

InMotion project meeting in Madrid



23-25.10.2017 in Library building of UNED

The attendants to the meeting were welcomed by the faculty and staff members of UNED that participate in InMotion: Alfonso Urquía, Carla Martín, Miguel Ángel Rubio, Victorino Sanz and Aurora González. After the welcome speech, a library staff member showed to the meeting attendees the premises of the UNED Central Library and explained the services provided to the students by the UNED's library network.

Alfonso Urquía discussed with the meeting attendees the role of libraries and Associate Centers in the blended learning methodology implemented by UNED.

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Calendar of events

Past events

- 23 -25.10.2017** Project meeting in Madrid
- 15.11.2017** Monitoring Visit in St. Petersburg
- 21.11.2017** Cluster meeting in of Malaysia partners in Kuala Lumpur

Upcoming events

- 23 -25.10.2017** Project meeting in Johor Bahru

New teaching and learning materials

The partners are working on fundamental textbooks in CMSE for Bachelors and Masters and special textbooks for different simulation tools, such as RMD, Modelica, Simulink, ISMA and Wolfram System Modeller.

In this issue, we present "**Modeling and simulation in Engineering using Modelica**" by: A. Urquía, C. Martín-Villalba

This book offers an introduction to the development and simulation of Modelica models for engineering applications. The target audience are bachelor's or master's level students, interested in modeling and simulation, and with a background in both physics and numerical methods. The modeling methodology, the Modelica language features, and the use of modeling environments are explained through examples. This facilitates the use of this book in the context of student-centered learning strategies, such as problem-based learning, and project-based learning. The book is structured into three parts: (i) continuous-time modeling; (ii) simulation of continuous-time models; and (iii) hybrid system modeling and simulation. The modeling methodology and the Modelica features for continuous-time modeling are discussed in the first part of the book. The modeling methodology supported by Modelica, named object-oriented modeling, is discussed in Lesson 1. The mathematical formalism underlying the Modelica language and algorithms for simulating this type of model, named hybrid DAE system, are also discussed in the first lesson, and the use of Dymola and OpenModelica is introduced. The description of atomic models and model libraries in Modelica is discussed in Lessons 2 and 3. The simulation of continuous-time Modelica models is addressed in the second part of the book. We have favored simplicity, clarity and readability over mathematical rigor. The main objective is to provide the reader with the minimum knowledge required for understanding the messages generated by the modeling environment (e.g., Dymola & OpenModelica) during the model translation and simulation. [Continued on page 2](#)

InMotion project meeting in Madrid (continued from page 1)

After this guided tour through the Central Library, the steering group started the discussion on the current issues. First of all the partner universities presented the new developed or updated Syllabi for CMS and discussed the development of teaching and learning materials for them. The plan for writing and translation of the new textbooks was accepted. The partners discussed the composition of the eLearning modules. The program for the summer school in St. Petersburg was presented and procedure of selecting students and CMS tasks for pre-selection were approved. The first variant of the topics for the mini-projects for students completion were presented by NSTU. Vladimir Ryzhov (SMTU) reported on the quality assurance measures for the new developed teaching and learning materials. The partners discussed dissemination strategy and exploitation of results. Igor Novopashenny (UniHB) presented the template for the technical intermediate report. The next meeting of SG was confirmed to be held on 16th - 18th April 2018 in Johor Bahru (UTM).

New teaching and learning materials (continued from page 1)

A broad range of topics are introduced: computational causality assignment, DAE index reduction, DAE initialization, state variable selection, and numerical methods for DAE systems. The analyses and symbolic manipulations that modeling environments perform on Modelica models are discussed in Lessons 4 and 5, and the numerical methods in Lesson 6.

The third part of the book is devoted to discuss hybrid modeling and simulation in Modelica. The formal specification of hybrid models, and the relationship of this specification with the simulation algorithm and the Modelica description, are described in Lesson 7. Numerical methods for event detection and handling are discussed in Lesson 8. Once again, simplicity has been favored over mathematical rigor. The objective is to provide the reader with the minimum knowledge required to understand the issues associated with the description of events, and variable structure models in Modelica. The goal is not to explain how to implement a simulator, but to explain how to design and implement models that can be simulated efficiently, without causing errors. Finally, the language features for describing time and state events, and runtime changes in the model mathematical description, are illustrated by a series of examples in Lesson 9.

