

Uncertainty Quantification for Nonlinear Differential Equations

In engineering applications driven by physical modeling under high accuracy requirements, the management of uncertainties is vital. Methods range from the estimation of sensitivities to the computation of stochastic methods with guaranteed error bounds. An overview with a real scale example will be given. Focus of this talk will be on high level uncertainty quantification methods for nonlinear differential equations. Interpreted stochastically they lead to the Fokker-Planck equation. This partial differential equation has as many dimensions as the initial ordinary differential equation has states. Exploiting its typically smooth behaviour, an algorithm based on the propagation of a given probability density using Gaussian basis functions can be derived. It allows a priori hard error bounds while working at low memory consumption. An outlook will be given.