<table>
<tr><td>Course code</td><td></td></tr>
<tr><td>Type and description</td><td>EC</td></tr>
<tr><td>ECTS credit</td><td>1</td></tr>
<tr><td>Course name</td><td>Numerical Methods in Mechanics</td></tr>
<tr><td>Course name in Polish</td><td>Numeryczne metody mechaniki</td></tr>
<tr><td>Language of instruction</td><td>English</td></tr>
<tr><td>Course level</td><td>8 PRK</td></tr>
<tr><td>Course coordinator</td><td>Piotr Brzeski</td></tr>
<tr><td>Course instructors</td><td>Piotr Brzeski</td></tr>
<tr><td>Delivery methods and course duration</td><td>
<table>
<tr><th></th><th>Lecture</th><th>Tutorials</th><th>Laboratory</th><th>Project</th><th>Seminar</th><th>Other</th><th>Total of teaching hours during semester</th></tr>
<tr><td>Contact hours</td><td>0</td><td>0</td><td>0</td><td>15</td><td>0</td><td>0</td><td>15</td></tr>
<tr><td>E-learning</td><td>No</td><td>No</td><td>No</td><td>No</td><td>No</td><td>No</td><td></td></tr>
<tr><td>Assessment criteria (weightage)</td><td>0,00</td><td>0,00</td><td>0,00</td><td>1,00</td><td>0,00</td><td>0,00</td><td></td></tr>
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<tr><td>Course objective</td><td>1. Enabling students to gain knowledge about application of numerical methods to simulate the dynamics of mechanical systems.

2. Enabling students to learn how to apply in practice numerical integration algorithms for dynamical systems of different types.</td></tr>
<tr><td>Learning outcomes</td><td>After finishing the course student can:

1. Apply different numerical integration algorithms – effects W4, U4, K1

2. Choose appropriate integration method and parameters of integration algorithm depending on the type of dynamical system – effects W4, U4, K1. Visualize the results of numerical integration make their physical interpretation – effects W4, U4, K1</td></tr>
<tr><td>Assessment methods</td><td>Effects W4, U4, K1 – individual project

The final grade consists of:

Individual project evaluation - 80%

Activity during laboratory classes - 20%</td></tr>
<tr><td>Prerequisites</td><td>Master course in differential equations</td></tr>
<tr><td>Course content with delivery methods</td><td>1. Numerical integration of continuous systems. Creation and interpretation of time series and phase portraits.

2. Numerical integration of continuous systems. Creating Poincare maps and their interpretation.

3. Numerical integration of continuous systems. Generation of bifurcation diagrams and resonance</td></tr>
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	plots and their interpretation. 4. Numerical integration of continuous systems with many degrees of freedom. 5. Numerical integration of continuous systems coupled by inertia matrix. Unbinding of differential equations. 6. Numerical integration of discontinuous systems including Coulomb friction. Non-continuous and continuous model. 7. Numerical integration of discontinuous systems with hard impact (restitution coefficient) and soft impact (various models). 8. Integration of a simple system using the finite element method (continuous beam). 9. The Galerkin method. 10. Discussion on individual projects.
Basic reference materials	1. Lecturer materials, 2. C. Conca, G. N. Galtica: Numerical Methods in Mechanics, Chapman & Hall, 1997 3. A. Greenbaum, T. P. Chartier: Numerical methods: design, application and computer implementation, Princeton University Press; .2012
Other reference materials	1. Seydel R. Practical bifurcation and stability analysis. Vol. 5. Springer Science & Business Media, 2009.
Average student workload outside classroom	10 h
Comments	
Last update	17 March 2023