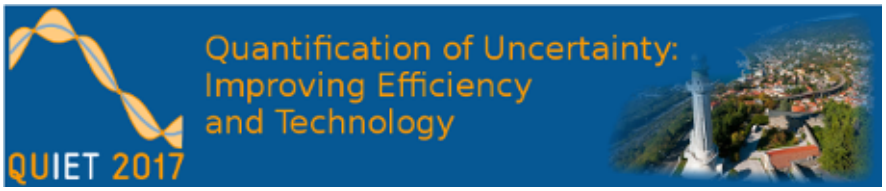

Collocation Methods for Exploring Perturbations in Linear Stability Analysis

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We show that the methods of sparse-grid collocation used in uncertainty quantification can be used to develop new efficient algorithms to explore the stability of dynamical systems. In particular, eigenvalue analysis is a well-established tool for stability analysis, but there are situations where eigenvalues miss some important features of physical models. For example, in models of incompressible fluid dynamics, there are examples where linear stability analysis predicts stability but transient simulations exhibit significant growth of infinitesimal perturbations. This behavior can be predicted by pseudo-spectral analysis. In this study, we show that an approach similar to pseudo-spectral analysis can be performed inexpensively using stochastic collocation methods and the results can be used to provide quantitative information about instability. In addition, we demonstrate that the results of the perturbation analysis provide insight into the behavior of unsteady flow simulations.