# Elliptic PDEs on log-Gaussian Shapes: Sparsity and Finite Element Discretization

Helmut Harbrecht[1] Dinh Dung[2] Van Kien Nguyen[3] Christoph Schwab[4]

In this talk, we consider the solution to elliptic diffusion problems on a class of random domains obtained by log-Gaussian random homothety of the unit disk respectively an annulus. We model the problem under consideration and verify the existence and uniqueness of the random solution by path-wise pullback to the nominal unit disk respectively annulus. We prove the analytic regularity of the solution with respect to the random input parameter. We consider the numerical approximation of the random diffusion problem by means of continuous, piecewise linear Lagrangian Galerkin Finite Elements with numerical quadrature in the nominal domain, and by sparse grid interpolation and quadrature of Gauss-Hermite Smolyak and Quasi-Monte Carlo type in the parameter domain. The theoretical findings are complemented by numerical results.

References:

[1] https://arxiv.org/abs/2603.24056

[1]University of Basel
helmut.harbrecht@unibas.ch

[2]Vietnam National University, Hanoi
dinhzung@gmail.com

[3]University of Transport and Communications, Hanoi
kiennv@utc.edu.vn

[4]ETH Zurich
schwab@math.ethz.ch