



Universität
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Research Project

Numerical methods in uncertainty quantification

Project funded by own resources

Project title Numerical methods in uncertainty quantification

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Organisation / Research unit

Departement Mathematik und Informatik / Computational Mathematics (Harbrecht)

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In recent years it has become more and more important to model and simulate boundary value problems with random input parameters. If a statistical description of the input data is available, one can mathematically describe data and solutions as random fields and aim at the computation of corresponding deterministic statistics of the unknown random solution. Applications are, besides traditional engineering, for example biomedical or biomechanical processes. To simulate biomechanical processes one has, on the one hand, uncertain domains arising from e.g. tomographic data. On the other hand, one often has only estimates on the material parameters.

Uncertainty might stem from the loading, the coefficients of the differential operator, or the domain of definition. In case of random loadings, the random solution depends linearly on the random input data. But this is not valid any more if the differential operator's coefficients or the domain of definition are random. Consequently, innovative methods must be developed in order to overcome the curse of dimension which is induced by the random process.

Keywords random input, boundary value problem, curse of dimension

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Add publication

Published results

3697038, Harbrecht, Helmut; Peters, Michael; Siebenmorgen, Markus, On the quasi-Monte Carlo quadrature with Halton points for elliptic PDEs with log-normal diffusion, 0025-5718 ; 1088-6842, Mathematics of Computation, Publication: JournalArticle (Originalarbeit in einer wissenschaftlichen Zeitschrift)

3888776, Harbrecht, Helmut; Peters, Michael, Solution of free boundary problems in the presence of geometric uncertainties, 978-3-11-043041-7, Topological Optimization and Optimal Transport In the Applied Sciences, Publication: Book Item (Buchkap., Lexikonartikel, jur. Kommentierung, Beiträge in Sammelbänden etc.)

3890015, Dambrine, Marc; Harbrecht, Helmut; Peters, Michael; Puig, Benedicte, On Bernoulli's free boundary problem with a random boundary, 2152-5080 ; 2152-5099, International Journal for Uncertainty Quantification, Publication: JournalArticle (Originalarbeit in einer wissenschaftlichen Zeitschrift)

4093494, Harbrecht, Helmut; Peters, Michael D., The second order perturbation approach for elliptic partial differential equations on random domains, 0168-9274, Applied Numerical Mathematics, Publication: JournalArticle (Originalarbeit in einer wissenschaftlichen Zeitschrift)

3890016, Ballani, Jonas; Kressner, Daniel; Peters, Michael D., Multilevel tensor approximation of PDEs with random data, 2194-0401 ; 2194-041X, Stochastics and Partial Differential Equations, Publication: JournalArticle (Originalarbeit in einer wissenschaftlichen Zeitschrift)

4479774, Gantner, Robert N.; Peters, Michael D., Higher-Order Quasi-Monte Carlo for Bayesian Shape Inversion, 2166-2525, SIAM/ASA Journal on Uncertainty Quantification, Publication: JournalArticle (Originalarbeit in einer wissenschaftlichen Zeitschrift)

4479646, Haji-Ali, Abdul-Lateef; Harbrecht, Helmut; Peters, Michael; Siebenmorgen, Markus, Novel results for the anisotropic sparse grid quadrature, 0885-064X, Journal of complexity, Publication: JournalArticle (Originalarbeit in einer wissenschaftlichen Zeitschrift)

Add documents

Specify cooperation partners

ID	Kreditinhaber	Kooperationspartner	Institution	Laufzeit - von	Laufzeit - bis
3348020	Harbrecht, Helmut	Griebel, Michael, Professor	University of Bonn and Fraunhofer Institute for Algorithms and Scientific Computing	01.10.2009	31.12.2035