Numerical techniques towards competitive partitioned solution strategies for thermomechanical contact problems

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In the current scientific landscape, the challenges associated with the simulation of thermomechanical contact are twofold. First, robust discretisation techniques are mandatory to obtain an accurate and stable approximation of the interface fields [1]. Second, an efficient solution to the coupled problem is most desirable. Monolithic techniques solve the coupled problem simultaneously. Besides the inherent temporal stability, they ensure excellent performance when combined with well-designed linear solver technology. Partitioned techniques solve the fields separately and are equipped with communication channels to realise the coupling. In particular, strong coupling techniques are originally built on top of fixed-point iterations to replicate the fully-coupled solution. These schemes are much simpler to implement and maintain, but may face convergence issues for strong physical coupling, which can be minimised with acceleration techniques [2].

Despite the maturity of acceleration and coupling techniques in other multi-physics fields, their application in thermomechanical contact problems is still very scarce. This work extends a previous contribution by the authors with a benchmark of partitioned coupling techniques focusing on thermomechanical contact [3]. Different aspects of the phenomenon are investigated using dedicated examples, with varying coupling degrees. The results demonstrate significant performance gains, levelling the competition with monolithic strategies.

Keywords: Thermomechanical Contact, Acceleration Techniques, Partitioned Solution

References

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