Sphere Rolling Down an Inclined Plane

Problem Description

Here, a sphere of soft plastic, initially at rest, rolls under the influence of gravity down a plane of a harder plastic. Gravity is oriented such that the plane is effectively angled at 45 degrees to the horizontal. This simulation demonstrates the effectiveness of the contact algorithm, described in [1]. Frictional contact, using a friction coefficient of $\mu = 0.495$ causes the ball to start rolling as it impacts the plane, after being dropped from barely above it.

Simulation Specifics

Component used: MPM

Input file name: inclinedPlaneSphere.ups

Command used to run input file: sus inclinedPlaneSphere.ups

Simulation Domain: 12.0 x 2.0 x 4.8 m

Cell Spacing:
.2 x .2 x .2 m (Level 0)

Example Runtimes:
9 minutes (1 processor, 3.0 GHz Xeon)

Physical time simulated: 2.2 seconds

Associate scirun network: inclinedPlaneSphere.srn

Results

Figure 1 shows a snapshot of the simulation, as the sphere is about halfway down the plane. Particles are colored according to velocity magnitude, note that the particles at the top of the sphere are moving most rapidly, and those near the surface of the plane are basically stationary, as expected.

References

[1] S.G. Bardenhagen, J.E. Guilkey, K.M. Roessig, J.U. Brackbill, W.M. Witzel, and J.C. Foster. An improved contact algorithm for the material point method and application to stress propagation in granular material. *Computer Modeling in Engineering and Sciences*, 2:509–522, 2001.

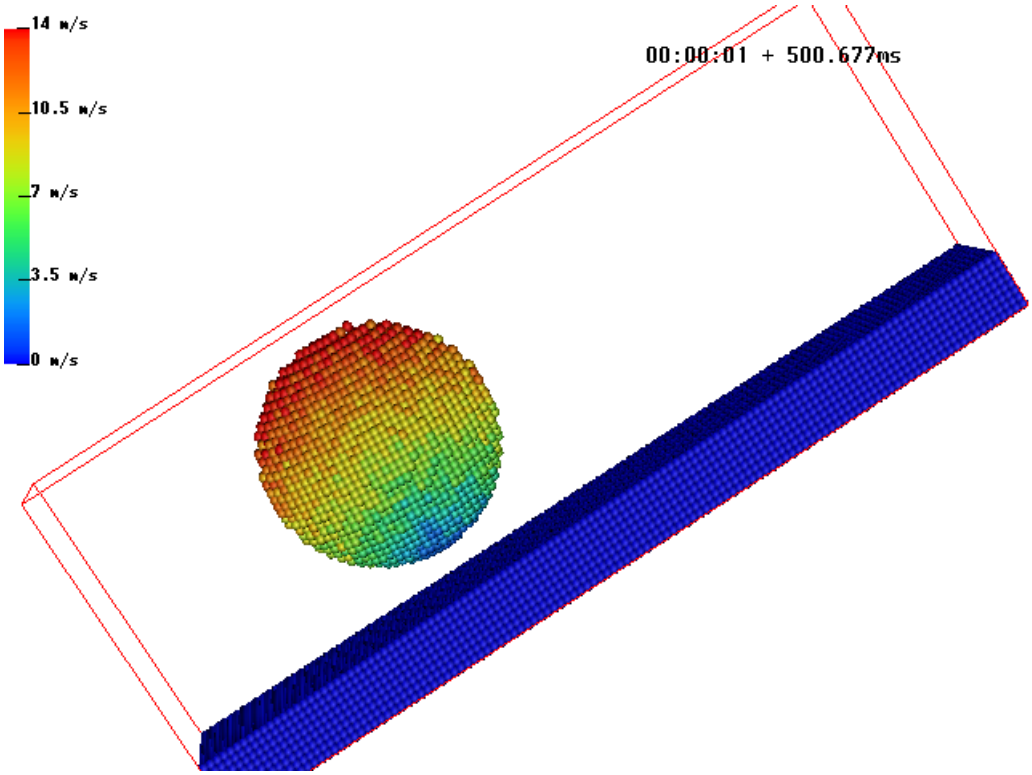

Figure 1: Sphere rolling down an "inclined" plane. The gravity vector is oriented at a 45 degree angle relative to the plane. Particles are colored by velocity magnitude.