Dealing with uncertainty via Probabilty Box in finite element method output

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Abstract

We present a new method for solving linear systems with uncertainty in the context of Fuzzy Finite Element Methods. We use a simple application, axially loaded Bar, to demonstrate our method. We build on an approach for solving general fuzzy linear systems presented by Vroman et al. [2]. Their method is based on parametric functions and has an exponential time complexity in the number of fuzzy numbers in the fuzzy linear system. The uncertainty model associated to uncertain parameters in Stiffness matrix is formulated as a coherent lower prevision $\underline{P}$ [3] (and its conjugate upper prevision $\overline{P}$). By using the Probability-Box (P-Box) model presented by Miranda et al. [1] to model uncertainty, our method is an optimization problem in intervals that are the approximation of a P-Box. In case of the Bar example we have very efficient solution, because of monotonicity in the parametric functions, in general it is a local optimization problem in extreme points of the parametric functions.

References

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