

# **On the analysis of finite deformations and continuum damage in materials with random properties**

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We present a couple of non-statistical Lagrangian formulations for quantification of uncertainty in finite deformation problems using finite elements. The developed approaches aim to estimate the probability density function and response statistics of the field variables with satisfactory accuracy in a single simulation.

The first approach is based on the Generalized Polynomial Chaos Expansion which involves expanding the random deformed configuration and the field variables in a suitable global polynomial basis. The second approach is based on a newly developed support space method. The support space method involves discretization of the random support space using finite elements. This discretization is used to expand the field variables and other parameters that arise in finite deformation problems in terms of local finite element basis functions.

The support-space method is then applied for analyzing continuum damage in materials with random distribution of micro-voids. The damage analysis is based on the Gurson-Tvergaard-Needleman model. Examples are considered highlighting the relative merits and demerits of the two approaches and their suitability for modeling continuum damage in random heterogeneous materials.

## References

[1] S. Acharjee and N. Zabarar, "Uncertainty propagation in finite deformations -- A spectral stochastic Lagrangian approach," *Computer Methods in Applied Mechanics and Engineering*, submitted.

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