Q/do know /wrap up

Montag, 14. Februar 2022 00:45

Intro

Wrap-Up

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- Computer Graphics
  - Rendering
  - Modeling
  - Visualization
  - Animation
  - Imaging
- Young, dynamic area
  - Progress driven by research & technology
- Big industry!
- Interdisciplinary field
  - Relations to mathematics, physics, engineering, psychology, art, entertainment, …

Math Primer

Wrap-Up

- Vectors
  - Operations
  - Scalar Products / Length
  - Projections
  - Cross Product
- Matrices
  - Matrix Vector Product
  - Matrix Matrix Product
  - Transpose
  - Inverse
  - Transformations
- Next lecture
  - Ray Tracing

RT1

Wrap-Up

- Background
  - Forward light transport vs. backward search in RT
- Ray tracer
  - Ray generation, ray-object intersection, shading
- Ray-geometry intersection calculation
  - Sphere, plane, triangle, box
- Recursive ray tracing algorithm
  - Primary, secondary, shadow rays
- Next lecture
  - Acceleration techniques

Questions

- Write down and explain the principle steps of a recursive ray tracer.
- How do you compute the ray intersections with:
  - Plane
  - Box
  - Triangle
  - Sphere
  - Cylinder
- How do you evaluate the shading for a diffuse surface?

RT2

Wrap-Up

- Hierarchical space partitioning
  - BSP, KD trees
  - Grids
  - Octrees
  - …
- Building
- Traversal

Next Lecture

- Raytracing Dynamic Structures

Questions

- Describe and compare quadtrees and grids.
- Describe and compare BVHs and kD-Trees.
- What is the surface area heuristic? What is it used for?
- How do you traverse a kD-Tree? or a BSP-tree?

RT3

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• Raytracing Dynamic Structures

RT3

Summary

- Large scenes
- Dynamic scenes
- Dynamic update of data structures

Questions

- Compare lazy build and multi-level hierarchies for representing large scenes.
- How can one adapt BVHs for dynamic scenes?

Shading

Wrap-Up

Appearance and Reflectance
- Phenomena
- Characterization
- Snell's law / Polarization

Shading
- Goraud / Phong
- Blinn-Phong
- Multiple light sources

Questions

- What does "BRDF" stand for? What is represented by a BRDF?
- Explain the differences between diffuse, glossy and mirror reflections.
- How can you control the specular lobe in the Blinn reflection model?

LT

Wrap-up

- Physical Quantities in Rendering
  - Radiance
  - Radiosity
  - Irradiance
  - Intensity
- Light Perception
- Light Sources
- Rendering Equation
  - Integral equation
  - Balance of radiance

Questions

- Why is radiance so important for ray tracing?
- What is described by the rendering equation?
- Which terms does it consist of?
- How does it describe global light transport?

LT2

Wrap-up

- Rendering Equation
  - Integral equation
  - Balance of radiance
- Radiosity
  - Diffuse reflectance function
  - Radiative equilibrium between emission and absorption, escape
  - System of linear equations
  - Iterative solution
- Path Tracing
  - Monte Carlo Approximation of the rendering equation

BRDFs

Wrap-up

- Today
  - BRDFs
  - Properties
  - Microfacet model
- Next lecture
  - Textures

Questions

- What is a BRDF? How is it defined?
- What are the properties described by it?
- Which phenomena are not covered?
- How can a BRDF be represented?

- Next lecture
  - Textures
  - Textures to modify surface properties
  - Texture Parameterization
  - Procedural Shading
  - Texturing Filtering

- How can a BRDF be represented?
- How do you measure a BRDF?

Textures & FIltering

Wrap-Up

- Texture Parameterization
  - mapping vertices to texture coordinates
  - problem of perspective transformation
- Procedural Textures
  - Noise
  - Turbulence
  - Fractal Landscapes
- Texture Filtering
  - Minification
  - Magnification
  - EWA
  - Summed Area Tables
  - MipMaps

Questions

- What spaces are involved in texture mapping?
- What is forward and inverse mapping?
- Why do we need filtering in texture mapping?
- How is a mip map organized?
- What are bump mapping and reflection mapping?

Aliasing & FT

Summary

- Fourier Transform
- Importance of Amplitude and Phase
- Spatial Extent vs. Frequency
- Low-Pass Filtering

Next Lecture

- Filtering and Reconstruction
- Anti-Aliasing

Questions

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- What does the Fourier transform do?
- How does the power spectrum looks like for a horizontal/ vertical bar, set of dots, circles of varying sizes?
- How to perform a convolution?
- What is a low-pass, high-pass, band-pass filter?

