



T-423-ENOP

ENGINEERING OPTIMIZATION

6 ECTS

Year of study:	3 rd year BSc / 1 st year MSc.
Semester:	Spring.
Level of course:	3. First cycle, advanced / 4. Second cycle, introductory.
Type of course:	Elective.
Prerequisites:	(1) Working knowledge of Matlab programming. (2) Calculus (elementary linear algebra, in particular, vector/matrix operations and linear systems. Basic knowledge of derivatives, including Taylor expansion.
Schedule:	Runs for 3 weeks – 4 teaching hours a day.
Supervising teacher:	Slawomir Koziel.
Teacher:	Slawomir Koziel.

Learning outcome: Upon completing the course, the students should be able to:

- (1) Formulate engineering optimization problem, corresponding objective functions and constraints,
- (2) Select appropriate optimization/modeling methodology,
- (3) Implement basic optimization and modeling procedures as well as develop necessary Matlab code,
- (4) Solve problems using existing packages, in particular Matlab and Matlab's Optimization Toolbox,
- (5) Visualize the optimization process and the results.

Content: The course introduces the concept and methods of engineering optimization. Major topics discussed throughout the course are: formulation of unconstrained and constrained optimization problems, objective functions, classification of optimization methods, first- and second-order optimality conditions, gradient-based search methods, derivative-free optimization, stochastic search methods including multi-agent systems and evolutionary algorithms, multi-objective optimization, surrogate-based optimization with focus on space mapping, functional and physical surrogate modeling, design of experiments, model selection and validation, as well as solving real-world engineering optimization problems with interfacing of commercial simulators. The relevant material concerning Matlab programming as well as calculus in the scope necessary for the course will also be given.

Reading material:	Lecture slides provided by the teacher
Teaching and learning activities:	Lectures and practical sessions.
Assessment methods:	Grades are based exclusively on the assessment of the solutions to the practical exercises. Requirement regarding the solution format and other details will be given during the first lecture.
Language of instruction:	English.

All course descriptions may be subject to change. Revised information on the course schedule, reading material, teaching and learning activities, and assessment methods will be introduced in the learning management system Canvas at the beginning of the semester.