Current Activities

Deputy Director of ERASMUS + National Office in Russia Visit to SMTU

15th November 2017 the Department of Applied Mathematics and Mathematical Modeling underwent monitoring of the international project "InMotion: New strategies for training engineers using visual modeling environments and open educational platforms", currently implemented in the SPbGMTU. SPbGMTU (represented by the Department of PMMM) is the national coordinator of the scientific and educational project, in which universities from Germany, Spain, Slovenia, Malaysia and Russia are participating. The project is coordinated at the international level by the University of Bremen.

The monitoring meeting was attended by: representatives of the ERASMUS + national office in Russia (deputy director A.A. Muravieva, administrator N.M. Aksenova); the representative of the project coordinator is the University of Bremen (Associate Professor I.V. Novopashenny); representatives of the Russian participants of the project - St Petersburg Polytechnic University Peter the Great (Professor Y.B. Senichenkov, Professor A.L. Mazina) and the St Petersburg Institute of Informatics and Automation of the Russian Academy of Sciences (Professor B.V. Sokolov); the teaching and administrative staff of SPbGMTU participating in the project.



Teachers from the PMMMM department participating in the project (head of the department (Professor V.A. Ryzhov, Associate Professor T.A. Fedorova, Assistant K.S.Safronov), representative of the project coordinator (Associate Professor I.V. Novopashenny) prepared a detailed report-presentation on project implementation, describing results, received by the universities for the first year of the project.

The participants of the project stated that at present they are working on creating textbooks, guidelines, electronic training resources based on OMSE; in spring

semester of 2017/2018 academic year the universities of Russia and Malaysia will start training students basing on new work programs, using prepared textbooks and electronical resources.



Result of the meeting was summed up by Associate Professor I.V. Novopashenny from the University of Bremen. In particular, he noted that this is the second international project implemented by the team from Bremen in conjunction with SPbGMTU. He expressed confidence that all the goals set for the InMotion project participants will be successfully implemented

Participation of SMTU in the international scientific and practical network conference "Synergy-2017"

In accordance with the work plan of the Scientific and Educational Inter-College Council of PJSC Gazprom in 2017, activities were held in the framework of the international network scientific and practical conference on engineering education "New Standards and Technologies of Engineering Education: Opportunities for Universities and the Needs of the Oil, Gas and Chemical Industry - Synergy-2017".



Plenary meeting

The co-organizers of the conference were the Ministry of Education and Science of the Russian Federation, the Association for Engineering Education of Russia, the European Society for Engineering Education (SEFI),

the International Society for Engineering Education (IGIP), the International Federation of Engineering Education Societies (IFEES).

SMTU took an active part in these events.

The purpose of the international network scientific-practical conference was to consider the world and domestic experience in using the new standards and technologies (CDIO, NBICS, STEAM, MOOC, etc.) in engineering education aimed at training demanded specialists for work at oil and gas chemical enterprises. Topics of the conference were related to the following main areas:

- engineering education and engineering pedagogy (methodology of research in the field of engineering education, relation between research and education, new projects and innovations, etc.);
- systems of standards and accreditation (correlation of federal state educational and professional standards, accreditation, etc.);
- engineering education quality and ratings (methods and algorithms for assessing competencies of students, technological entrepreneurship and competencies of engineers, system of training teachers, etc.);
- experience exchange in the sphere of engineering education (university network of engineering education in basic universities, best practices, interaction between universities and industry, etc.).

At the conference the SMTU was represented by the head of the Department of Applied Mathematics and Mathematical Modeling (PMMM), InMotion project coordinator from SMTU - Ryzhov V.A.

Ryzhov V.A. reported at the plenary and sectional sessions on the topic "The experience of introducing new teaching and learning technologies in engineering education in the SMTU."



Prof. Ryzhov on the plenary meeting

In the report was presented SMTU experience, acquired within the framework of the international project "InMotion: New strategies for training engineers using visual modeling environments and open educational platforms".



After the reports were made, discussions among participants of the conference took place, that showed great interest in the models and methods of training, as well as ICT platforms developed within the framework of the project.

