Time-adaptive finite element computations for large deformation contact problems

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ABSTRACT

In recent years, mortar finite element methods have been successfully applied as space discretization scheme to a wide range of contact problems. The finite deformation contact formulation taken up is based on a mortar approach using so-called dual Lagrange multipliers. On the other hand we consider the commonly applied node-to-segment method for large deformation contact problems. If the constitutive models of the material bodies are of rate-type, the entire system of equations represents a non-smooth system of differential-algebraic equations. This system will be investigated in connection with higher-order time integration methods using diagonally implicit Runge-Kutta methods for solving initial boundary value problem. As a preparatory step, we perform convergence studies in time for determining the time integrator behavior. This is done for 2D and 3D contact problems with and without friction. In a second investigation, we incorporate time-adaptive step-size control based on local error estimations, which merely requires a small extra time-investment. Several numerical examples show the behavior of the proposed procedure.

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