Syllabus for the course

"Modern Algorithmical Optimization"

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ECTS	3
Contact hours	32
Self-study hours	82
Study year	1
Format	Full-time

Learning Objectives

In this course we present the most important research directions in the modern Optimization Theory. The main topics of our interest are related to the provable complexity of optimization problems and the most efficient methods for finding their approximate solution. The main attention will be given to the methods for solving problems of large and super-large dimension, which arise in many engineering applications, telecommunications, and models for analyzing the Internet activity. We consider also the optimization schemes, which are necessary for justifying rationality of consumers in economic models. The most of the material is absent in the monographic literature. Therefore, we include in the course all necessary proofs.

Course Plan

The course will be giving in two weeks in April 2019 by ten lectures, two hours each. During the course, we are going to discuss the following topics.

Topic 1. Complexity of optimization problems
Topic 2. Universal first-order methods
Topic 3. Second-order methods. Systems of nonlinear equations.
Topic 4. Looking into the Black Box: Smoothing technique
Topic 5. Looking into the Black Box: Interior-point methods
Topic 6. Optimization with relative accuracy.
Topic 7. Solving the huge-scale optimization problems.
Topic 8. Algorithmic models of human behavior.

Grading System

A written work on the content of the course will be proposed in June: 3 hours for 3 questions. The list of the questions will be distributed in advance. The answers should contain all basic points of the theory and sometimes the proofs of theorems. All necessary proofs will be explicitly presented and discussed during the lectures. The answers may be given either in English or Russian. Quality of their answers will be estimated by a 20-point scale with further transfer to 10-point scale.

Reading List

Required:

Yu. Nesterov. Introductory lectures on Convex Optimization. Kluwer 2004.

Optional:

1) S.Boyd, L.Vandenberghe. Convex Optimization. Cambridge University Press, 2008
2) Yu. Nesterov. Lectures on Convex Optimization. Springer, 2018.
2. Guidelines for Knowledge Assessment.