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CONSTRAINT-BASED TERRAMECHANICS FOR REALTIME AND FASTER SIMULATION

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Abstract

We present models and numerical methods for realtime and faster simulation of wheeled and tracked vehicles traversing and interacting with deformable terrain. The wheel-terrain interaction is formulated as a set of kinematic constraints with constraint forces and limits that reflect the stresses on the wheel and soil failure at critical stresses. When soil failure occurs, a 3D soil displacement field is predicted and used to update the spatial distribution of soil, local packing density, and the surface heightmap. The constraint-based formulation enables stable and strong coupling between the terrain and vehicle multibody dynamics at large time-steps. Simulation tests are performed where the implemented model is compared to experiments and standard semi-empirical terramechanics models. Finally, we apply the terramechanics model on a model of a heavy forest machine traversing rough terrain and study how the motion and dynamic load forces are affected by inclusion of deformable terrain.

Keywords: realtime simulation, wheel-terrain interaction, multibody dynamics, deformable terrain.

Presenter: Martin Servin

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