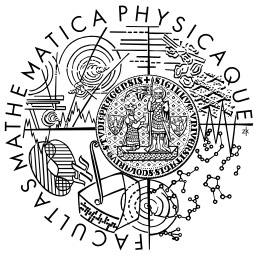

FACULTY
OF MATHEMATICS
AND PHYSICS
Charles University

BACHELOR THESIS

Štěpán Henrych

The PD-KIND algorithm in the Golem SMT solver

Department of Distributed and Dependable Systems

Supervisor of the bachelor thesis: doc. RNDr. Jan Kofroň, Ph.D.
Study programme: Informatika

Prague 2024

I declare that I carried out this bachelor thesis on my own, and only with the cited sources, literature and other professional sources. I understand that my work relates to the rights and obligations under the Act No. 121/2000 Sb., the Copyright Act, as amended, in particular the fact that the Charles University has the right to conclude a license agreement on the use of this work as a school work pursuant to Section 60 subsection 1 of the Copyright Act.

In ..... date ....

Author's signature

Dedication.

Title: The PD-KIND algorithm in the Golem SMT solver

Author: Štěpán Henrych

Department: Department of Distributed and Dependable Systems

Supervisor: doc. RNDr. Jan Kofroň, Ph.D., Department of Distributed and Dependable Systems

Abstract: Use the most precise, shortest sentences that state what problem the thesis addresses, how it is approached, pinpoint the exact result achieved, and describe the applications and significance of the results. Highlight anything novel that was discovered or improved by the thesis. Maximum length is 200 words, but try to fit into 120. Abstracts are often used for deciding if a reviewer will be suitable for the thesis; a well-written abstract thus increases the probability of getting a reviewer who will like the thesis.

Keywords: keyword, key phrase

Název práce: Algoritmus PD-KIND v řešiči Golem

Autor: Štěpán Henrych

Katedra: Katedra distribuovaných a spolehlivých systémů

Vedoucí bakalářské práce: doc. RNDr. Jan Kofroň, Ph.D., Katedra distribuovaných a spolehlivých systémů

Abstrakt: Abstrakt práce přeložte také do češtiny.

Klíčová slova: klíčová slova, klíčové fráze

Contents

1 Introduction

1.1 Goals

Describe the goals of this work, what we added and what we expect.

2 Definitions

Describe theory needed to understand the following chapters.

2.1 Transition System

2.2 Satisfiability Modulo Theories

2.3 OpenSMT

3 Golem

What Golem is. How it works. What inputs it recieves. How is the framework structured (language etc.). Analyze how we integrate our engine into it (library, different language or the same way as other engines are integrated.

4 PDKind

Describe the individual procedures of the algorithm and in each part analyze how the implementation went. If there were more ways to do it, compare them. The last section should describe how we also added validity witnesses because Golem and other engines in it produce them).

4.1 Induction vs k-Induction

4.2 Rechability checking procedure

4.3 PD-Kind procedure

4.4 Push procedure

4.5 Validity checking

5 Implementation

Describe the API, the main functions of the engine, its structure and how we used other parts of Golem.

5.1 Reachability class

5.1.1 reachable

5.1.2 checkReachability

5.2 PD-Kind engine

5.2.1 solve

5.2.2 push

5.2.3 generalize

5.3 Data structures

5.3.1 Reachability frame

5.3.2 Induction frame

6 Experiments

Compare PDKind with other engines in Golem. Possibly with other solvers.

I also noticed that there is a part in the code where we are supposed to pick a number between k_1 and k_2. So far it always picks k_1. We could make more approaches and compare them.

7 Conclusion

List of Figures

List of Tables

List of Abbreviations

A Attachments

A.1 First Attachment