Sampling & Antialiasing

826
Wrap-up:
- Aliasing
- Aliasing and Prefilterung
- The Digital Dilemma
- Aliasing
- Anti-Aliasing

What you should learn today

- What is sampling, aliasing?
- How does the Nyquist-Frequency come into play?
- The difference between sampling and reconstruction
- How to fight aliasing – by anti-aliasing!

Questions

- Why do we hardly see aliasing in digital photo cameras?
- 10x zoom (3x optical) – what does this mean?

Image Processing

942
Wrap-Up:
- Gaussian - Implementation
- Large-scale Layer (Bilateral Filter)
- Edge-Avoiding A-Trous Wavelents - Smoothing
- Sparse Representation

Summary

- Simple Filters
  - Gauss
  - Sobel
  - Median, …
- Bilateral
  - Upsampling
  - Cross-modal Upsampling
- Wavelets
  - Haar
  - À-Trous
  - Edge-avoiding À-Trous
  - Denoising

What you should learn today

- Definition of standard filter kernels
- Properties of Wavelets
- Edge-Avoiding Wavelets
- When to apply which filter
- How to compute a filtered image

Questions

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- What happens if I leave out the detail coefficients of the last two levels?
- How many detail coefficients do you need to faithfully represent an image?

  10%, 25%, 50%, 75% or 100%?

Human Vis Sys

1018
Wrap-Up:
- Human Visual System
  - Today
    - The Human Visual System
      - The eye
      - Early vision
      - High-level analysis
      - Color perception

What you should learn

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- The setup of the human eye.
- What is displayed and what we “see” is not necessarily the same. Be aware.

Color

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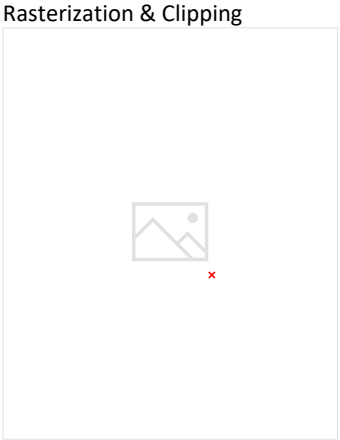
Wrap-Up:
- Interaction of light and surfaces
- CIE Chromaticity Diagram

HDR & Tone Mapping

Transformations

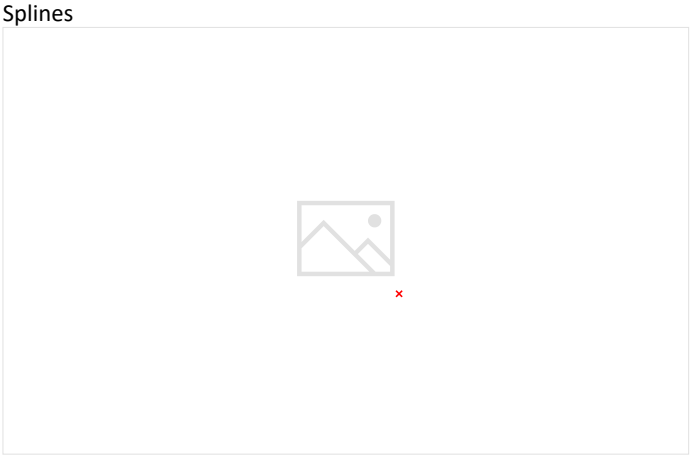
Camera Transformations

Rasterization & Clipping

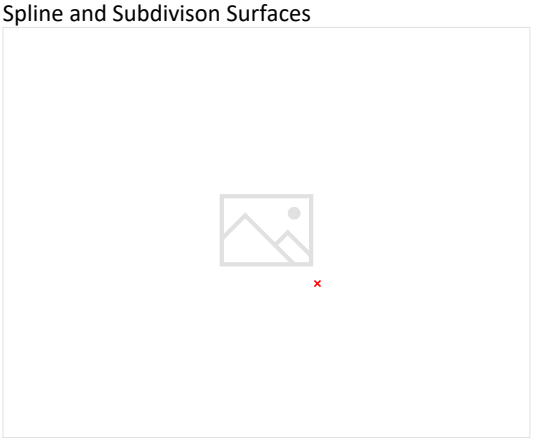


OpenGL1
OpenGL2
OpenGl3-3D Rendering and Effects

Splines



Spline and Subdivison Surfaces



Character Animation

Image-based Rendering