

BERNOULLIS TAFELRUNDE

GRADUATE STUDENT SEMINAR

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Seminarraum 00.003, Spiegelgasse 1

MARC SCHMIDLIN

Universität Basel

Uncertainty Quantification for PDEs with Anisotropic Random Diffusion

ABSTRACT

We will consider elliptic diffusion problems with an anisotropic random diffusion coefficient. More specifically, we will model diffusion in a medium comprised of very thin fibres, where the diffusion strength in fibre direction is notably different to the diffusion strength perpendicular to the fibres – thus we may describe the diffusion strength in fibre direction and the actual fibre direction by a vector field V . Any uncertainty regarding the vector field V then propagates, yielding uncertainty in the diffusion coefficient and therefore also in the solution of our elliptic diffusion problem.

Using the vector field V 's Karhunen-Loève expansion we can reformulate the elliptic diffusion problem into a parametric form, with a random parameter. We then derive that the regularity of the solution's dependence on the random parameter is entirely determined by the decay of the vector field V 's Karhunen-Loève expansion. This result allows for sophisticated quadrature methods, such as the quasi-Monte Carlo method or the anisotropic sparse grid quadrature, to be used to approximate quantities of interest, like the solution's mean or its variance. Numerical examples will supplement the presented theory.