

CMPPM 164 F2019

Game Engines

Homework 3 – Topics in Real-time Rendering

You will work in pairs to investigate a technique from the list below. You will prepare an in-depth presentation for class during on October 28th or October 30th. I will provide links to excerpts from the Real-Time Rendering and Foundations of Game Engine Development texts, and you will additionally find resources (blogs, articles, video tutorials) to help explain the underlying rendering concepts, and also find examples of how the techniques are used in games or visual effects. You are not required to implement the technique yourselves. Each topic will be assigned to only one team.

Topics:

- A. Tangent Space / Bump Mapping / Parallax Mapping / Horizon Mapping (FDGE2, 7.6 through 7.82; RTRe4, 6.7 and 6.8)
- B. Acceleration Algorithms / BVH / BSP / Octrees (RTRe4, 19 through 19.1.4)
- C. Decals / Billboards (RTRe4, 13.6; FDEG2, 10.1 and 10.2)
- D. Volumetric Effects / Halos / Shafts / God Rays (FDEG2, 10.4 and 10.6)
- E. Shadow Maps (RTRe4, all of 7, but especially 7.4; FDEG2, 8.3 and especially 8.3.3, Cascaded Shadow Maps)
- F. Ambient Occlusion (FDGE2, 10.5; RTRe4, 11.3 through 11.3.6)
- G. Motion Blur and Depth of Field (FDEG2, 10.7; RTRe4, 12.4 and 12.5)

Ideas for what to present:

- Start by provide visual examples (images or videos) to help contextualize what each technique is.
- Explain what the various terms/concepts mean.
- Provide a high-level overview of the components that make up the effect or effects.
- Provide interesting low-level details as needed (but you don't need to derive formulas). What mathematical concepts and/or matrix operations are used?
- Show pseudo-code or code examples that implement these techniques. Show how the mathematics can be realized in code.
- Showcase lots of examples (can be historical or contemporary) of how these techniques are used.
- How do game engines enable these techniques? How can you use Unreal Engine to create a project using these techniques?
- Are there any gaps in your understanding? Terms you don't understand? Equations that you couldn't make sense of? Highlight aspects of the technique that you'd like to explore further in the future.
- Create a list of all the resources you consulted while researching your topic (blogs, videos, games, textbooks), share this list with the class.
- Speculate on how you might use these techniques in your own projects.
- Identify recent research papers from conferences (SIGGRAPH, EuroGraphics, GDC, etc.) that explore current ideas related to these techniques.
- Aim for a 20-30 minute presentation with lots of visual examples.