

Physically Based Simulation – Project progress report

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Title: Simulation of sand and granular materials

Current state:

After trying to formulate a model based on modeling the incompressibility projection as an energy minimization problem, with constraints specified by friction, unilateral incompressibility, and contact boundary conditions, I hit the roadblock of getting an efficient solver to handle all these constraints.

As a result I have attempted to implement the existing state-of-the-art, i.e. “Animating Sand as a Fluid” by Zhu et al. The 3D simulator is running with minor bugs. Some of the remaining issues are:

- Better support for solid obstacles – Need to add volume intersection tests
- Rigidity projection for rigid sand – some bugs to be ironed out with finding connected components
- Some other bugs to be fixed in advection of the associated particle system

I will continue working on extending the simulator using a Dostal LCP solver to add the unilateral incompressibility and contact boundary constraints and iteratively solving these with the frictional constraints. Some features I'll be adding soon are:

- Better solid interaction, support for loading .obj meshes as obstacles
- Adding a 3D LCP solver and add more variational constraints
- Having a true friction model to have simultaneous solution to all constraints
- Adding a better renderer to the model to improve visualization