AGH UNIVERSITY OF SCIENCE AND TECHNOLOGY

Module name: Basics of mechatronics

Academic year: 2013/2014 Code: RMS-1-402-s ECTS credits: 5

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: 4

Course homepage: —

Responsible teacher: prof. dr hab. inż. Uhl Tadeusz (tuhl@agh.edu.pl)

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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	Student is able to work in a team project.	MS1A_K05	
Skills			
M_U001	Students will able to synthesize and design of mechatronic systems based on virtual prototyping.	MS1A_U10, MS1A_U12, MS1A_U07, MS1A_U11	Activity during classes, Presentation, Execution of a project, Involvement in teamwork
M_U002	They will work with smart materials and structures as well as microsystem design and testing.	MS1A_U10	Activity during classes, Project
Knowledge			
M_W001	Within a frame of this subject students will learn rules of modeling and simulation of mechatronic systems and the will get practical knowledge on software tools for simulation of mechatronic systems.	MS1A_W13, MS1A_W12, MS1A_W11	Project

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	Student is able to work in a team project.	-	-	+	+	-	-	-	-	-	-	-
Skills												
M_U001	Students will able to synthesize and design of mechatronic systems based on virtual prototyping.	-	-	+	+	-	-	-	-	-	-	-
M_U002	They will work with smart materials and structures as well as microsystem design and testing.	-	-	+	+	-	-	-	-	-	-	-
Knowledge												
M_W001	Within a frame of this subject students will learn rules of modeling and simulation of mechatronic systems and the will get practical knowledge on software tools for simulation of mechatronic systems.	+	-	-	+	-	-	-	-	-	-	-

Module content

Lectures

Basics of mechatronics

1. Modeling of mechatronic systems – general rules, methods of modeling and simulation, application of models for synthesis and analysis of Mechatronic systems. Electro – mechanical analogy and its application. Software tools for multiphysics simulation.
2. Modeling of mechanical, electrical and electronic components of Mechatronic products. Multiphysics simulation.
3. Control of Mechatronic products, analysis and synthesis of Mechatronic products. The methods based on block diagram and state space equations, the methods based on artificial intelligence. Simulation of control systems.
4. Application of smart materials for mechatronic structure, SMA materials, piezoceramics, magnetorheological materials. Modeling and simulation of smart structures.
5. Electronic components and its modeling and simulation. Digital and analog electronic components and their models, A/D and D/A converters, Digital components of Mechatronic systems, digital controllers of Mechatronic products, DSP and its

application in mechatronic products.
6. Microelectronics and micromechanics in Mechatronic design, mathematical model of microstructures, physical phenomena considered in micro system modeling.
7. Smart structures, Structural Health monitoring, interfaces with environment, man – machine interface, control, services and maintenance.
8. Examples of Mechatronic structures and its analysis.

Laboratory classes

Basics of mechatronics
1. Modeling and simulation of mechatronic systems using block diagram methods – SIMULINK
2. Modeling and simulation of mechatronic systems using electro – mechanical analogy (SPICE)
3. Modeling and simulation of piezoceramic systems Rusing – Comsol
4. Modeling and simulation of mechatronic systems with controller – Automation Studio.
5. Modeling and simulation of mechatronic systems using AMESIM
6. Synthesis of a digital control system and its prototyping

Project classes

Basics of mechatronics
Perform design mechatronic systems.

Method of calculating the final grade
Average of ...

Prerequisites and additional requirements
Prerequisites and additional requirements not specified

Recommended literature and teaching resources
1. R.H. Bishop (ed.) The Mechatronics handbook, CRC Press, Boca Raton, 2002.
2. Giurgiutiu V., Lyshevski S.E., Micromechatronics, Modeling, Analysis and design with Matlab, CRC Press, 2004
3. Clarence W de Silva (Ed), Mechatronic Systems: Devices, Design, Control, Operation and Monitoring Editor(s) CRC Press, Boca Raton, 2007.
4. Fatikov S., Rembold U., Microsystem Technology and Microrobotics, Springer, Berlin, 1997
5. Iserman R., Mechatronic Systems, Fundamentals, Springer, Berlin, 2003.

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

Additional information
The goal of this subject is to get students knowledge on methods of modeling of mechatronic systems as well as synthesis, analysis and testing of mechatronic products.

Student workload (ECTS credits balance)

Student activity form	Student workload
Participation in lectures	14 h
Participation in project classes	15 h
Participation in laboratory classes	30 h
Preparation for classes	40 h
Realization of independently performed tasks	20 h
Completion of a project	15 h
Summary student workload	134 h
Module ECTS credits	5 ECTS