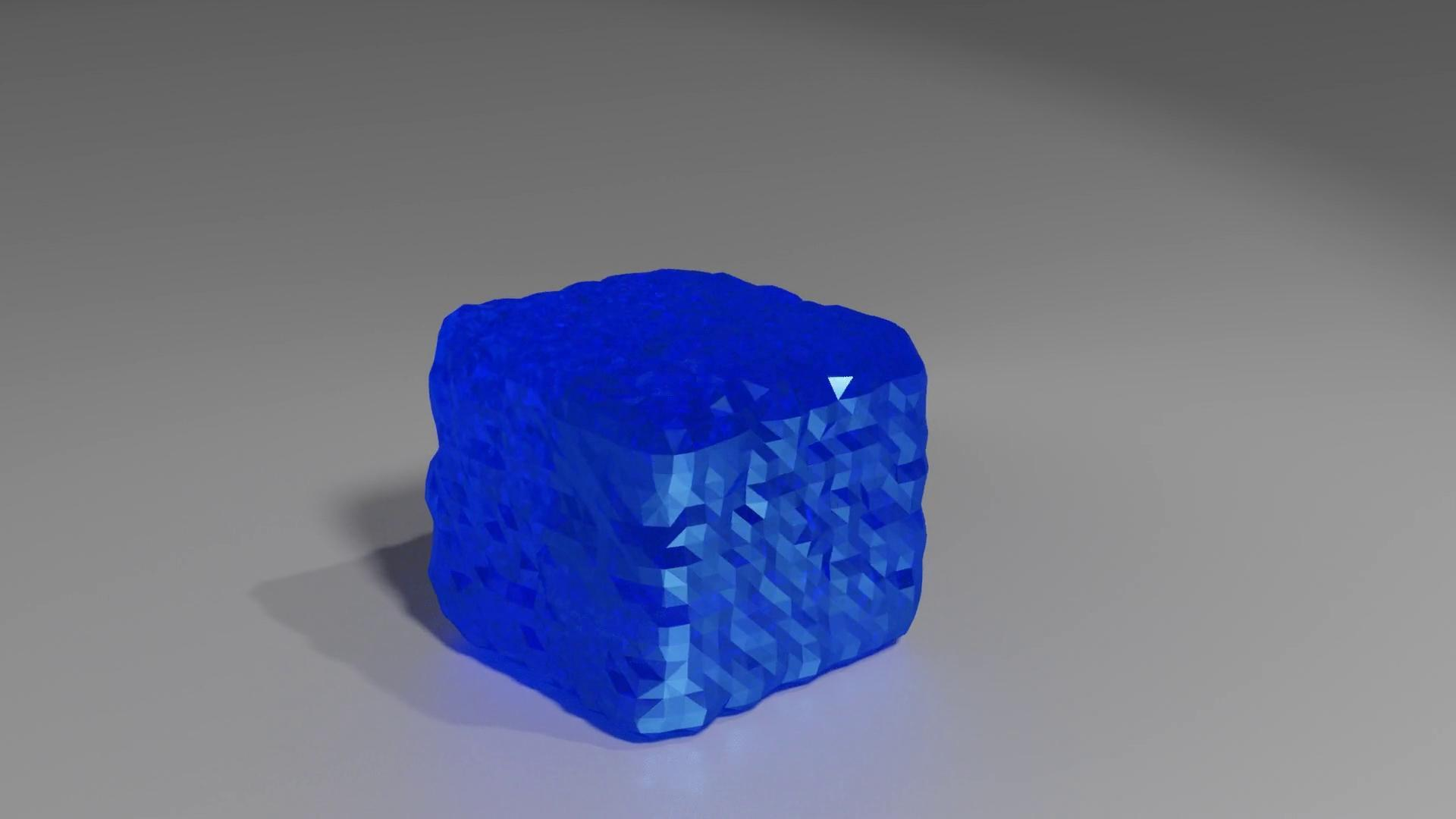
Physically-Based Simulation

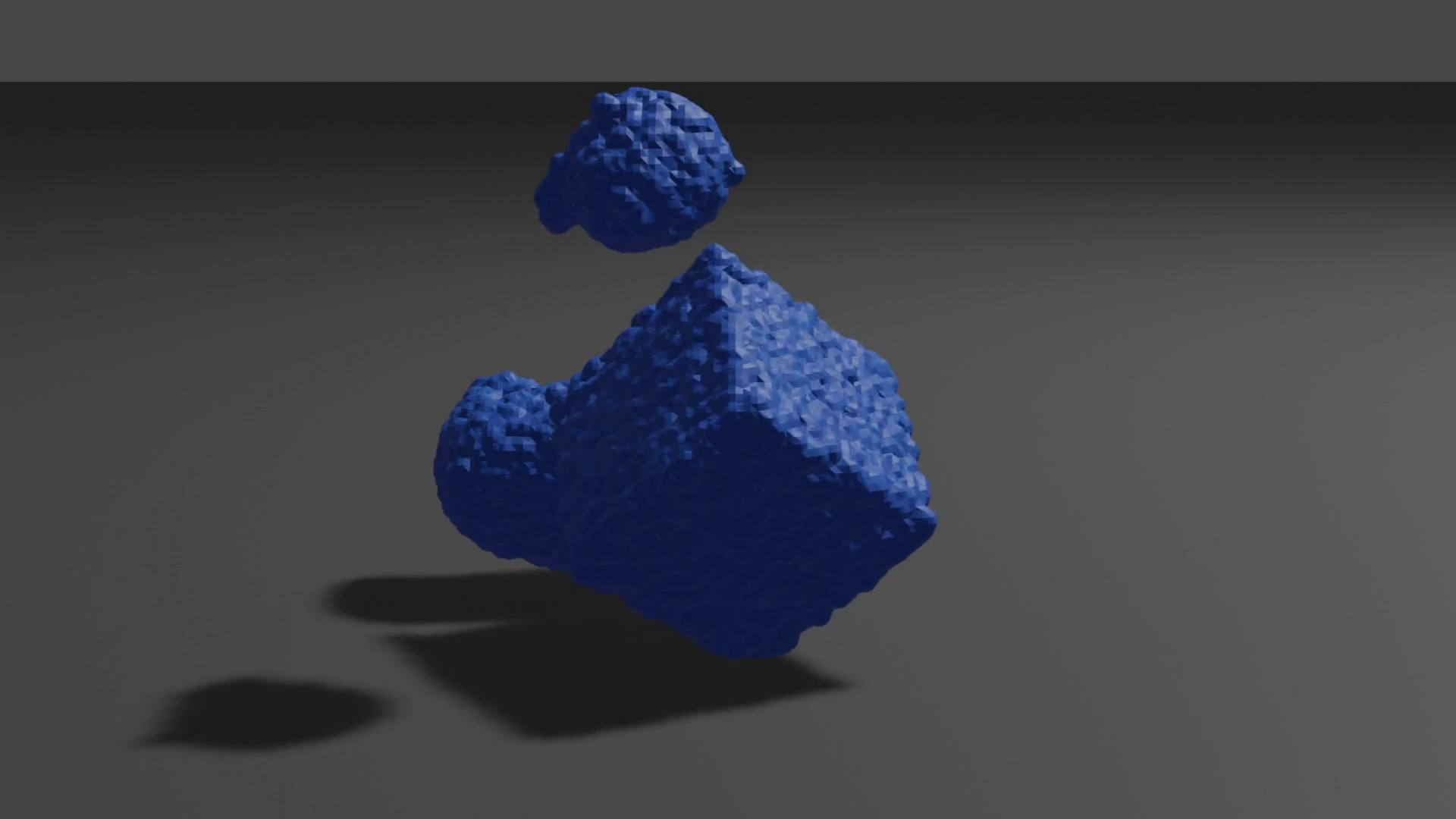
Material Point Method (MPM)

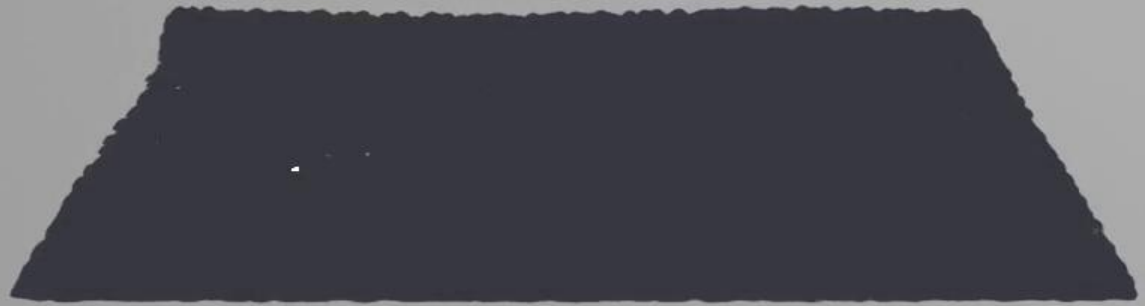
The A-Team
Simon Dünser
Kenneth Blomqvist

One Sim to rule them all?

- Rigid
- Elastic
- Plastic
- Fluid
- Springy
- Fluffy
- Mushy
- Spongy
- Fishy
- Seals







Achievements

- MPM Implementation running
- Modular structure facilitates implementation of different flavours of MPM
- A general material model that covers a large range of materials
- Parallelized code with reasonable performance

“Future Work”

- Dedicated material models for fluids or close-to-rigid bodies
- Explicit collision handling between objects
- Implicit time integration
- Improve rendering

Conclusions

- MPM suitable to simulate a wide range of materials with ease

  … when physical accuracy is secondary.
- Most useful for cohesive, plastically deformable materials (snow, clay, liquids)
- Fairly expensive for applications with small deformations
  - Lots of particles
  - Timesteps for explicit integration as small as people say

References

[1] Hu, Yuanming, et al. "A moving least squares material point method with displacement discontinuity and two-way rigid body coupling." ACM Transactions on Graphics (TOG) 37.4 (2018): 150.

[2] Chenfanfu Jiang. "The Material Point Method for the Physics-Based Simulation of Solids and Fluids." Doctoral dissertation (2015).