AGH UNIVERSITY OF SCIENCE AND TECHNOLOGY

Module name: Virtual prototyping in design

Academic year: 2013/2014 Code: RMS-1-502-s ECTS credits: 4

Faculty of: Mechanical Engineering and Robotics

Field of study: Mechatronics with English as instruction languagege Specialty: —

Study level: First-cycle studies Form and type of study: Full-time studies

Lecture language: English Profile of education: Academic (A) Semester: 5

Course homepage: —

Responsible teacher: dr hab. inż. Pieczonka Łukasz (lukasz.pieczonka@agh.edu.pl)

Academic teachers:

Description of learning outcomes for module

MLO code	Student after module completion has the knowledge/ knows how to/is able to	Connections with FLO	Method of learning outcomes verification (form of completion)
Social competence			
M_K001	awareness of the importance of virtual propotyping in the decision process involved in the development of mechatronic systems	MS1A_K01, MS1A_K04	Report
Skills			
M_U001	knows engineering tools for modelling and simulation of mechatronic devices	MS1A_U15	Test, Report
M_U002	has the ability to perform basic types of numerical simulations with use of Finite Element Method, Multibody System (MBS) and Finite Difference Method (FDM)	MS1A_U07, MS1A_U09	Test, Report
M_U003	has the ability to correctly interpret the results of simulations, asses the correctness if the results and relate them to experimental data	MS1A_U09	Test, Report
Knowledge			
M_W001	knows the methodology of design and analysis of mechatronic devices	MS1A_W12	Test, Report

FLO matrix in relation to forms of classes

MLO code	Student after module completion has the knowledge/ knows how to/is able to	Form of classes										
		Lectures	Auditorium classes	Laboratory classes	Project classes	Conversation seminar	Seminar classes	Practical classes	Others	Fieldwork classes	Workshops	E-learning
Social competence												
M_K001	awareness of the importance of virtual propotyping in the decision process involved in the development of mechatronic systems	-	-	+	-	-	-	-	-	-	-	-
Skills												
M_U001	knows engineering tools for modelling and simulation of mechatronic devices	+	-	+	-	-	-	-	-	-	-	-
M_U002	has the ability to perform basic types of numerical simulations with use of Finite Element Method, Multibody System (MBS) and Finite Difference Method (FDM)	-	-	+	-	-	-	-	-	-	-	-
M_U003	has the ability to correctly interpret the results of simulations, asses the correctness if the results and relate them to experimental data	+	-	+	-	-	-	-	-	-	-	-
Knowledge												
M_W001	knows the methodology of design and analysis of mechatronic devices	+	-	-	-	-	-	-	-	-	-	-

Module content

Lectures

Introduction to numerical methods used in virtual prototyping od mechatronic systems.
Introduction to discretization methods as a foundation to numerical simulations od mechatronic systems.
Discussion of basic types of numerical analyses involved in the virtual prorotyping process, including theoretical background and available software tools.

Laboratory classes

Implementation and analysis of different discretization methods in Matlab.
Simulations od Multibody Systems (MBS) and Finite Element Models (FEM). Model definition, problem solution and critical analysis of the results.

Method of calculating the final grade
Arithmetic mean of partial grades from the reports and tests.

Prerequisites and additional requirements
Basic knowledge in mathematics (linear algebra, matrix theory), physics, applied mechanics and materials science.

Recommended literature and teaching resources
Rakowski G., Kacprzyk Z.: MES w mechanice konstrukcji, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2005
Bathe K-J., Finite Element Procedures, Prentice Hall, 1995
Kleiber M. (Ed.), Handbook of Computational Solid Mechanics, Springer-Verlag, 1998
MSC Software Corporation, MSC.Nastran Documentation, 2010
Dassault Systèmes, Abaqus Software Documentation, 2010
ANSYS Inc., Ansys Software Documentation, 2010

Scientific publications of module course instructors related to the topic of the module
Additional scientific publications not specified

Additional information
None

Student workload (ECTS credits balance)

Student activity form	Student workload
Participation in laboratory classes	42 h
Participation in lectures	14 h
Realization of independently performed tasks	15 h
Preparation for classes	15 h
Preparation of a report, presentation, written work, etc.	20 h
Summary student workload	106 h
Module ECTS credits	4 ECTS