On expansions and nodes for sparse grid collocation of lognormal elliptic PDEs [1]

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sparse grids;PDEs with random coefficients;Uncertainty Quant.;Weighted Leja points;Gauss-Hermite points;Levy-Ciesielski exp.;Karhunen-Loeve exp. [5]

Abstract:
This work is a follow-up on a previous contribution (`Convergence of sparse collocation for functions of countably many Gaussian random variables (with application to elliptic PDEs)' SIAM Journal of Numerical Analysis 2018), and contains further insights on some aspects of the solution of elliptic PDEs with lognormal diffusion coefficients using sparse grids. Specifically, we first focus on the choice of univariate interpolation rules, advocating the use of Gaussian Leja points as introduced by Narayan and Jakeman in 2014 ('Adaptive Leja sparse grid constructions for stochastic collocation and high-dimensional approximation', SIAM Journal on Scientific Computing) and then discuss the possible computational advantages of replacing the standard Karhunen-Loeve expansion of the diffusion coefficient with the Levy-Ciesielski expansion, motivated by theoretical work of Bachmayr, Cohen, DeVore, and Migliorati in 2016 ('Sparse polynomial approximation of parametric elliptic PDEs. part II: lognormal coefficients' ESAIM Mathematical Modelling and Numerical Analysis, 2016).

Links
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