Wind-Driven Snow Buildup Using a Level Set Approach

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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

- Intuitive
- Simple scenes

[FO02]

Explicit Surfaces

- Arbitrary scenes
- Subdivision
- Refinement
- Sharp edges

[Fea00, MMAL05]

Implicit Surfaces

- Arbitrary scenes
- Smooth
- Manual
- “Blobby”

Metaballs [NIDN97]
Level Sets

Distance Field

Propagation

Constructive Solid Geometry

Intersection  Union  Difference
Method I - Scene

Scene Components
- Source(s)
- Scene Object(s)
- Wind Field(s)
Method II - Surfaces

Dual Level Set Representation

Initial Buildup Final

Stability Criterion

\[ \frac{\pi_H}{\theta} \]

\( \theta_{AOR} \)

Unstable Stable

\( T \ [\text{°C}] \)

\[ \begin{array}{cccccc}
-35 & -30 & -25 & -20 & -15 & -10 & -5 & 0 \\
0 & 10 & 20 & 30 & 40 & & & \\
\end{array} \]
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]

House Scene [4 h]

Height Field

Triangles

Level Set

(Model courtesy of the Stanford 3D Scanning Repository)
Future Work

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

Thanks!

Questions?