State of the Art in Hardware Shading

Marc Olano
Chas Boyd
Bill Mark
Michael McCool
Jason Mitchell
Randi Rost

Overview

8:30 – 10:15 Shading Hardware

- 8:30 Introduction — Marc Olano
- 9:00 NVIDIA — Bill Mark
- 10:00 ATI — Jason L. Mitchell

10:15 – 10:30 Break

10:30 – 12:15 Shading Hardware (cont)

12:15 – 1:30 Lunch

1:30 – 3:15 APIs

3:15 – 3:30 Break

3:30 – 5:15 APIs (cont)

What is Shading

Ultimate control of appearance

Programmable

- Arbitrary computation

Procedural

- Simple procedures
- High-level language

RenderMan Types

Compute what?

- Surface color
- Light color and direction
- Fog density and attenuation
- Surface displacement

Hardware Types

Compute what?

- Vertex position
- Vertex texture coordinates
- Vertex color
- Pixel color

Non-Real Time / Real Time

Not Real-Time

- Seconds to hours per frame

Real-Time

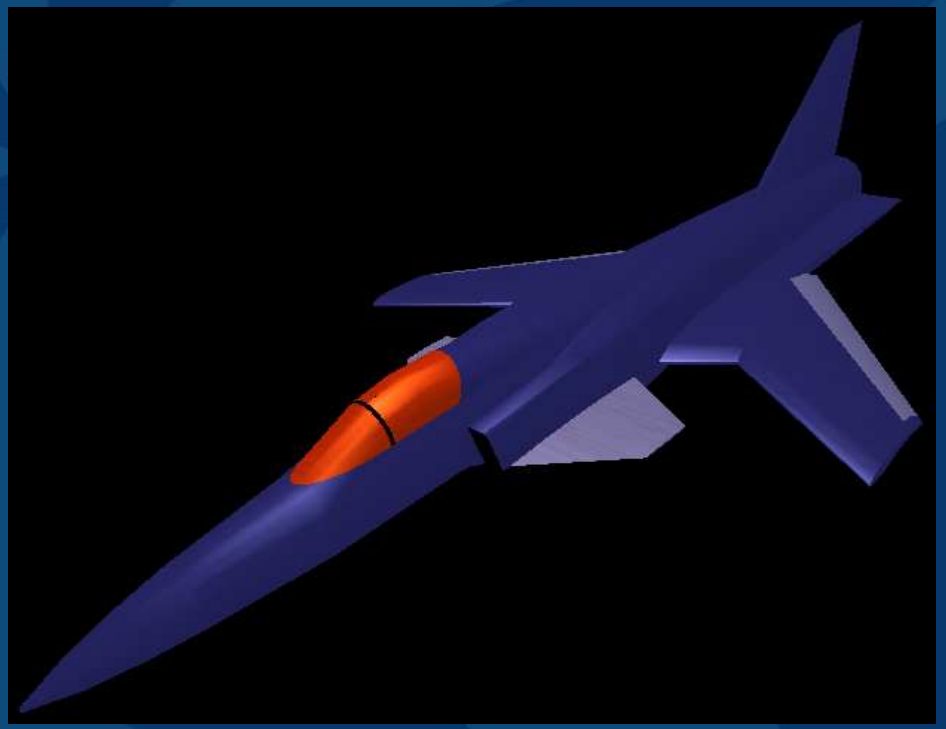
- Tens of frames per second

Interactive Rendering

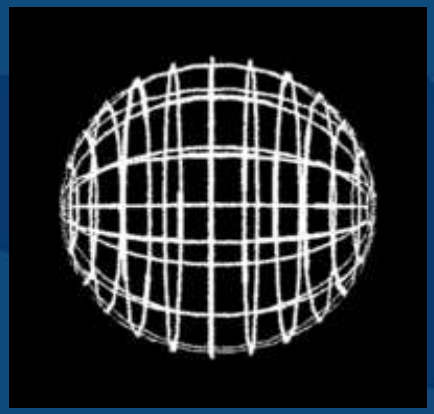
SAN ANTONIO SIGGRAPH 2002

Illusion of Presence

- 10 – 30 – 60 frames per second
- Immediate response
- Simple appearance



Interactive Rendering



Vector

Flat

Gouraud

Texture

+Fragment Lighting

Shading

Uses for Real-Time Shading

More realistic appearance

- Automotive styling

Visualization

- Data fields on surfaces

Non-realistic appearance

- Games, Illustration

A Short History

History

- Pixel-Planes 5 **[Rhoades 1992]**
- PixelFlow/pfman **[Olano 1998]**

What about now?

Present

- SGI OpenGL Shader
- NVIDIA Cg / Vertex shader + register combiners
- ATI Vertex & Pixel Shaders
- Microsoft DirectX
- OpenGL 2.0

What's coming next?

Future

- SMASH?

But How Do I Choose?

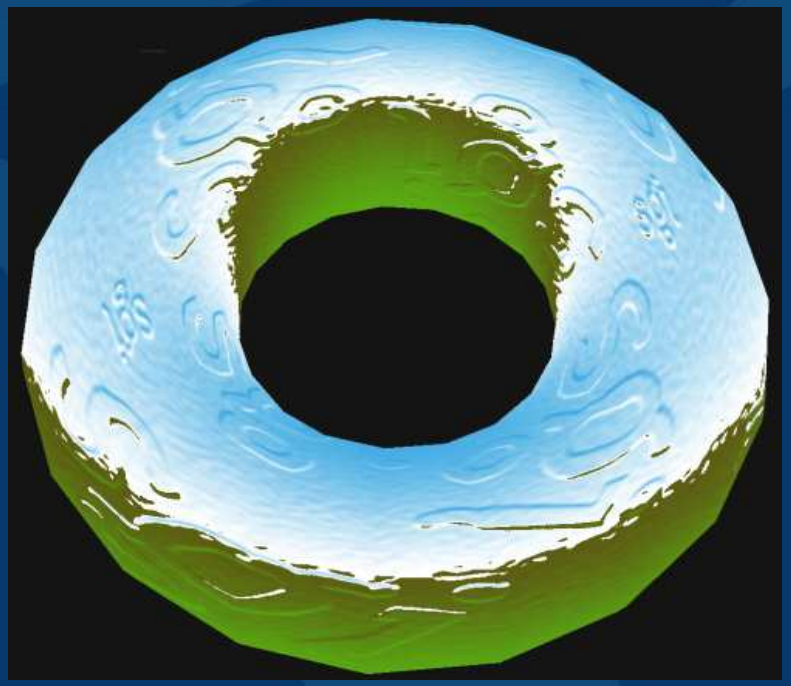
This course may help you compare…

- Three common examples from each presenter
- One to show off
- “Tutorial” style

Example 1

Shiny Bump Map

- Dependent texturing
  - Environment texture depends on bump texture results
- Popular



Example 2

Homomorphic BRDF Factorization

- BRDF factored into three texture terms
- Non-standard texture coordinates
  - Maps indexed by local **V**, **L** and **H**
- **Renders a wide range of real surfaces**

Example 3

Parameterized Wood

- Push complexity
- Growth ring size, dark and light colors, grain, shininess, …

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- 3:30 OpenGL 2.0 (cont) — Randi Rost
- 3:45 API Design — Michael McCool
- 4:45 Panel Discussion and Q & A — All