COUPLED STOCHASTIC PROBLEMS

Hermann G. Matthies[1], Rainer Niekamp[2], Martin Krosche[3] and Alireza Doostan[4]

[1,2,3] Institute for Scientific Computing, Technische Universität Braunschweig,
Hans-Sommer-Straße 65, 38092 Braunschweig, Germany,
e-mail: wire@tu-bs.de - web page: http://www.wire.tu-bs.de/

[2]Aerospace Engineering Science Department (AESD),
University of Colorado, Boulder, CO 80309, USA
e-mail: Alireza.Doostan@Colorado.edu - web page: http://www.colorado.edu/aerospace/

Key Words: *Low-Rank approaches, coupled stochastic problems.*

Many systems describing complex phenomena can be viewed as an assemblage of simpler subsystems. These subsystems may exhibit uncertainties in the input or in the system itself. As a consequence the output of the coupled system becomes uncertain as well. Such uncertainties can be observed for example in the flow through heterogeneous porous media, in the mechanical response of heterogeneous media, and in fluid-structure uncertain boundary conditions, showing that uncertainties are also present in many coupled problems.

A stochastic description of the input and output allows a detailed uncertainty representation, and functional or spectral approximations have become one of the most interesting methods in solving partial differential equations with stochastic parameters. Many different techniques have been developed recently to speed up the computations and expecially for high dimensional problems.

These techniques include low-rank approaches, and here these techniques are applied to coupled stochastic field problems.

We present iterative rank-one update schemes based on the variational formulations of the coupled problem. The resulting low-rank representation is not necessarily an optimal one at the given rank. Therefore, in order to obtain high quality solutions, a posterior iteration scheme was developed which improves the solution with a fixed rank.

http://www.wccm-eccm-ecfd2014.org/frontal/Registration.asp.