<table>
<tr><td>Course code</td><td></td></tr>
<tr><td>Type and description</td><td>Elective Course</td></tr>
<tr><td>ECTS credit</td><td>1</td></tr>
<tr><td>Course name</td><td>Fracture and fatigue in civil engineering</td></tr>
<tr><td>Course name in Polish</td><td>Zagadnienia pękania i zmęczenia w inżynierii lądowej</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>Prof. dr hab. inż. Marcin Kamiński</td></tr>
<tr><td>Course instructors</td><td>Prof. dr hab. inż. Marcin Kamiński</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></td><td></td><td></td><td>1,00</td><td></td><td>0,00</td><td>1,00</td></tr>
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<tr><td>Course objective</td><td>A fundamental objective of this course is a presentation of the fracture problems analysis for homogeneous and heterogeneous (composite) solids. Basic experimental methods and results in civil engineering will be demonstrated together with available criteria of elastic or elasto-plastic fracture; determination of the stress intensity factors will be introduced. Fundamental analytical solutions in elasticity and thermo-elasticity will be proposed together with selected solutions obtained with the use of the Finite Element Method programs.
The second purpose of this lectures cycle is presentation of fundamental experimental results and available theories in the area of fatigue fracture of civil engineering materials and structures. Selected well known models in deterministic formulation as well as some stochastic extensions necessary for final reliability and durability assessment in civil engineering will be presented. PhD students will be taught more important Finite Element Method and Stochastic Finite Element Method applications in mechanical and thermo-mechanical fatigue of some materials, elements and structures.</td></tr>
<tr><td>Learning outcomes</td><td>PhD would be able to
1. describe fundamental models of materials elastic fracture under static or quasi-static loads (W4)
2. formulate elastic fracture criteria under uncertain loads and/or material parameters (W4)
3. define stress intensity factors for the basic structural load cases (W4)
4. carry out the Finite Element Method of the fracture problems for the given engineering problem (U4, K1)
5. present fundamental models of structural materials fatigue (U4)
6. discuss an influence of the loads/materials parameters uncertainty on material fatigue (K1)
7. describe reliability index and its time fluctuations for the given civil engineering structure including its fatigue cycles number (U4)
8. perform computer simulation using the Finite Element Method program of fatigue fracture for the given engineering problem (U4).</td></tr>
<tr><td>Assessment methods</td><td>Learning outcomes would be verified during preparation (U4, K1) and presentation of the project results (W4, U4)</td></tr>
<tr><td>Prerequisites</td><td>The candidate should have basic information from mathematics and computer science to use any symbolic computing program for a development of mathematical operations and numerical visualization as well as to remember learning outcomes from the course CC 3 of this school.</td></tr>
<tr><td>Course content with delivery methods</td><td>Project in this course includes preparation of the Finite Element Method model and performance of computer simulation of the quasi-static fracture or fatigue analysis for the given problem in the area of civil engineering and transportation. The course is supported by e-learning realized via email submission of the presentations and computer applications to the program MAPLE as well as usage of the Author's webpage {http://www.kmk.p.lodz.pl/pracownicy/kaminski/index.htm} connected with the on-line discussion on the projects.</td></tr>
<tr><td>Basic reference materials</td><td>[1] K. Sobczyk, B.F. Spencer, Random Fatigue: from Data to Theory. Academic Press, San Diego, 2012.</td></tr>
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	[2] A. Neimitz, Mechanika Pękania. Warszawa, PWN, 1998. [3] M. Kamiński, Computational Mechanics of Composite Materials. Springer, London, 2005.
Other reference materials	[1] K. Sobczyk, Modelling of random fatigue crack growth. Engrg. Fract. Mech. 24: 609-623, 1986. [2] A.A. Griffith, The phenomena of rupture and flow in solids. Phil. Trans. Royal Soc. London A 221: 163-198, 1921. [3] M. Kamiński, On probabilistic fatigue models for composite materials. Int. J. Fatigue 24(2-4): 477-495, 2002.
Average student workload outside classroom	10 h
Comments	
Last update	25.04.2023