Unsteady Convection Diffusion Equation with Random Input Data

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Partial differential equations (PDEs) with random input data is one of the most powerful tools to model oil and gas production as well as groundwater pollution control. However, the information available on the input data is very limited, which cause high level of uncertainty in approximating the solution to these problems. To identify the random coefficients, the well–known technique Karhunen Loève (K–L) expansion has some limitations. K–L expansion approach leads to extremely high dimensional systems with Kronecker product structure and only preserves two–point statistics, i.e., mean and covariance. To address the limitations of the standard K–L expansion, we propose Kernel Principal Component Analysis (PCA).

In this talk, we investigate the numerical solution of unsteady convection diffusion eqution with random input data by using stochastic Galerkin method. Since the local mass conservation play a crucial role in reservoir simulation and transport problem, we use discontinuous Galerkin method for the spatial discretization. On the other hand the rational deferred correction method is performed for the temporal discretization. We provide some numerical results to illustrate the efficiency of the proposed approach.

References:

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