UCLouvain

lmeca2802

2021

Multibody system Dynamics

5.00 credits	30.0 h + 30.0 h	Q2

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 multobody systems (e.g. serial robot manipulators) and closed-loop systems (e.g. parallel manipulators, vehicles,...) : automatic computer generation of the dynamical eduations and numerical integration algorithms for differential-algebraic equations (DAE)
Learning outcomes	**At the end of this learning unit, the student is able to :** 1 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 • AA2.3, AA2.4, AA2.5 • AA3.2, AA3.3 • AA5.1, AA5.2, AA5.3 • AA6.2, AA6.4 Give students a complementary education in the field of mechanics of systems of rigid bodies (geometry, kinematics, dynamics) bu studying the modelling aspects of complex articulted systems. Develop the sutdents 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.
Evaluation methods	The evaluation is an open book oral exam: • The theoretical course counts for 60% of the points • The project counts for 40% of the points
Teaching methods	• 13 or 14 theoretical lectures • 1 Project in multibody dynamics: bibliographic or modeling
Content	1. Definition and classification of multibody systems (NBS). Principal characteristics of the computer programs used in modelling and analyzing multibody systems. 2. Multobody 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. 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.
Inline resources	https://moodle.uclouvain.be/course/view.php?id=3025
Bibliography	Samin, J.C. and Fisette, P., « Symbolic Modeling of Multibody Systems », Kluwer Academic Publishers, Dordrecht, 2003, ISBN 1-4020-1629-8
Faculty or entity in charge	MECA

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