6th European Conference on Computational Mechanics (ECCM 6)
7th European Conference on Computational Fluid Dynamics (ECFD 7)
11-15 June 2018, Glasgow, UK

TRULY VARIATIONALLY CONSISTENT MORTAR-BASED CONTACT FORMULATION FOR FINITE DEFORMATION SOLID MECHANICS

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Keywords: *Variationally consistent, Lagrange multiplier, mortar, contact*

Contact mechanics are a field of continuing wide interest. The research interest often stems from problems arising during numerical simulations of complex real-world applications. One possible source of complexity is the efficient computational treatment of the involved non-linear contact conditions. In this talk two possible finite element approaches are going to be investigated. While the first one is built on a completely consistent variation of a scalar-valued potential function leading to a symmetric system of equations in each semi-smooth Newton step, the second approach will weaken the consistency while retaining important properties such as the conservation of linear and angular momentum.

Due to the rigorous mathematical derivation, the introduced errors can be easily quantified. We will show that the influence on the final solution is only minor. Nevertheless, the performance of the non-linear solver can be affected severely. One major goal of this talk is to draw attention to often quietly introduced assumptions in almost all available and popular mortar contact formulations (see e.g. [1]) and, in this way, to open the field for more advanced non-linear solution strategies. For example, we will show a simple variation of Newton's method [2] which can drastically improve the robustness of the non-linear solver for large initial penetrations.

REFERENCES

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