Physically-Based Simulation
Material Point Method (MPM)

The A-Team
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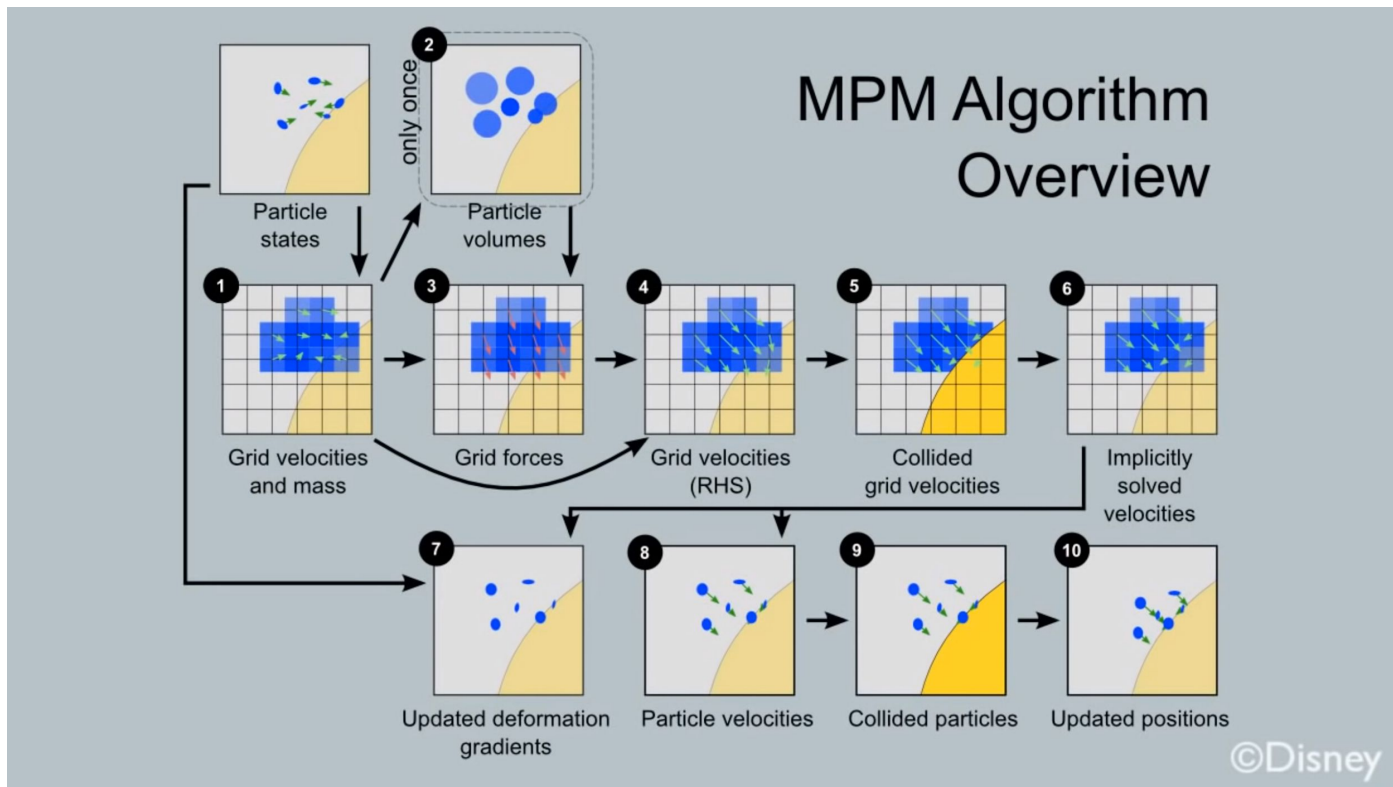
Simon Dünser

Velko Vechev

The Pingu World

One Sim to rule them all?

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

- Objects changing state

Horrific How To's, 2019. How To Melt a Face Off. Youtube.

Material Point Method (MPM)

Stomakhin A. et al. 2013. A material point method for snow simulation. ACM Trans. Graph. 32(4).

[1] Disney's Frozen

[2] Chenfanfu J. et al. 2016. The material point method for simulating continuum materials. In ACM SIGGRAPH 2016 Courses (SIGGRAPH '16).

Minimal

- Basic MPM Implementation

    - Working for <u>a</u> type of Material (probably some deformable solid)

    - Explicit time integration

- Gaining insights into the method's

    - up- and downsides

    - shortcomings and limitations

- Learning about practical aspects, implications and pitfalls of implementing MPM

Desired

- Different Material models

- Wide range of material properties

    - fairly stiff

    - almost fluid

Target

Overambitious

- Decent computational efficiency

- Nice rendering

- Implicit time integration

Milestones & Timeline

(1) by 27/11

- P2G & G2P transfer

- Grid & grid-based operations

- Material Model

- Collisions & Boundaries

- Input & discretization

- Output & rendering

(2) by 18/12

- Testing, determine limitations

- More material models

- Optimization

- Better rendering

- Implicit time integration

- Compile results