Referee report

on the dissertation of Ing. Josef Rukavička
"Enumeration of Factor in Special Languages" (2021)

The topic of the doctoral thesis is the combinatorics on words, in particular it focuses on the problems connected with languages of rich, power-free, closed, and privileged words. Apart from privileged words, these types of languages have been studied for decades and therefore it is not easy to come up with new relevant results filling gaps in the recent knowledge. The more I appreciate the effort of the candidate who (partly) solved a sequence of interesting open problems addressing substantial issues of the field.

In more detail, results on the rich words focus on the growth of their number (with respect to their length) and their factor complexity. New subexponential and quasi-polynomial, respectively, upper bounds have been shown, supporting some previously formulated conjectures. Concerning power-free words, two conjectures formulated in 1985 were partially solved, on the basis of extendability of these words, with a particular focus on rich words again. The other results in the thesis deal with de Bruijn graphs, palindromic length of words and with dissection of infinite languages. I actually appreciate that the thesis is not strictly mono-thematic, as the dealing with not so closely inter-related problems within the field of combinatorics on words provides an overview of approaches, proof techniques and paradigms helping to cross-fertilize the progress in the studied topics. All the presented results are sound, clearly explained, the proofs are convincing and verifiable.

Formal aspects of the thesis: the English is at a very good level, apart from rare misprints (e.g., "priviledged" in the title of Sec. 3.3). The thesis contains all the necessary parts to be comprehensive. The typesetting in LaTeXis correct. The list of references is adequate, showing the candidate's overview of the studied topics.

Conclusions: The reviewed doctoral thesis presents new and important results in the active research area of combinatorics of words which substantially contribute to the research progress in this field. Although these results are theoretical, the studied topics have also significant applications in computer science, bioinformatics and related fields. I therefore consider research goals of the thesis to be fulfilled. All the results have been published in peer-reviewed journals and conference proceedings, four of them having already a record at the Web of Science, while two others being under review yet. The candidate is the sole author in all these papers.

In my opinion, the systematic research work of the candidate fulfills all the necessary criteria for a quality PhD thesis and I firmly suggest acceptance of the thesis.

In Opava April 16, 2021

L... ...g. Petr Sosík, Dr.