The cluster meeting of E+ CBHE projects in Malaysia

The cluster meeting of E+ CBHE projects was held on 21st November 2017 at Universiti Teknologi Malaysia Kuala Lumpur (UTM KL). It was attended by participants representing 16 E+ CBHE projects with active periods between 2015 to 2017. The session was coordinated by Dr. Fauzan Khairi Che Harun of UTM. The EACEA representative for the session was Miss Antonella Giorgio.



Participants of the Cluster Meeting

The main objective of the session was to give HEIs from the Partner Country a floor to create synergies, encourage contacts and networking activities to increase the impact of the CBHE action in the country. Concurrently, the session provides the opportunity for all project members to discuss with all the partners and the EACEA representative on various aspects concerning their participation in the projects whilst making them aware of the challenges and the difficulties on project implementation.



InMotion Presentation

Among the highlights of the session was that each project coordinator gave a brief presentation about their project, its progress, issues and challenges. Miss Giorgio also briefed all members on how to manage projects, expected project communication and dissemination activities, quality assurance, financial management, project monitoring and the overall CBHE framework. Several issues were also highlighted, among them are the inclusion taxes in procured equipment for the project and the sustainability of the newly formed network on this platform. As such, the EACEA representative agrees to take up the issue taxes for further deliberation and UTM KL agrees to lead the initiative to sustain the communication between all project members via the creation of its own webpage.

News from the Partners Universities

Modeling and Simulation in Control Engineering UNED

Modeling and Simulation in Control Engineering

The Master's program in Systems and Control Engineering, offered jointly by Universidad Nacional de Educación a Distancia (UNED)[1] and Universidad Complutense de Madrid (UCM)[2], prepares specialist in Automated Control Engineering to design, implement, operate and maintain automatic regulation systems. 34 faculty members participate in this Master's program, in which 50 new students are admitted every year.

This distance learning master's degree of 60 ECTS-credits (1 ECTS = 25 study/work hours) is made up of the following eight modules:

1. Mathematics and computation
2. Computers and communications
3. Sensors and signal processors
4. Robotics and industrial automation
5. Modeling and simulation
6. Control

7. Biologically inspired engineering
8. Practices

Each module is composed of several 6 ECTS-credit subjects. All subjects are optional, but the following rule applies: students have to choose 42 ECTS-credits among the subjects of Modules 1 to 7, and additionally 6 ECTS-credits among the subjects of the "Practices" module (Module 8). The Master's Thesis is compulsory and comprises 12 ECTS-credits.

The "Modeling and simulation" module is composed of the following 6 ECTS-credit, optional subjects:

1. Modeling of dynamical systems
2. System identification
3. System simulation

Mixed-domain modeling of cyber-physical systems, based in physical principles, is discussed in the "Modeling of dynamical systems" subject. The objective is twofold. Firstly, students learn to design model libraries, applying the object-oriented modeling methodology and facilitating model reuse. Secondly, they learn the model analyses and manipulations performed by the modeling environments, and the numerical methods for simulating hybrid-DAE systems. This capacitates students for developing models avoiding numerical errors and favoring simulation efficiency. The concepts explained in "Modeling of dynamical systems" are put into practice and developed in "System simulation", where students learn to use, design and develop model libraries using the Modelica language.

Students interested in acquire deeper knowledge on modeling and simulation can select the 6 ECTS-credit practice (Module 8) dedicated to this topic, entitled "Development of model libraries in the Modelica language", and also they can develop their Master's Theses within the suggested research topic entitled "Mathematical modeling and simulation of physical systems".

The Doctorate Degree in Systems and Control Engineering offered by UNED allows students to conduct research on modeling and simulation in the Control Engineering context. This doctoral program is research-based. As students don't have to take courses, they are focused on performing research toward their dissertations. 15 new PhD students are admitted to this program every year.

The faculty members of UNED that participate in the InMotion project are the instructors of the above-mentioned subjects "Modeling of dynamical systems" and "System simulation", and compose the UNED's Research Group on Modeling & Simulation in Control Engineering[3], participating in the Doctoral Programme in Systems and Control Engineering.

References: [1] www.uned.es [2] www.ucm.es [3] www.euclides.dia.uned.es

InMotion Project



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