This paper gives a review of our recently proposed dual mortar approach combined with a consistently linearized semi-smooth Newton method for 3D finite deformation contact analysis. The mortar finite element method, which is applied as discretization scheme, initially yields a mixed formulation with the nodal Lagrange multiplier degrees of freedom as additional primary unknowns. However, by using so-called dual shape functions for Lagrange multiplier interpolation, the global linear system of equations to be solved within each Newton step can be condensed and thus contains only displacement degrees of freedom. All possible types of nonlinearities, including finite deformations, nonlinear material behavior and contact itself (active set search) are handled within one single iterative solution scheme based on a consistently linearized semi-smooth Newton method. The extension of the proposed framework towards additional model complexities such as Coulomb friction and self contact is addressed shortly. Moreover, an outlook towards multiphysics and multiscale effects...
simulations, coupling contact analysis with other physical fields and taking into account effects on different length scales is provided by exemplarily discussing the integration of mortar contact into a fixed-grid fluidstructure interaction (FSI) framework based on the extended finite element method (XFEM). Several numerical examples are presented to show the high quality of results obtained with the proposed methods.

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