

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

<b>Course name</b>	Distributions and Differential Operators
<b>Contents and Objectives</b>	<p><u>Content:</u></p> <ul style="list-style-type: none"> <li>• Spaces of test functions</li> <li>• Distributions</li> <li>• Basic operations with distributions (differentiation, multiplication by smooth functions etc.)</li> <li>• Support and singular support of distributions</li> <li>• Convolution of distributions</li> <li>• Distributional solutions to PDE</li> <li>• Fundamental solutions of differential operators</li> <li>• Theorem of Malgrange-Ehrenpreis</li> <li>• Tempered distributions and Fourier transformation</li> <li>• Paley-Wiener-Schwartz theorems</li> </ul> <p><u>Objectives of the course:</u> This course gives an introduction to the theory of distributions and emphasizes its application to problems arising in linear partial differential equations. The main goal of the lecture is to prove the famous Malgrange-Ehrenpreis theorem about the existence of fundamental solutions to linear differential operators. Moreover, we investigate the relationship between properties of fundamental solutions of a differential operator and regularity of solutions to partial differential equations involving said operator.</p>
<b>Teaching</b>	<p>This course consists of lectures and exercise classes.</p> <ul style="list-style-type: none"> <li>• Lecture: Distributions and Differential Operators (4h/week)</li> <li>• Exercise class: Distributions and Differential Operators (2h/week)</li> </ul>
<b>Prerequisites</b>	Basic notions of Analysis, Linear Algebra
<b>Examination</b>	Oral exam (30 minutes)
<b>Credits</b>	8 ECTS points
<b>Frequency</b>	This course is given at least every second year.
<b>Workload</b>	The estimated total working time for this course is 240 hours.
<b>Duration</b>	This course is given during one semester.