



Course title: Modeling of mechatronic systems

ECTS credit allocation (and other scores): 3

Semester: autumn

Level of study: ISCED-6 - first-cycle programmes (EQF-6)

Branch of science: Engineering and technology

Language: English

Number of hours per semester: 45

Course coordinator/ Department and e-mail: Sławomir Kulesza, Department of Mechatronics,  
kulesza@matman.uwm.edu.pl

Type of classes: classes and lectures

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#### Substantive content

CLASSES: 1) damped 1D mass-spring system, 2) damped 2D mass-spring system (car suspension), 3) pump-engine system, 4) serial RLC circuit, 5) DC engine, 6) fluid flow from tank, 7) free falling with turbulent drag, 8) pendulum with elastic suspension, 9) chaotic system - double pendulum, 10) constraints with Lagrange multipliers – sliding bob on a curve

LECTURES: 1. Intro into Mod/Sim, 2. Systems vs models, 3. Conceptual vs numerical models, 4. Verification and validation of results, 5. Newton dynamics, 6. Lagrange and Hamilton forms, 7. Deterministic chaos, 8. Molecular dynamics, 9. Cellular automata

Learning purpose: Prepare students to design, implement and analyze numerical models of various mechatronic systems rooted in physical phenomena

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On completion of the study programme the graduate will gain:

Knowledge: Students are expected to differentiate between systems described using differential and difference equations, students are expected to know the models of common physical phenomena.

Skills: Students are expected to design and solve a numerical model of a given phenomenon using Scilab/Matlab.

Social Competencies: Students are expected to co-operate in group in order to achieve presumed goals and are aware of the need of lifelong learning

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Basic literature: SL Campbell, JP Chancelier, R. Nikoukhah, "Modeling and simulation in Scilab/Scicos", Springer

Supplementary literature: SE Lyshevski, Engineering and Scientific Computations Using MATLAB, Wiley

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The allocated number of ECTS points consists of:

Contact hours with an academic teacher: 45

Student's independent work: 15