



In view of the health context linked to the spread of the coronavirus, the methods of organisation and evaluation of the learning units could be adapted in different situations; these possible new methods have been - or will be - communicated by the teachers to the students.

5 credits	30.0 h + 30.0 h	Q2
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Teacher(s)	Fisette Paul ;
Language :	English
Place of the course	Louvain-la-Neuve
Main themes	Definition and classification of multibody systems. Description of the various methods used by multibody softwares. Multibody formalisms for tree-like multibody systems (e.g. serial robot manipulators) and closed-loop systems (e.g. parallel manipulators, vehicles,...) : automatic computer generation of the dynamical equations and numerical integration algorithms for differential-algebraic equations (DAE)
Aims	<p>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:</p> <ul style="list-style-type: none"> • AA1.1, AA1.2, AA1.3 • AA2.3, AA2.4, AA2.5 • AA3.2, AA3.3 1 • AA5.1, AA5.2, AA5.3 • AA6.2, AA6.4 <p>Give students a complementary education in the field of mechanics of systems of rigid bodies (geometry, kinematics, dynamics) by studying the modelling aspects of complex articulated systems.</p> <p>Develop the students capacities in designing, writing and/or using multibody modelling software for robots, vehicles, suspensions systems and other mechanisms, with a view to their geometrical, kinematical and dynamical analysis.</p> <p>-----</p> <p><i>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".</i></p>
Evaluation methods	<p>Due to the COVID-19 crisis, the information in this section is particularly likely to change.</p> <p>Exam : oral examination. The exam consist of two parts: an examination on the theory (with lecture notes available) and a discussion about the project (theory, modelling and software implementation). support : lecture notes and copies of the slides used during the lectures.</p>
Content	<ol style="list-style-type: none"> 1. Definition and classification of multibody systems (NBS). Principal characteristics of the computer programs used in modelling and analyzing multibody systems. 2. Multibody formalisms for tree-like systems (e.g. serial robots) or closed-loop mechanisms (e.g. vehicles) - definition of barycentric quantities - automatic generation of the dynamical equations using the Lagrange multipliers technique (use of the virtual power principle and Newton-Euler recursive algorithm). 3. Coordinate partitioning method. 4. Numerical analysis : equilibrium, modal analysis, time simulation, inverse dynamics. 5. Particular applications : serial and parallel robots, road vehicles, railway vehicles, multibody systems with flexible elements. <p>Students must choose a project (for 1 or 2 students) dealing with the modeling and analysis of a multibody system or with the reading and the synthesis of a couple of scientific publications.</p>
Inline resources	http://icampus.uclouvain.be/claroline/course/index.php?cid=MECA2802
Bibliography	<p>Référence de base :</p> <ul style="list-style-type: none"> • P. Fisette et J.C. Samin : Symbolic Modelling of Multibody Systems, à paraître chez Klawer Academic Press. <p>Références (conseillées) :</p> <ul style="list-style-type: none"> • Parviz E. Nikravesh, Computer-Aided Analysis of Mechanical Systems, Prentice Hall Inc., 1988. • Haug, E.-J. : Computer Aided Kinematics and Dynamics of Mechanical Systems, Allyn and Bacon, Boston, 1989.

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