FACULTY
OF MATHEMATICS
AND PHYSICS
Charles University

Report on doctoral thesis defence jointly organized by Charles University and Universita della Swizzera Italiana

Academic year: 2022/2023

Student's name and surname:	Mgr. Martin Blicha, Ph.D.
Student's ID:	66629312
Type of the study programme:	doctoral
Study programme:	Computer Science - Software Systems
Study ID:	525521
Title of the thesis:	Effective Automated Software Verification: A Multilayered Approach
Thesis department:	Katedra distribuovaných a spolehlivých systémů (203. • 32-KDSS)
Language of the thesis:	English
Language of defence:	čeština
Supervisor:	doc. RNDr. Jan Kofroň, Ph.D.
Reviewer(s):	prof. Philipp Rümmer
	Dr. Nikolaj Bjørner
Date of defence:	21.03.2023 **Venue of defence:** Praha
Attempt:	regular

Course of defence:

The defense of PhD thesis by Martin Blicha was organized at USI Lugano, according to the agreement between universities.
Chair of the committee started the defense by introducing the candidate and explaining the whole process.
The candidate presented his work in the field of automated software verification. First, he explained the main challenges, including scalability and complexity of verification techniques and difficulties in computing useful abstractions. In the rest of his presentation, the candidate described his contributions at the three layers into which software verification tasks can be split - foundational, verification, and cooperative. The main contributions are the following: generalization and improvement of the interpolation procedure by using the Farkas lemma (the foundational layer), developing the concept of transition power abstraction (TPA) for the purpose of detecting long error traces more efficiently (verification layer), and development of the IcE/FiRE framework that enables multiple verifiers to run in parallel and exchange information (cooperative layer). He also presented GOLEM, a new solver for Constrained Horn Clauses.
The defense continued by questions from reviewers and other committee members.
Questions were asked on the following topics: comparing transition power abstraction (TPA) with other acceleration methods (e.g., for loops with many iterations), the possibility of considering multiple conflicts at the same time when performing interpolation based on Farkas lemma, how common are multi-phase loops in real programs

and handling of programs with multiple loops (sequence) by TPA, general ways of interpreting results of experiments and practical impact of new techniques, whether differences in performance of SMT/CHC solvers are caused by scientific/algorithmic improvements or engineering/technical details (SW architecture, implementation), whether we really need more precise abstraction provided by decomposed Farkas interpolants, and reproducibility of experimental results.
The candidate answered all the questions very well.
After that, the public part of the defense finished, and a closed private meeting of the committee was held.
The decision of the committee was unanimous, with all the votes being positive.
Therefore, the candidate successfully defended his thesis and was awarded the Ph.D. title.

Result of defence:	pass (P)	
Chair of the board:	prof. Patrick Thomas Eugster	.....
Committee members:	doc. RNDr. Jan Kofroň, Ph.D.	.....
	doc. RNDr. Pavel Parízek, Ph.D.	.....
	Dr. Nikolaj Bjørner	.....
	prof. Matthias Hauswirth, Ph.D.	.....
	prof. Philipp Rümmer	.....
	Natalia Sharygina	.....