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Numerical implementation of efficient stochastic finite element methods using Abaqus

As a powerful tool for uncertainty analysis, the stochastic finite element method (SFEM) has been widely applied to a variety stochastic problems [1]. Several intrusive and non-intrusive SFEMs are available to solve the stochastic solutions of stochastic systems, e.g., the Monte Carlo simulation and its extensions, the spectral SFEM and the stochastic collocation method, etc [1,2,3]. For the numerical implementation of intrusive methods such as spectral SFEM, we have to modify existing codes and extensive programming work is required. For the nonintrusive methods such as Monte Carlo simulation, we need to solve a large number of deterministic equations to achieve accurate stochastic solutions, which is computationally very expensive.

The main goal of this thesis is to implement a weakly intrusive SFEM [4,5] using Abaqus software. Due to its weak intrusiveness, the method can be implemented quickly with little improvement on existing codes, and only a few deterministic equations are solved. We choose Abaqus as the underlying software for numerical implementation. To illustrate the performance of the implementation, several benchmark stochastic problems will be tested.

Literatur:

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