

Posudek diplomové práce

Matematicko-fyzikální fakulta Univerzity Karlovy

Autor práce Bc. Bohuš Brečka
Název práce Efficient light transport simulation of participating media in color 3D printing
Rok odevzdání 2021
Studijní program Informatika **Studijní obor** Počítačová grafika a vývoj počítačových her

Autor posudku Tobias Rittig, M.Sc. **Role** Vedoucí
Pracoviště KSVI

Text posudku:

Topic Summary

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The thesis at hand is a comprehensive study of volume rendering algorithms assessing their performance in the setting of 3D printing. Given the specialized circumstances in this area, general volume path tracing algorithms do not perform optimally. Through rigorous numerical testing, the student compares a dozen of algorithmic and implementation changes. He assembles a few optimal solutions from all possible combinations. Comparisons with other algorithmic families such as bidirectional path tracing and photon mapping are conducted in both a secondary framework (SmallUPBP) as well as within the presented framework.

In a final comparison between the previously chosen combinations an optimum is not becoming apparent and multiple of his solutions perform equally well on different inputs. Overall, the results are more than convincing in terms of increased visual quality (reduced variance) and speedup. The thesis also succeeded in decreasing the memory requirements by a large factor without significant overhead.

Formal presentation

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The overall structure and the reading flow of the thesis is good. The presented theoretical basis covers the whole width of the thesis. Topics are mostly well introduced and consistently build upon each other in an understandable way. The writing style is rather technical and detailed which occasionally is hard to follow when referring to specifics in other topics. The measurements are very thorough but their presentation in tabular form is dry. The processing of the results could be improved with visualizations such as convergence graphs or other plots to convey the information in a more pleasing way. Exemplary imagery which allows for a visual inspection by the reader is also provided for the final test only.

Methodology

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The scientific approach of measuring efficiency composed by runtime and resulting variance is sound. Throughout the thesis, the tests are consistent (hardware, parameters, input models etc.) and comparable with each other. The student separates and studies the effects of individual components well which allows for a differentiated assessment. In a secondary stage, combinatorial effects are measured based on the previous selection.

Attached Software

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The thesis contains a implementation of the presented algorithms including prebuild binaries for Windows. The documentation was sufficient to replicate the very impressive results.

From a supervisor's perspective, the student demonstrated that he is capable of working independently and in a scientific way. Weekly consultations showed a consistent progress towards the goals of the thesis without the need for intervention. Even on exploratory branches that were less successful he did not loose focus and knew when to move on to more promising experiments. The detailed thesis and the exhaustive background research is evidence that the student understood the topic excellently.

Overall I recommend this thesis for defense.

Práci doporučuji k obhajobě.

Práci nenavrhuji na zvláštní ocenění.

Pokud práci navrhujete na zvláštní ocenění (cena děkana apod.), prosím uveďte zde stručné zdůvodnění (vzniklé publikace, významnost tématu, inovativnost práce apod.).

Datum 18. June 2021

Podpis