Study programmes: PhD studies – Mathematics

Course name: Optimization

Lecturers: Zorica Stanimirović

Status: Optional

ECTS: 9

Attendance prerequisites: -

Course aims: Acquiring theoretical and practical knowledge and mastering various methods for solving optimization problems.

Course outcome: At the end of the course, a student will be able to independently analyze and solve optimization problems from the theoretical aspect, as well as implement the appropriate methods for their exact or approximate solution using some programming language.

Course content:

1. Optimization with and without constraints: Basic concepts. Conugate gradient method. Trust region method. Quasi-Newton method. Variational calculus and optimal control. Optimality conditions. Linear programming, internal methods. Quadratic programming.

2. Optimal control and stohastic optimization: Dynamic programming. Hamilton-Jacobi-Bellman equation. Linear-quadratic control problems. Stohastic optimization. Implicit filtering. Direct seaech algorithms.

3. Global optimization: Branch and bound method, cutting plane method. Interval methods. Simulated annealing. Clustering methods, Genetic algorithms.

Literature:

[1] J. E. Dennis and R. B. Schnabel, Numerical Methods for Unconstrained Optimization, SIAM, Philadelphia 1996.

[2] P. Dorato, C. Abdallah, and V. Cerone, Linear-Quadratic Control, Prentics Hall, Englewood Cli®s, N. J., 1995.

[3] C. Geiger and C. Kanzow, Numerische Verfahren zur LÄosung unrestringierter Optimierungs-aufgaben, Springer-Verlag, Berlin 1999.

[4] C. Geiger and C. Kanzow, Theorie und Numerik restringierter Optimierungsaufgaben, Springer-Verlag, Berlin 2002.

[5] D. E. Goldberg, Genetic Algorithms in Search, Optimization and Machine Learning, Addison-Wesley, New York 1989.

[6] E. Hansen, Global Optimization Using Interval Analysis, Pure and Applied Mathematics Vol. 165, Marcel Dekker, New York 1992.

[7] C. Hillermeier, Nonlinear Multiobjective Optimization: A Generalized Homotopy Approach, BirkhÄauser Verlag, Basel 2001.

[8] R. Horst and H. Tuy, Global Optimization: Deterministic Approaches, Springer-Verlag, Berlin 1990.

[9] F. Jarre and J. Stoer, Optimierung, Springer-Verlag, Berlin 2004.

[10] C. T. Kelley, Iterative Methods for Optimization, Frontiers in Applied Mathematics Vol. 18, SIAM, Philadelphia 1999.

[11] D. G. Luenberger, Linear and Nonlinear Programming, Addison-Wesley, Reading (USA) 1984.

[12] K. Mietinen, Nonlinear Multiobjective Optimization, Kluwer, Dordrecht 1999.

[13] J. Nocedal and S. Wright, Numerical Optimization, 2nd ed., Springer-Verlag, NewYork 2006.

[14] R. E. Steuer, Multiple Criteria Optimization: Theory, Computations and Applications, John Wiley & Sons, New York 1986.

[15] B. Rustem, Algorithms for Nonlinear Programming and Multiobjective Design, John Wiley & Sons, Chichester 1998.

[16] A. A. TÄorn and A. ·Zilinskas, Global Optimization, Lecture Notes in Computer Science Vol. 350, Springer-Verlag, Berlin 1989.

[17] A. A. Zhigljavsky, Theory of Global Random Search, Mathematics and Its Applications Vol. 65, Kluwer, Dordrecht 1991.				
Number of hours: 10	**Lecures: 4**	**Tutorials:**	**Laboratory: -**	**Research: 6**
Teaching and learning methods: Frontal / Tutorials / Project				
Assessment (maximal 100 points)				
Course assignments	**points**	**Final exam**		**points**
Lectures	-	Written exam		-
Exercises / Tutorials	20	Oral exam		30
Colloquia	-	Written-oral exam		-
Essay / Project	50			