An error indicator-based adaptative reduced order model for nonlinear structural mechanics

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ABSTRACT

In the aicraft engine industry, the prediction of high-pressure turbine blades lifetime remains a challenging computational task: the finite element models involve large meshes to take into account small structures such as the internal cooling channels, and the simulation of the stabilized cycle requires to compute potentially a very large number of time steps.

In [1], our team has proposed a nonintrusive reduced order modeling framework for nonlinear structural mechanics, in a high-performance computing context, to accelerate such computations. In this work, we illustrate that even a relatively small variability in the thermal loading, that was not encountered in the offline phase, can lead to important errors for the reduced order model. From this observation, we propose a simple and cheaply computed heuristic error indicator. When the indicator becomes too large in the online stage, the reduced order model is updated with a snapshot computed using the high-fidelity model. The approach is illustrated on a series of academic test cases and applied on a setting of industrial complexity, where the whole procedure is computed in parallel with distributed memory [2].

REFERENCES

[1] F. Casenave, N. Akkari, F. Bordeu, C. Rey and D. Ryckelynck, A Nonintrusive Distributed Reduced Order Modeling Framework for nonlinear structural mechanics – application to elastoviscoplastic computations. Submitted.

[2] F. Casenave and N. Akkari, An error indicator-based adaptative reduced order model for nonlinear structural mechanics – application to fatigue computation of high-pressure turbine blades. In preparation.