Virtual Laboratories in Wolfram SystemModeler (Part 1)

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and

A practical guide for performing virtual laboratories in Wolfram SystemModeler (Part 2)

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Guidelines abstract

The guidelines «Virtual Laboratories in Wolfram SystemModeler» is an educational material intended for practical supporting of the training course «Computer Modeling and Simulation of Dynamic Systems Using Wolfram SystemModeler» for bachelor cycle students.

The guidelines is devoted to mechanical systems component modeling. This material contains basic information a student needs to perform virtual lab. The supplement to the guidelines is methodical instructions «A practical guide for performing virtual laboratories in Wolfram SystemModeler», containing material with solutions to the cases posed in the guidelines.

The guidelines contains information that a student needs to perform virtual lab on a personal computer in Wolfram SystemModeler (version 4). The guidelines covers both theoretical material that may be required by the student, and a set of labs with tasks relevant to the discipline.

The guidelines consists of four chapters:
- Requirements for implementation of virtual labs;
- Component modelling in Wolfram SystemModeler;
- Mathematical models of dynamic systems;
- Virtual Laboratories.

The guidelines provides requirements for implementation of a lab: to it's structure, content, design and presentation, as well as defending and evaluation of work results.

A strictly structured sequence of lab's stages is proposed, including: obtaining an idea of the technical system being modeled (problem statement); development of it's mathematical model; development of component computer model; conducting computational experiment; analysis of the obtained simulation results; adequacy assessment of the obtained quantitative and qualitative data.

Performing a lab includes: passing the entrance test to determine required level of basic knowledge and the output (control) testing, evaluating achievement by the student of the necessary competences. These tests are conducted using the Sakai virtual educational environment.

The requirements for analytical report and presentation are presented in the guidelines, as well as clearly defined evaluation criteria for all stages of the work, that allows a student to independently assess the quality of conducted work.

The guidelines «A practical guide for performing virtual labs in Wolfram SystemModeler» is intended to be used together with the textbook «Virtual Laboratories in Wolfram SystemModeler» and the textbook «Computer modeling and simulation of dynamic systems using Wolfram SystemModeler».

The guidelines provides recommendations for implementing those stages of virtual lab that may seem most difficult to students. The instructions contain necessary reference material that is required to complete the tasks.

For each ten virtual laboratories from the guidelines «Virtual Laboratories in Wolfram SystemModeler», recommendations are given on:

- component models diagrams construction;

- the process and results of the computational experiment conducted in Wolfram SystemModeler software.

The guidelines provides an example of an analytical report that a student must prepare for virtual laboratoties.

The guidelines «A practical guide for performing virtual laboratories in Wolfram SystemModeler» can be used by both students and tutors in the course «Computer modeling and simulation of dynamic systems using Wolfram SystemModeler».

While working on the guidelines, materials from the software development company Wolfram Research, Inc. website were used.

The guidelines «Virtual Laboratories in Wolfram SystemModeler» and «A practical guide for performing virtual laboratories in Wolfram SystemModeler» is written by creative team of authors from partner universities: SMTU, Russia and UniKL, Malaysia.