Modeling and Simulation of Appearance

Lab #4 - Path Tracing

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About this lab

- This lab **builds upon previous assignment,** make sure it works correctly.

- You can find scenes in the file `patch_04.zip` posted in Moodle.

About this lab

- You will be implementing a full **path tracer with support for global illumination**.

- Implement naïve path tracing, NEE-based path tracing, and MIS-based path tracing.

- Analyze the different approaches in the provided scenes and a self-made interesting scene.

- **Reuse code** from previous assignments!!

Path tracing - With naïve path sampling (30%)

- Simple support for **global illumination**.

- New rays at hitpoints are sampled using **BSDF sampling**, similar to Assignment 3.

- *But…* don’t stop at the first bounce! ⇒ **Trace another path at every hitpoint**.

- Stop criteria: Russian roulette, or when path leaves the scene.

- Implement it on `path.cpp`.

Path tracing - With next-event estimation (30%)

- Two rays at every hitpoint:
    - One with **emitter sampling** ⇒ Direct illumination.
    - One with **BSDF sampling** ⇒ Indirect illumination, or direct illumination with perfectly smooth materials.
    - **Do not account for direct light through BSDF sampling**, except when sampling smooth materials (check `BSDFQueryRecord`).
- Check previous assignments to see how to deal with emitter sampling.
- **Recursive implementation** for BSDF rays is recommended.
- Implement it on `path_nee.cpp`.

Path tracing - With MIS (30%)

- Two rays at every hitpoint:
    - One with **emitter sampling ⇒ Direct illumination**.
    - One with **BSDF sampling ⇒ Both indirect illumination AND direct illumination**.
- Weigh the samples reaching emitters using **multiple importance sampling**.
- Implement it on `path_mis.cpp`.

Interesting scene (10%)

- Test your implemented features in:
    - The scenes in patch_P4.zip
    - One scene of your own creation.
- Show and comment the implemented features in at least one of the submitted scenes.

Submission

Deadline for this task: **November 27, 2023, at 23:59**.

Include:

- `README.txt` with the names of the authors, consulted references, and comment on the features in the scene shown in Section 2.
- A folder `./figures` with the generated figures.
- A folder `./src` with all the source files you modified or added.