Model reduction of finite element models for the simulation of the mechanical nuclear fuels behavior

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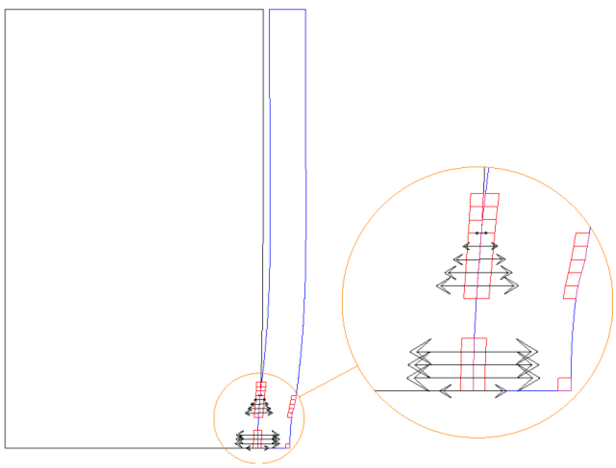

Hyper-reduced approximation of a 2D elastic contact

- Model reduction of mechanical problems involving contact
- Extension of the hyper-reduction method to frictionless contact written with Lagrange multipliers
- Hybrid hyper-reduced/full-order model strategy
- Efficient results on a 1D and a 2D elastic test cases
- Good approximation of the contact forces

Abstract:

The model reduction of mechanical problems involving contact remains an important issue in computational solid mechanics. We propose to extend the hyper-reduction method based on a reduced integration domain to frictionless contact problems written by a mixed formulation. As the potential contact zone is naturally reduced through the reduced mesh involved in hyper-reduced equations, the dual reduced basis is chosen as the restriction of the dual full-order model basis. We then obtain a hybrid hyper-reduced model combining empirical modes for primal variables with finite element approximation for dual variables. If necessary, the inf-sup condition of this hybrid saddle point problem can be enforced by extending the hybrid approximation to the primal variables. This leads to a hybrid hyper-reduced/full-order model strategy. By this way, a better approximation on the potential contact zone is furthermore obtained. A post-treatment dedicated to the reconstruction of the contact forces on the whole contact zone has also been introduced. The proposed hybrid hyper-reduction strategy has been successfully applied to a one-dimensional static obstacle problem with a two-dimensional parameter space and also to a two-dimensional contact problem between two linearly elastic bodies. The numerical results show the efficiency of the reduction technique, especially the good approximation of the contact forces compared to other methods.