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A Direct Elimination Algorithm (DEA) for Full Stick and Frictionless, Quasi-static and Dynamic Contact Problems

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ABSTRACT

This paper deals with the computational modelling and numerical simulation of quasi-static and dynamic contact problems at finite deformations using the finite element method (FEM). Full stick and frictionless contact conditions are addressed.

A direct elimination algorithm (DEA) for full stick and frictionless, quasi-static and dynamic, contact problems is introduced [1]. A slave/master description of the contact surfaces is used. A node-to-segment (NTS) contact formulation is considered. Drawbacks linked to penalty-based and Lagrange multipliers methods are avoided [2,3].

Suitable discrete contact kinematic constraints are introduced for quasi-static and dynamic contact problems, considering full stick and frictionless contact conditions. A discrete momentum and energy conserving algorithm is introduced for frictionless dynamic contact problems [4], while a discrete energy conserving algorithm is considered for full stick dynamic contact problems.

An assessment of the performance of the DEA is shown in a number of benchmark tests and representative numerical simulations, including full stick and frictionless conditions for quasi-static and dynamic contact problems. Conservation of key discrete properties inherited by the proposed DEA, such as the angular momentum and energy for frictionless dynamic contact problems, or energy for full stick dynamic problems, is also shown.

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