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## **Supervisor's report**

**PhD student:** Ing. Jiří Minarčík

**Thesis:** "Properties and Applications of Geometric Flows"

The submitted thesis has been prepared within the framework of the research carried out at the Department of Mathematics, Faculty of Nuclear Sciences and Physical Engineering, Czech Technical University in Prague, and given by the contacts to the University of Kanazawa, the Meiji University, Japan, and to the Comenius University Bratislava. The author deals with the geometric flow of curves in space and related analytical and topological aspects. The aim of the thesis was to understand the complexity of the space dynamics of moving curves, with a view to applications.

The text of the thesis is a continuous collection of mathematical results that are described in particular chapters and summarized at the end of each of them. The content is based on the articles already published by the author in the impacted mathematical journals.

The introductory part of the thesis lists applications of curve motion in plane and space, provides definitions and basic tools describing this motion. Curve shortening in space or higher-dimensional spaces is discussed in the next chapter where the comparison principle, convexity and sphericity are discussed.

The second part deals with the flow generating minimal surfaces. Mathematical properties of this flow and difficulties in its treatment are discussed in the text. The third part addresses general topological relations associated with geometric flows and

suitable invariants. The last chapter opens a new area of analysis working with frames for the geometric flows. In the appendix, another open area of filament networks is introduced, and computational methods for all problems with accompanying examples are described.

The submitted thesis summarizes the achievements of the author during his work on the topic and his visions for future research. The author has published 4 articles in the impacted journals so far, and some parts of his work are still worthy of publishing.

The PhD study of the candidate was part of the cooperation between the CTU in Prague and several institutions abroad. He repeatedly visited or stayed at universities in Japan and at Comenius University in Bratislava. He also participated in several international conferences, workshops and summer schools abroad. He actively participated in the educational process in the Department of Mathematics, advising students and leading exercises in basic courses.

Throughout his work on this topic, the candidate has proved high ability to independently master and develop problems of interdisciplinary nature. Through his work, the topic of geometric flows has become an integral part of the research activities of the department. In view of the above, I have every reason to recommend the candidate to the committee for the defence of the degree of Doctor of Philosophy.

prof.Dr.Ing. Michal Beneš

(supervisor)