have to interact with us, humans. Biorobotics investigates the applications where robots cross the boundaries with life sciences, either because of their intrinsic design (in which case robots are said to be 'bio-inspired'), or due to the physical and/or cognitive proximity they have with humans. This includes medical applications: nowadays, robots are routinely used in surgical theatres and rehab facilities. This course covers some of the most recent developments in biorobotics. The first part focusses on bio-inspired robots, both regarding their design and the way they are controlled. We particularly pay attention to highlight the bidirectional influence between robotics and biology: biology/nature inspiration helps in making better robots (e.g. regarding skills and agility), while robotics offers test benches to make new hypotheses about the functioning of the corresponding biological agent. The performances being achieved by these robots are compared to those of their human or animal counterpart. The second part will focus on robots displaying a physical interaction with humans, with a specific attention to robots being used for the rehabilitation and assistance of disabled users.
Aims	In consideration of the reference table AA of the program "Masters degree in Mechanical Engineering", this course contributes to the development, to the acquisition and to the evaluation of the following experiences of learning: · AA1.1, AA1.2, AA1.3 · AA3.1, AA3.2, AA3.3 · AA4.1, AA4.2, AA4.3, AA4.4 · AA5.2, AA5.3, AA5.5, AA5.6 · AA6.1, AA6.2, AA6.3 At the end of this course, students will be able to: a. Disciplinary Learning Outcomes 1 · Describe several applications of biorobotics, both regarding bio-inspired robots and robots having the capacity to interact with humans. · Illustrate ' through several examples ' the bilateral relationship between robotics and biology, i.e. how both disciplines influence each other. · Analyze the working principle of a bio-inspired robot and model its interactions with the environment. · Design the controller of a typical haptic interface, and adapt it to the field of rehab and assistive robotics. · Reproduce and evaluate the results of a scientific paper dealing with biorobotics. b. Transversal Learning Outcomes · Search and read a book chapter or a scientific paper dealing with biorobotics, and reproduce its main results, either in a simulated or is a physical environment. - Report the main results of this paper as a short oral presentation, and provide a critical opinion about them. - - - - *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	**Due to the COVID-19 crisis, the information in this section is particularly likely to change.** L'évaluation combine le projet de groupe et un examen final (oral), portant sur la matière couverte pendant les séminaires donnés par les étudiants. Une originalité de cet examen est que ce sont les étudiants eux-mêmes qui constituent la banque de questions qui peuvent être tirées lors de l'examen oral. The evaluation combines the group project and a final exam (oral), dealing with the materials covered during the seminars given by the students. An original aspect of this exam is that the questions that are picked are written by the students themselves, next to their seminar. If the final exam is failled with 30% (6/20) or less, the final mark is equal to the exam mark. Otherwise, the final mark is obtained as following: • 50% based on the group project (see the "Teaching methods" section). Students from the same group receive the same mark, except if it appears that the workload was not fairly distributed. • 50% based on the performance during theoral exam.
Teaching methods	**Due to the COVID-19 crisis, the information in this section is particularly likely to change.** The course combines a few ex cathedra lectures introducing biorobotics and group projects conducted by the students. Groups are made of 2 to 3 students. The project outline is the following: • Students select a recent bio-inspired robot and a series of scientific papers describing and analyzing this robot. • Using a simulation environment or a physical setup, students have to try reproducing the results described in the papers (at least partly). • They present their work in front of the classroom, comparing their own resumts to the original papers. A critical discussion is expected.
Content	This class mostly consists in the achievement of a group project where students study a bio-inspired robot, for which scientific publications have been issued. The student group is invited to analyze results obtained with this robot, put them in perspective with respect to the literature, and possibly repoduce some of them with a numerical simulation tool or a prototype. A few lectures introduce the field and the project, as well as methods of scientific research and communication.
Inline resources	Moodle: https://moodleucl.uclouvain.be/course/view.php?id=12494
Faculty or entity in charge	MECA

Force majeure

Evaluation methods	In case of force majeure, the oral exam will be organized remotely via a computer platform.

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Aims
Master [120] in Electro-mechanical Engineering	ELME2M	5		
Master [120] in Biomedical Engineering	GBIO2M	5		
Master [120] in Mechanical Engineering	MECA2M	5		