

# Evaluation of the supervisor of the diploma thesis

Author of the thesis: **Bc. Ondřej Havlíček**

Title: **Muscle interaction in the context of muscle deformation modelling by a Position Based Dynamics method**

Originality of the work and related works

*The submitted work follows the previous research in musculoskeletal modelling at the Department of Computer Science and Engineering, University of West Bohemia, in Pilsen, which resulted in a simulator exploiting a Position Based Dynamics (PBD) method to estimate the shape of a single muscle deforming in response to the movement of bones. The primary goal of the work was to extend the current simulator by supporting multiple muscles, interacting with each other, and to introduce new constraints allowing the muscles to behave as active elements instead of passive ones.*

Student engagement and collaboration with the supervisor

*The student engagement and his collaboration with the supervisor was clearly outstanding. He did not need to be pushed, he worked independently and only occasionally he needed to discuss which of the potential approaches he thought of to the issue he was dealing with should be chosen. He did not suffice with some working solution, but beyond the research plan he tried hard to make it as perfect as possible, e.g., by introducing parallel search for virtual edges (partially done, as a part of KIV/PPR course), creating a new dataset and retesting the original approach on it while performing a thorough analysis of the influence of various PBD parameters on the results, and finding and fixing bugs in the original code. He kept the supervisor informed of his progress using Discord, which allowed the supervisor to quickly propose some ideas for the future work (not always meant to be a part of this diploma work). The student took these immature ideas and turned them into working solutions (or into a detailed explanation why it could work). It is probably the first student I supervised that I needed to persuade that the solution he developed so far is good enough and does not need any further improvement and that he should focus on different aspects of this thesis.*

Quality of the solution

*The software is fully functional, running at interactive speed. The source code, written in modern C++ with the use of parallel constructs to speed up the calculation, is clean, well-structured and perfectly commented. The amount of the code is impressive (138 commits, lines of code exceeding a couple of thousands). The proposed solution is well described in the text of the thesis, with each individual detail explained and justified. Experiments done are extensive and clearly shows the capabilities of the solution. I appreciate the student also compared the results with the results of relevant state-of-the-art methods and critically discussed them.*

*The thesis is written in English of a good quality and is easy to follow. The main text, spreading over 118 pages, is rich in illustrations, which supports understanding of the solution.*

Usability / reusability of the solution

*The solution proposed and implemented in this work is superior to the currently used one and, therefore, once its Git branch is merged to the master, it will become the default method of the simulation.*

## Conclusion

*The student has unequivocally demonstrated that he is able to design, implement, and verify an engineering solution to a complex problem in Computer science – Medical Informatics, and therefore **I recommend the thesis for defence**. Considering the difficulty of the topic and the outstanding quality of the thesis, I suggest the grade **excellent**.*

*I also believe that the student demonstrated in his thesis a great research potential and, therefore, **I also recommend Bc. Ondřej Havlíček (and his thesis) for the Dean's Award** and for IT SPY competition.*

In Pilsen 30. 5. 2024

Doc. Ing. Josef Kohout, PhD.

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