

Course description for International Master's program „Mathematical Modeling, Computation and Optimization“

<b>Course Name</b>	Mathematical Methods for Uncertainty Quantification
<b>Contents and Objectives</b>	<p><u>Contents:</u></p> <ul style="list-style-type: none"> <li>• formal methods for describing uncertainty</li> <li>• numerical approximation of random fields</li> <li>• polynomial chaos expansions of random variables</li> <li>• random differential equation models and their numerical solution</li> <li>• Monte Carlo sampling and related methods, stochastic Galerkin and collocation methods</li> <li>• Bayesian inference and inverse problems</li> <li>• High dimensional approximation</li> </ul> <p><u>Objectives:</u> Understanding uncertainty as an important component of modeling and simulation; familiarity with basic computational tasks for quantifying uncertainty in scientific modeling and computing as well as current approximation methods. Exercises provide opportunity to implement algorithms in MATLAB as well as theoretical problem sets.</p>
<b>Teaching</b>	<p>This course consists of lectures and exercise sessions.</p> <ul style="list-style-type: none"> <li>• Lectures: Mathematical Methods for Uncertainty Quantification (4h/week)</li> <li>• Exercises: Mathematical Methods for Uncertainty Quantification (2h/week)</li> </ul>
<b>Prerequisites</b>	Basic concepts in analysis, linear algebra, functional analysis, statistics, probability theory, partial differential equations. Familiarity with MATLAB is helpful..
<b>Examination</b>	Oral exam (30 minutes)
<b>Credits</b>	8 ECTS points
<b>Frequency</b>	This course is given at least every other year.
<b>Workload</b>	The estimated total working time for this course is 270 hours.
<b>Duration</b>	This course is given during one semester.