Thesis Topic – A Tool for Regular Real Analysis

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1 Project Tasks

In recent work (www.cs.rice.edu/~sc40/pubs/lics13.pdf), a new approach was presented to encode functions on the real numbers using Büchi automata [CSV13]. Automata-based constructions are given for composing simple functions and for deciding properties of functions like continuity.

The goals of the thesis would be the following:

• Familiarize yourself with the literature and choose a suitable library for Büchi-Automata (e.g. http://spot.lip6.fr/wiki/).

• Implement the constructions from the paper, develop optimized variants, and produce a library to aid experimentation with regular real functions (e.g. enable easy construction of functions via several predefined primitive functions).

• Complete the missing proofs of constructions (e.g. automata constructions for linear combinations of functions, fixed-point computation of regular functions).

• (Practice) Experiment with your tool and assess the practicality of the approach.

• (Practice) Investigate Applications [CGLN11, CGL10] (e.g. automatic stability analysis of controllers)

• (Theory) Try to lower the complexity of the problem of recognizing a regular function or prove PSPACE hardness.

• (Theory) Investigate how to check differentiability of certain regular functions. To this end, use your tool to identify a suitable subclass of functions since the general problem might be hard.

This topic can be pursued as a Bachelor’s thesis, Master’s thesis, or as a guided research project, depending on your interests and level of expertise.

2 Contact

If you are interested, please write an email to Maximilian Schlund (schlund@model.in.tum.de) or just drop by at my office (Room 03.11.055).
References

