Valid from 2024.HS

Module description: Higher Mathematics for Computer Scientists 2

Module Code	t.BA.ITM.HM2.19HS
ECTS Credits	4
Language of Instruction/Examination	German
Organizational Unit	IAMP
Module Coordinator	Reto Knaack
Legal Framework	The module description is part of the legal basis in addition to the general academic regulations. It is binding. During the first week of the semester a written and communicated supplement can specify the module description in more detail.
Module Characteristic	Type 3a 2 lecture lessons per semester week and class+ 2 lab bi-weekly lessons per semester and half-class
Module Description	Using Python, students learn the advanced basics of numerical mathematics for computer scientists. Topics include the numerical solution of nonlinear equation systems, numerical integration, interpolation and curve fitting, and the solution of ordinary differential equations.
Module Content	**Numerical solution of nonlinear systems of equations** • Functions with several variables • Newton method and damped Newton method **Regression analysis** • Polynomial interpolation & spline interpolation • Linear and non-linear regression problems • Gauss-Newton method **Numerical integration** • Quadrature formulas, their extrapolation and error calculation **Numerics of ordinary differential equations** • Slope field and approximate solutions • Euler method and Runge-Kutta method • Systems of ordinary differential equations
Prerequisite Knowledge	• Analysis 1 & 2 • Diskrete Mathematik • Lineare Algebra • The contents of "Höhere Mathematik für Informatiker 1" are required

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Learning Objectives (Competences)

Students...	Competencies	Taxonomies
Students deepen their knowledge of Python and can apply Python to advanced problems in numerical mathematics in weekly group work.	M, F, SO	K3
Students can explain the principles of the most important solution methods for nonlinear systems and apply them to concrete problems.	F, M	K2, K3
Students can solve typical problems in the fields of interpolation and linear or non-linear regression numerically.	M, F	K2, K3
Students can integrate functions of a single variable and quantify the errors that occur.	M, F	K2, K3
Students know the most important numerical solution methods for ordinary differential equations. They can solve simple systems of such differential equations using Python.	M, F	K2, K3

Performance Assessment

End-of-module exam	Assessment	Length (min.)	Weighting	Form
written exam	Grade	120	80	acc. to module agreement

Performance assessment during the semester	Assessment	Length (min.)	Weighting	Form
Weekly Assignments / Preparations	Grade		20	acc. to module agreement

Classroom Attendance Requirement

None

Learning material

- Knorrenschild, M. (2013). Numerische Mathematik: Eine beispielorientierte Einführung. 5 Edition. Carl Hanser Verlag GmbH & Co. KG. ISBN 978-34464323386.
- Script and Presentations

Comments