Finite deformation frictional mortar contact using a semi-smooth Newton method with consistent linearization

Abstract:
A two-dimensional, finite deformation frictional contact formulation with Coulomb’s law is presented. The approach considers multibody contact and is based on a mortar formulation. The enforcement of contact constraints is realized with dual Lagrange multipliers. These alternative multiplier spaces are constructed in a way that the multipliers can easily be eliminated from the global system of equations by static condensation such that the system size does not increase. Friction kinematic variables are formulated in an objective way and enter non-smooth complementarity functions for expressing the contact constraints. An active set strategy is derived by applying a semismooth Newton method, which treats contact nonlinearities, material and geometrical nonlinearities in one single iterative scheme. By further carrying out a consistent linearization for both normal and frictional contact forces and constraints, a robust and highly efficient algorithm for linear and higher order (quadratic) interpolation is achieved. Efficiency of the proposed method and quality of results are demonstrated in several exemples.

Stichworte:
mortar finite element methods; frictional contact; finite deformations; finite sliding; dual Lagrange multipliers; primal-dual active set strategy (PDASS); semi-smooth Newton method; consistent linearization

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