Quality estimates of stochastic dynamic approximations based on Polynomial Chaos

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ABSTRACT

In the dynamic framework, introducing variability increases the complexity for finding solutions. This variability causes uncertainties about the actual level of the quantity that we are trying to predict. This variability can be observed both in the time domain and in the frequency domain.

The metho based on expansion on the basis of the Polynomial Chaos [1,2] makes it possible to construct an approximation of the complete model in the case of quantifiable parametric uncertainties. The cost of this approximation strongly depends on the choice of so-called interpolation degree. The more the degree is important, larger the number of sampling points is. Consequently, this method can lead to very high computational costs. Although it is fast, this method leads, for a set of parameters to a certain level of error. This error can be qualitatively estimated with different indicators (coefficient R^2, leave an error out) [3], but these indicators may lead to different error estimates from its exact value.

A new method of estimating the error is presented here and applied on simple examples. It leads to very good estimates and makes it possible to know about the quality of a given choice of parameters for Polynomial Chaos. Different choices are tested and compared to classical indicators.

REFERENCES

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