Existence of p-Moments for the Weak Space-Time Heat Equation with Random Coefficients and Stability of its Petrov-Galerkin Discretization

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We consider the heat equation in a weak space-time formulation with random right hand side and random spatial operator. The existence and uniqueness of a solution can be proven by the Banach-Necas-Babuska theorem. In this course we allow the spatial operator A to have lower and upper bounds depending on a stochastic parameter ω, i.e., we consider random variables $A_{\min}(\omega)$ and $A_{\max}(\omega)$ as lower and upper bounds. The L_p-regularity of the solution and its connection to the random variables bounding A can be proven.
A similar approach is applied to a full space-time Petrov-Galerkin discretization. The stability of such an approach requires a lower bound for the discrete inf-sup condition independent of the grid spacing. Using similar ideas, we can prove stability when allowing a finer discretization for the test space than for the solution space.

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