

Course content for International Master program „Mathematical modeling, computation and optimization“

Course name	Inverse Problems
Content and Objectives	<p><u>Content:</u></p> <ul style="list-style-type: none"> • Mathematical characterization of inverse problems and applications • Hadamard's well-posedness definition and the ill-posedness phenomenon • Inverse problems as linear and nonlinear operator equations • Linear ill-posed problems in Hilbert spaces • Singular value decomposition of compact operators and the degree of ill-posedness for linear problems • Theory and practice of regularization approaches for ill-posed problems based on tools from analysis, numerics, optimization and stochastics • Tikhonov regularization for nonlinear ill-posed problems in Hilbert spaces • Error estimates, convergence and rates results for Tikhonov and Lavrentiev regularization in Hilbert spaces • Regularization in Banach spaces with Bregman distances <p><u>Objectives of the course:</u> Introduction to the mathematics of inverse problems with applications in natural sciences, engineering and finance. The students learn how to overcome the ill-posedness of the problems by using objective and subjective a priori information in regularization methods adapted to specific classes of applied inverse problems.</p>
Teaching	<p>This course consists of lectures only.</p> <ul style="list-style-type: none"> • Lecture Inverse Problems (4h/week)
Prerequisites	Basic notions of Functional Analysis
Examination	Oral exam (30 minutes)
Credits	4 ECTS points
Frequency	This course is given at least every second year.
Workload	The estimated total working time for this course is 120 hours.
Duration	This course is given during one semester.

