Module Description 24-M-ND-NMSP Numerical methods for stochastic partial differential equations

Faculty of Mathematics

Version dated Jun 5, 2026

This module guide reflects the current state and is subject to change. Up-to-date information and the latest version of this document can be found online via the page

https://ekvv.uni-bielefeld.de/sinfo/publ/modul/533559589

The current and valid provisions in the module guide are binding and further specify the subject-related regulations (German "FsB") published in the Official Announcements of Bielefeld University.

Non-official translation of the module descriptions. Only the German version is legally binding.

24-M-ND-NMSP Numerical methods for stochastic partial differential equations

Faculty

Faculty of Mathematics

Person responsible for module

Prof. Dr. Lubomir Banas

Regular cycle (beginning)

This module is part of a long-term overall curriculum plan for the Master's programme, which ensures that modules with an amount of at least 20 CP are offered in all five fields each year. The module is offered at irregular intervals as part of this overall curriculum planning.

Credit points

10 Credit points

Competencies

Students master advanced content and methods of Numerical methods for stochastic PDE, in particular they can independently carry out very complex proofs in this area with reference to current research questions, requiring a higher level of mathematical expertise. They master discretization methods for SPDEs and are able to analyse their convergence behaviour and to implement them on computers.

Students will be introduced to current research questions in the area of Numerical methods for stochastic PDE. They are able to recognise and assess further development opportunities and research goals.
Furthermore, students recognise further-reaching connections to mathematical issues that have already been worked out. They can transfer and apply the knowledge and methods they have learnt so far to deeper mathematical problem areas. Students also expand their mathematical intuition as a result of more intensive study.
In combination with other in-depth modules, they will be able to write their own research papers, e.g. a master's thesis in the field of Numerical methods for stochastic PDE.
In the tutorials, students develop their ability to discuss mathematical topics and thus further prepare themselves for the requirements of the Master's module, in particular for the scientific discussion within the Master's seminar presentation and the defence of their Master's thesis.

Content of teaching

Topics include: introduction to SPDE theory, numerical approximation of stochastic ODEs, space-time discretization of linear SPDEs, monotone nonlinear and semilinear SPDEs, convergence analysis of discretization methods, error analysis of numerical approximations, Random number generators, Monte-Carlo methods.

This module prepares the content of a master's thesis.

Recommended previous knowledge

Solid knowledge of the numerics of partial differential equations and probability theory

Necessary requirements

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Explanation regarding the elements of the module

Module structure: 1 SL, 1 bPr [1]

Courses

Title	Type	Regular cycle	Workload [5]	LP[2]
Lecture Numerical methods for stochastic PDE	lecture	This module is part of a long-term overall curriculum plan for the Master's programme, which ensures that modules with an amount of at least 20 CP are offered in all five fields each year. The module is offered at irregular intervals as part of this overall curriculum planning.	60 h (60 + 0)	2 [Pr]

Tutorials Numerical methods for stochastic PDE	exercise	This module is part of a long-term overall curriculum plan for the Master's programme, which ensures that modules with an amount of at least 20 CP are offered in all five fields each year. The module is offered at irregular intervals as part of this overall curriculum planning.	90 h (30 + 60)	3 [SL]

Study requirements

Allocated examiner	Workload	LP[2]
Teaching staff of the course **Tutorials Numerical methods for stochastic PDE (exercise)** *Regular completion of the exercises, each with a recognisable solution approach, as well as participation in the exercise groups for the module's lecture. As a rule, participation in the exercise group includes presenting solutions to exercises twice after being asked to do so as well as regular contributions to the scientific discussion in the exercise group, for example in the form of comments and questions on the proposed solutions presented. The organiser may replace some of the exercises with face-to-face exercises.*	see above	see above

Examinations

Allocated examiner	Type	Weighting	Workload	LP[2]

Teaching staff of the course **Lecture Numerical methods for stochastic PDE (lecture)** *Written examination of usually 120 minutes, oral examination of usually 40 minutes, electronic written examination in presence of usually 120 minutes or electronic oral examination of usually 40 minutes. A remote electronic written examination is not permitted.*	e-Klausur o. Klausur o. mündliche e-Prüfung o. mündliche Prüfung	1	150h	5

Legend

1	The module structure displays the required number of study requirements and examinations.
2	LP is the short form for credit points.
3	The figures in this column are the specialist semesters in which it is recommended to start the module. Depending on the individual study schedule, entirely different courses of study are possible and advisable.
4	Explanations on mandatory option: "Obligation" means: This module is mandatory for the course of the studies; "Optional obligation" means: This module belongs to a number of modules available for selection under certain circumstances. This is more precisely regulated by the "Subject-related regulations" (see navigation).
5	Workload (contact time + self-study)
SoSe	Summer semester
WiSe	Winter semester
SL	study requirement
Pr	Examination
bPr	Number of examinations with grades
uPr	Number of examinations without grades