FACULTY OF INFORMATION TECHNOLOGY CTU IN PRAGUE

Supervisor's statement of a final thesis

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Thesis title:	Parallel computations on orthogonal grids on GPU
Branch / specialization:	Computer Science
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Evaluation criteria

1. Fulfillment of the assignment

▸ [1] **assignment fulfilled**
[2] assignment fulfilled with minor objections
[3] assignment fulfilled with major objections
[4] assignment not fulfilled

The assignment has been completely fulfilled. In addition, in the written part, the author describes the finite difference into more mathematical details than it was necessary. The author has also implemented an n-dimensional grid which was not part of the assignment.

2. Main written part

90 / 100 (A)

The text is well structured, the written English is very good. The author has also described the finite difference method into more details than it was necessary. In the section 3.3 he derives the finite differences based on the Taylor expansions and he shows the asymptotical order of convergence. The implemented algorithms and data structures are described very well including the details of the implementation. In the last chapter, the author presents a computational study where the performance of the implemented algorithms is analyzed. He also compares the solutions of the heat equation obtained by the finite difference method and by the convolution with the Gaussian kernel. There are just a few typos. Unfortunately one of them - "různých dimenze" - is already in the Czech abstract. In the list of abbreviations, there is written "Template Numeric Library" instead of "Template Numerical Library". In the mathematical parts, the author often writes the dot at the end of the sentence before the formula which is however a part of the sentence - for example formulas (3.9), (3.12), (3.13), (3.14) and several others. In the table 6.2, the author shows difference of computation time in percents. It would be much better if the sign of percentages was written next to the numbers.

3. Non-written part, attachments 95 /100 (A)

The code written by the author is of very good quality. He has also implemented a number of unit tests. To analyze the performance of the grid entity traversing, he has compared several different implementations. The results show that the performance seems to be affected by a lack of support of the generic lambda functions in the CUDA compiler.

4. Evaluation of results, publication outputs and awards 95 /100 (A)

The code implemented by the author is a part of the TNL library so it is very likely that it will be used by the users of the library. There are no new findings that could be published in scientific journals but the assignment did not allow anything like that.

5. Activity of the student

[1] excellent activity
▸ **[2] very good activity**
[3] average activity
[4] weaker, but still sufficient activity
[5] insufficient activity

We were meeting each other with the student on a weekly basis. He was working systematically already from the beginning, no work postponing. He has also started working on the written part soon enough so I was able to read the text several times and to give feedback remarks to the student.

6. Self-reliance of the student

[1] excellent self-reliance
▸ **[2] very good self-reliance**
[3] average self-reliance
[4] weaker, but still sufficient self-reliance
[5] insufficient self-reliance

The student has decided to study the finite difference method more into details than it was necessary. He was interested in understanding the basics of numerical mathematics and the role of structured grids on scientific computing. This was not necessary either but it increased the quality of the text. The student was also interested in implementation of a general n-dimensional grid. The implementation is not perfect but the author created good fundamentals for the n-D grid which would be a nice feature of the TNL library.

The overall evaluation 95 /100 (A)

I am very happy with the results achieved by the student and with the written part. He has helped with the development of the TNL library for which efficient, robust and user friendly implementation of the structured orthogonal numerical grid is very important. The code will need just small refactoring and in the text there were few typos and small typographical errors. This is what is preventing me from the overall rating of 100 points. But anyway, the author has created a very good bachelor thesis.

Instructions

Fulfillment of the assignment

Assess whether the submitted FT defines the objectives sufficiently and in line with the assignment; whether the objectives are formulated correctly and fulfilled sufficiently. In the comment, specify the points of the assignment that have not been met, assess the severity, impact, and, if appropriate, also the cause of the deficiencies. If the assignment differs substantially from the standards for the FT or if the student has developed the FT beyond the assignment, describe the way it got reflected on the quality of the assignment's fulfilment and the way it affected your final evaluation.

Main written part

Evaluate whether the extent of the FT is adequate to its content and scope: are all the parts of the FT contentful and necessary? Next, consider whether the submitted FT is actually correct – are there factual errors or inaccuracies?

Evaluate the logical structure of the FT, the thematic flow between chapters and whether the text is comprehensible to the reader. Assess whether the formal notations in the FT are used correctly. Assess the typographic and language aspects of the FT, follow the Dean's Directive No. 52/2021, Art. 3.

Evaluate whether the relevant sources are properly used, quoted and cited. Verify that all quotes are properly distinguished from the results achieved in the FT, thus, that the citation ethics has not been violated and that the citations are complete and in accordance with citation practices and standards. Finally, evaluate whether the software and other copyrighted works have been used in accordance with their license terms.

Non-written part, attachments

Depending on the nature of the FT, comment on the non-written part of the thesis. For example: SW work – the overall quality of the program. Is the technology used (from the development to deployment) suitable and adequate? HW – functional sample. Evaluate the technology and tools used. Research and experimental work – repeatability of the experiment.

Evaluation of results, publication outputs and awards

Depending on the nature of the thesis, estimate whether the thesis results could be deployed in practice; alternatively, evaluate whether the results of the FT extend the already published/known results or whether they bring in completely new findings.

Activity of the student

From your experience with the course of the work on the thesis and its outcome, review the student's activity while working on the thesis, his/her punctuality when meeting the deadlines and whether he/she consulted you as he/she went along and also, whether he/she was well prepared for these consultations.

Self-reliance of the student

From your experience with the course of the work on the thesis and its outcome, assess the student's ability to develop independent creative work.

The overall evaluation

Summarize which of the aspects of the FT affected your grading process the most. The overall grade does not need to be an arithmetic mean (or other value) calculated from the evaluation in the previous criteria. Generally, a well-fulfilled assignment is assessed by grade A.