Numerical solution for anti-planar shear model for granular flow using Runge-Kutta Discontinuous-Galerkin method with adaptive mesh refinement

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The flow and handling of granular materials is of major importance to many industries. We consider model of granular flow as elasto-plastic continua. In this picture, the granular material flows as a plastic with a frictional yield condition, and deforms as an elastic solid otherwise. It is clear, that there are serious mathematical difficulties with the equations for time-dependant elasto-plastic granular flow.

We describe the approach to numerical solution of simplified time-dependant granular flow in two dimensions where shear bands are presented.

We consider elasto-plastic deformation in anti-planar shear motion. That is, while the deformation is homogeneous in the z-direction (the state variables only depend on x and y direction) the motion is only in the z direction.

This model is the simplest model which still describes the 3D behavior of granular flow with shear bands. Deformation is described by a hyperbolic system of equations. The points, where hyperbolicity is lost, are points where shear banding occurs. Tracking this points we need high resolution of the motion.

Runge-Kutta Discontinuous-Galerkin (RKDG) method seems to be very suitable for this kind of problem. It is high order and mesh adaptivity can be easily adopted. This properties of the RKDG method gives us high resolution of the motion in whole domain, which is crucial for the simulation of the problem we have.

We will show numerical solutions in the square domain for different boundary conditions, different polynomial orders and different error estimators.

Period of poster presentation:

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