Imaging Fluid Dynamics for Art

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Design and Art session, 14h30
Outline

- 5 min - Intro (burned)
- 8 min – Modeling fluids
- 4 min - Converting data
- 3 min - Rendering
- 5 min - Display
- 5 min - Discussion
Modeling Fluids
“CFD”

- Computational fluid dynamics
“CFD”

- Computational colorful fluid dynamics
3D Vortex particle dynamics
3D Vortex tube dynamics
-vta -vh 176 -vv 88 -ab 1 -aa 0 -ad 16 -as 0 -x 24000 -y 12000
3D Vortex sheet dynamics

- Ph.D. research
- Triangle mesh
- Shear layers
void mist def 2 sun sky 0 7 30 30 30 0.5 0.5 0.5 0.1 -ms 0.0003 -ab 1 -aa 0 -ad 8

730619 triangles, obj2mesh
-ab 2 -aa 0 -ad 8
tracefield

- 3D raster $\rightarrow$ 3D vector $\rightarrow$ 2D raster
- 12048073 segments
- 2x primitives
- 6.4 GB RAM
- `-ab 2 -aa 0 -ad 16`  
  `-as 0 -ps 1 -u+`  
  `-x 24000 -y 24000`
- 2 weeks
DLA

- Diffusion-limited aggregation
- Not a CFD technique
Converting Data
Converting data

- Direct dump to .rad or .obj or .b3d
- Rocktools – 3D tri mesh
- Stickkit – 3D network
- makeMistCubes – from 3D scalar field
Stickkit

Reads .rad cylinders, cones, and spheres, too!
makeMistCubes

3D scalar field in
228204 mist cubes
out
Handling large models

Problem: oconv dislikes overlapping geom
Handling large models

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100k primitives w/ overlap – 10M w/o
Even with “-n 80”
Even with 8 GB RAM
Handling large models

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Even with “-n 80”

Even with 8 GB RAM

Solution: recursively split geometry

oconv, instance separately
Rendering
Rendering large frames

- 1 frame at 24000 to 50000 pixel res
- 7250 frames at 1080p
- Quad-core machines are great
- Play with compile options (gain 2-20%)
To “-aa 0”

- No amb cache – all oct
- Trivially parallel
- Can weight toward 1\text{st} bounce
- \textit{No frame coherence}
- \textit{Noisy, must oversample, but...}

...or not

- \textit{Ambient cache is big}
- \textit{Must share amb file}
- Smooth results
- Reusable results
7250 frames, -ab 2 -aa 0 -ad 16 -as 0 -ps 1 -dj 0.7 -ds 0.2 -u+ -x 3840 -y 2160
Display Techniques
Display techniques

- 1+ LCD screen
- Lightjet or Inkjet print
- HDR display
Display - HDR

- Dolby/Brightside

Backlight Simulation
LEDs are controlled through unique signals.

LCD
Provides color, resolution, and contrast. Contrast and image created by combining LED and LCD images.

Dolby Laboratories, 2008
Display - HDR

- Dolby/Brightside
- Projector + Reflective

Bimber and Iwai, 2008
Display - HDR

- Dolby/Brightside
- Projector + Reflective
- Overlaid transparencies
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16bpp
Display - HDR

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\[ \sqrt{16\text{bpp}} = 8\text{bpp} \]

- 8bpp Light map
- 8bpp Detail map
Perpetuity? 2008
Summary

1) Shapes from CFD
2) Triangles / segments
3) Radiance
Summary

1) Shapes from CFD
2) Triangles / segments
3) Radiance
4) ???
5) Profit