**Project Animating Sand as a Fluid**

**Project description**

Minimal target: working fluid simulation in 3d with proposed solver from the paper.

Desired target: sand simulation with surface reconstruction.

**Work packages**

* Setup: 3d GUI, with boundaries and particles
* Setup: We need a staggered MAC grid & particle representation
* Water simulation solver for all non-advection steps
  + Adding Gravity
  + Apply boundary conditions
    - Sand: frictional boundary conditions
  + Solve for pressure => incompressibility
  + Subtract
  + Additional sand steps:
    - Evaluate Strain rate tensor D in every grid cell
    - If cell is rigid, store
      * Use Mohr-Coulomb and add tiny cohesion c to compensate for numerical errors
    - Form connected rigid cell groups, project velocity field to space of rigid body motions
    - Update the remaining velocities with
* Implement PIC and/or FLIP for velocity update
  + PIC for sand
  + FLIP for water
  + Use sand specific stress/rigid body model
* ODE solver for moving particles with boundary handling
  + RK2 ODE solver with 5 sub steps
* Surface reconstruction from particles
* Connecting above packages:
  + Transfer particle velocities back to grid (Trilinear interpolation)

**Deadline:**

Project start: 09.11.2021

Project deadline: 14.12.2021

Project midterm presentation: 30.11.2021

Project presentation: 21.12.2021

**Timeline:**

09.11 – 16.11:

* Setup: 3d GUI, with boundaries and particles -> Lukas
* Setup: We need a staggered MAC grid & particle representation -> Rishi
  + Class particle with position, (velocity)
  + Class MAC grid with pressure/velocity and scale, sample(float, float, float) -> trilinear interpolated velocity
* Setup: Gitrepo -> Lukas
* ODE solver(dt, position, vector field)-> new position -> Joel

16.11 – 23.11:

* Water simulation solver for all non-advection steps
  + Apply boundary conditions => Joel
  + Solve for pressure => incompressibility => Lukas
* Implement PIC and/or FLIP for velocity update => Rishi

23.11 – 30.11:

* Fluid solver:
  + Additional sand steps:
    - Evaluate Strain rate tensor D in every grid cell
    - If cell is rigid, store
      * Use Mohr-Coulomb and add tiny cohesion c to compensate for numerical errors
    - Form connected rigid cell groups, project velocity field to space of rigid body motions
    - Update the remaining velocities with
  + Use sand specific stress/rigid body model

30.11 – 07.12:

* Surface reconstruction from particles

07.12 – 14.12:

* Create animated video
* prepare submission

14.12 – 21.12:

* prepare final presentation & demo