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Towards a Gauß-Seidel solver for problems involving line-to-line beam contact

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In recent years interest in the simulation of systems with flexible slender structures experiencing contact has grown significantly. At the heart of many implementations lie beam models with rigid cross-sections which introduce nonsmoothness into the contact model. Interactions between beams may occur along distributed regions of finite length (line-to-line) or be viewed as pointwise interactions (point-to-point). In both cases the distribution of contact forces can be discontinuous. The authors proposed a quasi static frictionless mortar formulation for modeling the former [1]. The constraints are enforced using an augmented Lagrangian approach. The dynamic case involves the handling of discontinuous velocities and impacts. We therefore select the NSGA [2] time integration scheme. It is based on a smooth prediction that excludes impact contributions and two subsequent projection steps that correct for the non-penetration constraint at position level and the velocity jump. In this contribution, we explore the idea of using a Gauß-Seidel method [3] for solving the discrete beam-to-beam contact problem at each time step. This type of iterative approach has proven robust in the context of rigid body contact. All developments are made within the $SE(3)$ local frame formalism for flexible multibody systems.

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