

Posudek diplomové práce

Matematicko-fyzikální fakulta Univerzity Karlovy

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Název práce Implementation of VCM in a fluorescence-capable path tracing framework
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Studijní program Informatika **Studijní obor** Počítačová grafika a vývoj počítačových her
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Text posudku:

Goal of this thesis was integration of modern path space integration techniques into an existing experimental rendering framework called ART that has been used as a testbed for various publications by our group for many years. As outcome of this research work, the framework has some features that are still unique: with the combined support for fluorescence and polarisation being one of them. However, the Monte Carlo (MC) global illumination (GI) solvers in the framework were extremely dated (partly because the solvers themselves were never a core research target of this part of CGG). As ART still has value as reference platform for predictive rendering, this effort was undertaken to implement some modern GI solvers in it.

As several reference implementations of modern bi-directional solvers like VCM exist, this at first sounds like a reasonably straightforward porting job: but the presence of fluorescence (i.e. wavelength shifting materials) makes bi-directional path-space integration more involved than in the case where no such materials are present, as the wavelength shift is an additional dimension that needs MC sampling. Proper integration of this into VCM is only partially documented in literature, so there was a genuinely experimental aspect to this work.

The thesis starts with a brief but sufficient introduction to the rendering algorithms which were later implemented, followed by a discussion of the phenomenon of fluorescence, and how it can be handled in a renderer. Then, an overview of the ART framework is given, along with a discussion of how the additional data structures and methods needed for bi-directional path-based rendering are best included. So far, ART only had uni-directional renderers, so some infrastructure work was needed, in addition to the implementation of the actual rendering techniques. The various components are all discussed, and the considerations that were made for their creation are presented.

The thesis concludes with a comparatively short result section which showcases the results

that were obtained. They demonstrate that the goals of the thesis were met, insofar as a first implementation of VCM in a fluorescence-enabled path-based rendering system was successfully undertaken. The end result is not complete, in the sense that the resulting implementation of fluorescence-aware VCM is in a state where it could not yet be integrated into a production system. But the candidate did reach initial operational capacity with his implementation, which is a major milestone for something that is pushing the boundaries of current rendering technology.

Because the definitely non-trivial goals of the thesis were met, I recommend it for defence.

Práci doporučuji k obhajobě.

Práci nenavrhuji na zvláštní ocenění.

V Praze dne 2. 9. 2024

Podpis: