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A Theory of Refinement of Cyber-Physical-Systems into Implementations

Bachelor's Thesis of

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I declare that I have developed and written the enclosed thesis completely by myself, and have not used sources or means without declaration in the text.

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Please replace with actual values

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(Daniel H. Draper)

Abstract

English abstract.

Zusammenfassung

Deutsche Zusammenfassung

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1 Introduction

The following Bachelorthesis will try to formalize the following process: Replacing the abstract notion of the control program in a verified (by KeYmaera) Cyber-Physical-System (*CPS*) with an actual implementation through a form of Formal Refinement and being able to verify that the entire CPS still satisfys the required safety constraints, using both KeYmaera and KeY.

   CPS are generally modelled as either Hybrid Automata or - Programs.(See ref. [**platzerb**]). Mostly, this means, that an abstract version of the discrete control program is modelled, often as a non-deterministic assignment of a control value (See app. **??**). To replace this non-deterministic assignment with an actual implementation a certain "glue" or "coupling" has to be found to translate discrete and real continous values into each other. To explain this process we will take a look at the following:

   I: CPS Watertank (Example taken from KeYmaera) refined.

   II: Introduction of Formalized used in both examples.

   III: CPS Gear-Backlash (See ref. [**bla**]) refined.

2 First Content Chapter

The content chapters of your thesis should of course be renamed. How many chapters you need to write depends on your thesis and cannot be said in general.

Check out the examples theses in the SDQWiki:

`https://sdqweb.ipd.kit.edu/wiki/Abschlussarbeit/Studienarbeit`

Of course, you can split this .tex file into several files if you prefer.

2.1 First Section

…

2.2 Second Section

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3 Second Content Chapter

...

3.1 First Section

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3.2 Second Section

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Add additional content chapters if required by adding new .tex files in the `sections/` directory and adding an appropriate `\include` statement in `thesis.tex`.

4 Evaluation

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4.1 First Section

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4.2 Second Section

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4.3 Third Section

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5 Conclusion

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A Appendix

A.1 Images

Placeholder

Figure A.1: Watertank Hybrid Program and - Automata with Non-Deterministic Control Program Abstraction marked.