Wind-Driven Snow Buildup Using a Level Set Approach

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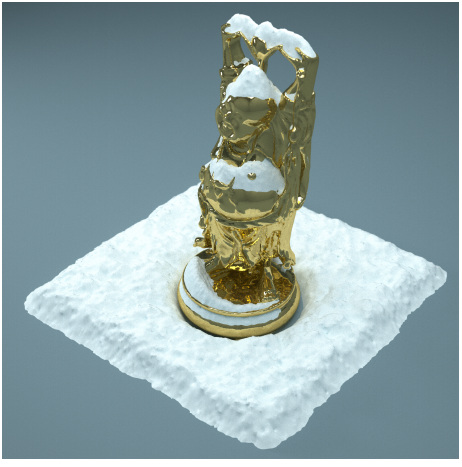
DreamWorks Animation



Outline

- Problem Description
- Related Work
- Level Sets
- Our Method
- Results
- Future Work

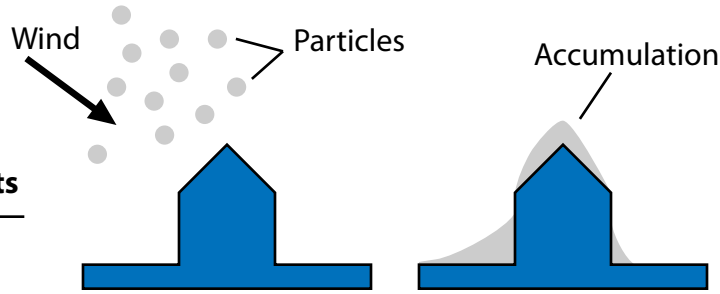
Problem Description

Criteria

- Physically plausible
  - Shape (granular)
  - Location (wind)

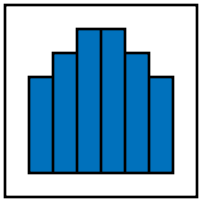
Simulation Components

- Surfaces
- Transportation
- Buildup



Related Work

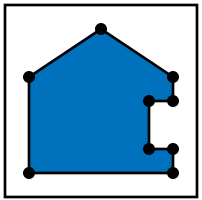
Height Fields



[FO02]

- Intuitive
- Simple scenes

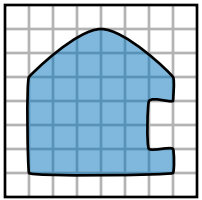
Explicit Surfaces



[Fea00, MMAL05]

- Arbitrary scenes
- Subdivision
- Refinement
- Sharp edges

Implicit Surfaces

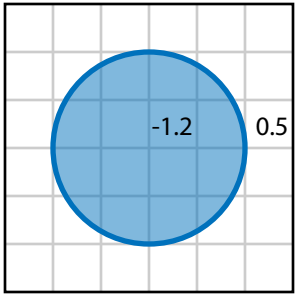


Metaballs [NIDN97]

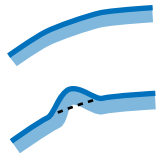
- Arbitrary scenes
- Smooth
- Manual
- “Blobby”

Level Sets

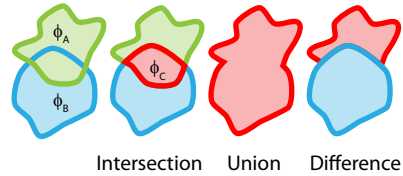
Distance Field



Propagation



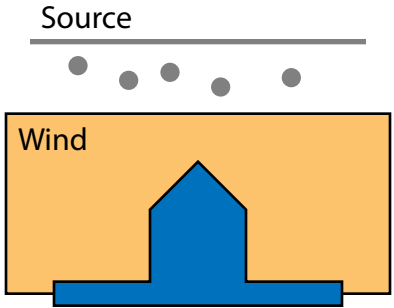
Constructive Solid Geometry



Method I - Scene

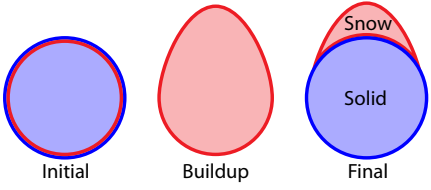
Scene Components

- Source(s)
- Scene Object(s)
- Wind Field(s)

