Simplifying V&V procedures by means of model reduction techniques

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A permanent issue in science and engineering activities is the verification and validation (V&V) of mathematical and numerical models, which nowadays can attain very high levels of complexity. We focus here on the Constitutive Relation Error (CRE) concept which has been widely used over the last 40 years for robust verification [1] and validation [2] of linear or nonlinear Structural Mechanics models, in which the constitutive relation is a major component. The objective of this research work is to present new numerical tools, based on Proper Generalized Decomposition (PGD) and an *offline-online* strategy, that can be coupled to the CRE concept to make this latter fully implementable and exploitable for practical industrial applications. The PGD is a model reduction technique that has been extensively applied over the last decade to solve multi-parametric problems [3]. Its use into the CRE concept enables to decrease the computational cost and technicality associated with the construction of so-called admissible fields, leading to faster and cheaper V&V procedures [4]. Numerical illustrations, addressing both model verification and model updating, are presented to assess the performances of the proposed approach. Furthermore, in the context of DDDAS applications, an extension to data assimilation by the additional use of Kalman filtering is also proposed [5].

References

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