THESIS REVIEWER'S REPORT

I. IDENTIFICATION DATA

Thesis title:	**Using Tight Bounding Volumes for Bounding Volume Hierarchies**
Author's name:	**Lucie Veverková**
Type of thesis :	master
Faculty/Institute:	Faculty of Electrical Engineering (FEE)
Department:	Department of Computer Graphics and Interaction
Thesis reviewer:	Ing. Martin Káčerik
Reviewer's department:	Department of Computer Graphics and Interaction

II. EVALUATION OF INDIVIDUAL CRITERIA

Assignment **challenging**

How demanding was the assigned project?

The assignment requires an understanding of GPU-based BVH construction/traversal and a study of recent publications.

Fulfilment of assignment **fulfilled**

How well does the thesis fulfil the assigned task? Have the primary goals been achieved? Which assigned tasks have been incompletely covered, and which parts of the thesis are overextended? Justify your answer.

Methodology **correct**

Comment on the correctness of the approach and/or the solution methods.

Technical level **B - very good.**

Is the thesis technically sound? How well did the student employ expertise in the field of his/her field of study? Does the student explain clearly what he/she has done?

The work is technically very good, with clear explanations of advanced topics and in-depth evaluation. Minor concerns are addressed in section III.

Formal and language level, scope of thesis **A - excellent.**

Are formalisms and notations used properly? Is the thesis organized in a logical way? Is the thesis sufficiently extensive? Is the thesis well-presented? Is the language clear and understandable? Is the English satisfactory?

The text is well-structured and explains the problem in logical steps. Language is clear, with little to no errors or typos.

Selection of sources, citation correctness **B - very good.**

Does the thesis make adequate reference to earlier work on the topic? Was the selection of sources adequate? Is the student's original work clearly distinguished from earlier work in the field? Do the bibliographic citations meet the standards?

Previous work is adequately referenced and distinguished, selection of sources is rich and covers the topic well. Authorship of the central DiTO paper is however incorrectly assigned to a book editor instead of the original authors (in sections 1.3 and 3.3, referencing entry 17). Some bibliography entries (e.g., 6, 20) are missing fields.

Additional commentary and evaluation (optional)

Comment on the overall quality of the thesis, its novelty and its impact on the field, its strengths and weaknesses, the utility of the solution that is presented, the theoretical/formal level, the student's skillfulness, etc.

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III. OVERALL EVALUATION, QUESTIONS FOR THE PRESENTATION AND DEFENSE OF THE THESIS, SUGGESTED GRADE

Summarize your opinion on the thesis and explain your final grading. Pose questions that should be answered during the presentation and defense of the student's work.

In this work, the student deals with BVH construction using bounding volumes with a tighter fit than the prevalent axis-aligned bounding boxes. Specifically, two recent methods employing the oriented bounding boxes are investigated, a DiTO-based AABB BVH to OBB BVH transformation and direct OBB BVH construction with the intermediate use of orthogonal discrete orientation polytopes and the PLOC algorithm. First, basic concepts of ray tracing and acceleration structure construction are introduced. Then, an exhaustive explanation of relevant papers is given. After that, a description of the unified evaluation framework is provided (based on the previous work of PLOC authors, using C++ and CUDA), followed by a detailed evaluation and discussion.

Overall, the thesis is comprehensive, with occasional slight imprecisions or unsubstantiated claims. More significant technical concerns of mine are expressed in the questions.

The grade that I award for the thesis is **B - very good.**

However, if the student provides clear answers to the questions below, I am open to grade improvement.

Questions:

1. Comparing the results in Table 6.1 with the results of Meister in the original PLOC paper, specifically for the AABB method and Hairball scene: for the described algorithm configuration, you report about 3x faster BVH construction, yet less than 0.5x traversal performance. Furthermore, the BVH cost is significantly different (~1080 vs. ~2700). Considering your benchmark is based on Meister's original framework, can you address these inconsistencies?
2. Possibly related to the previous question: if I understood correctly, you evaluated only one view per scene (please correct me if I am wrong). Ray tracing performance is however view dependent. To what degree could this have affected the results?
3. Presented results, supported by visualization in Fig. 6.13, suggest that DiTO-based OBBs work well in lower levels of the hierarchy, while in the higher levels, they typically do not improve over the AABBs. Yet, in the Future Work section, you propose to use DiTO specifically in the higher levels during the BVH construction. Can you explain why?

Date: **5.6.2024** Signature: