MODEL ORDER REDUCTION IN COMPUTATIONAL NONLINEAR SOLID MECHANICS : A GENERAL WEAKLY-INVASIVE PGD VERSION.

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ABSTRACT

The aim is to provide engineers, through industrial finite element analysis software, with new tools that are reduced solutions or reduced computational models in Nonlinear Solid Computational Mechanics. The new generation of Model Order Reduction methods as the Proper Generalized Decomposition (PGD) which relies on the separation of variables (space, time, design parameters) have now demonstrated their great strength and interest in reducing complexity. Unfortunately, today, these methods are not fully integrated into current engineering tools that are industrial finite element analysis software.

The work presented here, which attempts to answer this question, is based on a new version of LATIN-PGD, which is very general and not very invasive with regard to industrial finite element analysis software. General means compatible with all non-linear material models included in industrial finite element analysis software and, in particular, unilateral contact models and all this in large displacements; design parameters may also be included. The only restrictions we have for the actual implementation [Scanff et al 2022] in the Simcenter Samcef software are quasi-statics conditions and loadings free of instabilities. To further improve performance, we introduce and compare several hyper reduction techniques, also weakly invasive, to reduce the computational time spent on integrating constitutive laws, which is currently the most important part of the computational time.

Finally, we give a number of illustrations that show the great possibilities and also the gains that we have with this new weakly invasive version of the LATIN-PGD.

REFERENCES

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