REVIEW OF DOCTORAL THESIS

Parameterized Complexity – Nonstandard Parameterizations of Graph Problems

RNDr. Ondřej Suchý

This thesis belongs to the rapidly evolving field of parameterized complexity, which received very significant attention over the last decade. Parameterized complexity arose as a reaction to the fact that many, if not most, natural graph problems are NP-complete. The goal is therefore to more finely classify the complexity of such problems. This is achieved by expressing the complexity not only in the size of the input, but also as a function of some parameter(s) (e.g. the size of the solution). Such classification can then tell us more about the nature of the problem, i.e. which particular aspects significantly affect the overall complexity.

The thesis comprises of two parts of about the same length. The first part is intended as an introduction to the field of parameterized complexity. The most important are the chapters 5-7, in which the most important techniques of proving fixed parameter tractability/intractability are presented. This is reflected in the space devoted to these chapters. As the author himself mentions, only selected aspects of this ever richer area could be presented in any detail. Still to me the coverage feels slightly imbalanced in places. E.g. I do not think it is necessary to include the definitions of complexity classes P or NP (Section 2.1). On the other hand some notions could perhaps be covered in a little bit more detail - e.g. clique-width and tree-width. More figures illustrating various concepts would benefit the reader. I also feel the presentation in this part could be improved, more so in Chapters 2-4.

I like the way the author uses examples to illustrate the concepts he writes about. Moreover, these examples are then often chosen in such a way so that they can be used in the second part of the thesis. Some of the considered problems are not defined precisely enough in the text, however the definitions of all mentioned problems are given in the appendix.

The second, and also the more important, part of the thesis consists of three chapters, each based on a research paper coauthored by O. Suchý. All the papers were presented at well known international conferences and their quality is also witnessed by the fact that the extended versions of the first two were already accepted for publication by prestigious international journals. The presented results are original and certainly advance the current knowledge in the area. Their broadness clearly demonstrates author's ability to use various proof techniques (for proving both tractability and intractability) and very good working knowledge of his research domain. I would like to point out that the problems studied are well known and natural, with practical applications. The quality of presentation is also very high, with each chapter being very well structured. The second part as a whole clearly exceeds the first part.

The bibliography (16 pages) is well done and does, as far as I can say, includes the relevant literature, including many very recent results. I particularly like the fact that with each entry there is a list of pages on which that result was referenced.

The whole thesis is technically sound, with consistent and sufficiently formal notation and proofs throughout. The level of command of English is rather good, although it could be improved in some places. (E.g. the author often errs in the use of articles and particularly in the use of commas.) I have not found too many spelling errors or typos throughout the

thesis, however typographically the thesis leaves something to be desired. (E.g. large number of „widows“, cf. pages 8 and 9, a major formatting error.)

To conclude, the presented work satisfies the requirements for doctoral thesis and without any doubt shows author's ability to do independent original research. I therefore recommend it being accepted as a doctoral thesis at MFF UK.

In Chennai, India, December 13, 2010.

Mgr. Jan Obdržálek, Ph.D.