



Module	<b><i>Econophysics: Numerical Simulation Methods</i></b>
Code	71657
Instruction language	German or English
ECTS credits	6
Credit hours	5
Duration	1 semester
Cycle	Irregularly
Coordinator	Dean of Physics Studies
Lecturer	Dr. Jürgen Stockburger
Allocation to study programmes	Physics M.Sc., elective module, 1 <sup>st</sup> or 2 <sup>nd</sup> semester Wirtschaftsphysik M.Sc., elective module, 1 <sup>st</sup> - 3 <sup>rd</sup> semester
Formal prerequisites	None
Recommended prerequisites	Basic knowledge of Probability Theory
Learning objectives	Students who successfully passed this module <ul style="list-style-type: none"><li>• understand the theory of the numerical simulation of stochastic processes, and statistics of complex systems</li><li>• are able to apply numerical simulation methods to complex systems</li></ul>
Syllabus	Integral and convergence concepts <ul style="list-style-type: none"><li>• Ito and Stratonowitsch integrals, Ito processes</li><li>• concepts of convergence for random variables</li></ul> Numerical integration and differentiation <ul style="list-style-type: none"><li>• integration method with equidistant nodes</li><li>• Gaussian integration</li><li>• Taylor expansion and difference schemes</li></ul> Numerics for stochastic differential equations <ul style="list-style-type: none"><li>• explicit methods</li><li>• Predictor-corrector methods</li><li>• numerical integration of stochastic differential equations</li></ul> Random numbers and Monte Carlo simulations <ul style="list-style-type: none"><li>• elementary MC method</li><li>• Metropolis algorithm</li><li>• MC simulation of large systems</li></ul> Optimization methods and Control Theory <ul style="list-style-type: none"><li>• numerical optimization methods</li><li>• Control Theory: optimization of dynamic systems</li><li>• algorithms for Control Theory</li></ul>
Literature	
Teaching and learning methods	Lecture (3 hours per week) Exercise (2 hours per week)



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Workload	45 hours lecture (attendance time) 30 hours exercise (attendance time) 105 hours self-study and exam preparation Total: 180 hours
Assessment	Written or oral examination. A prerequisite for the participation in the examination is an ungraded course achievement. Form and scope of the examination and of the course achievement are determined and notified by the lecturer at the beginning of the course.
Examination	12366 Econophysics: Numerical Simulation Methods (precourse) 12365 Econophysics: Numerical Simulation Methods
Grading procedure	The module grade is the examination grade.
Basis for	Research in the field of Econophysics

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