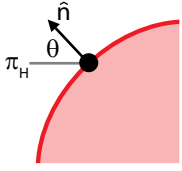


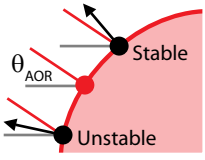
Method II - Surfaces

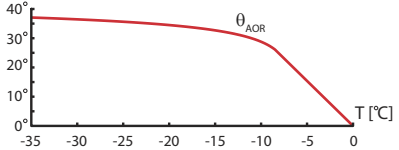
Dual Level Set Representation



Stability Criterion





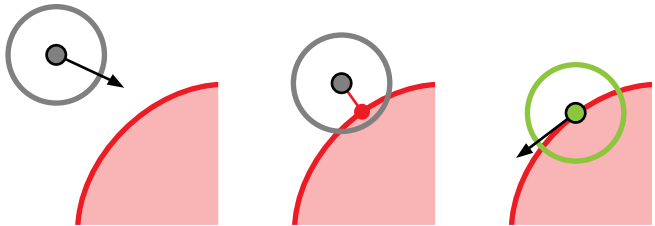


Method III - Transportation

Snow Packages

- Wind Packages
- Slide Packages

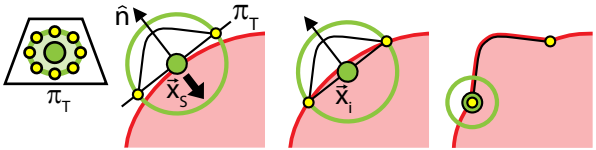
- Distance field:
  - Collision detection
  - Closest Point Transform



Method IV - Buildup

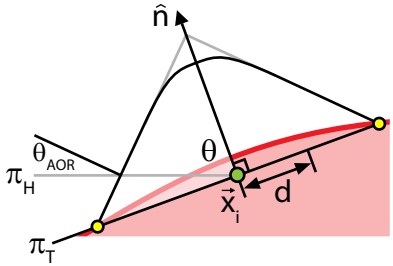
Stabilize Domain

- Ensure tangent plane is inside



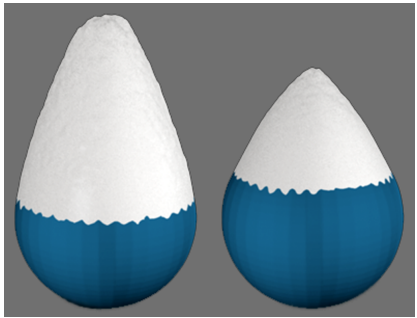
Propagate

- Shape function



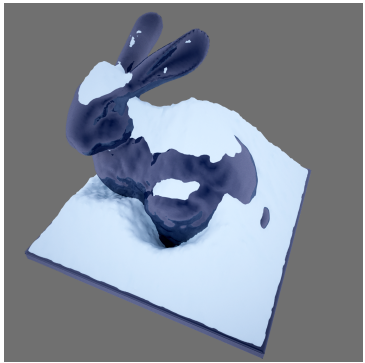
Results I

Varying Temperature [1.5 h]



−2°C −8°C

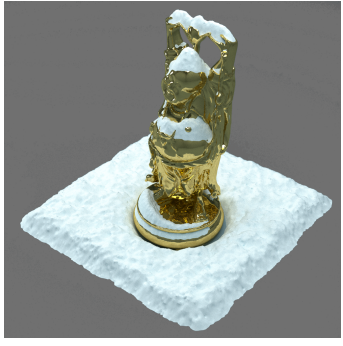
Large Volume [3 h]



(Model courtesy of the Stanford 3D Scanning Repository)

Results II

High Resolution [4 h]

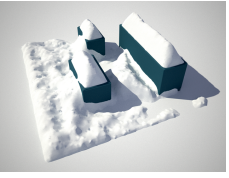


(Model courtesy of the Stanford 3D Scanning Repository)

House Scene [4 h]

Height Field

Triangles



Level Set

Future Work

- Redistribution
- Density Transportation
- Global Propagation
- Parallelize Level Set Operations

The End

Thanks!

Questions?