

Report of the 1st year of Doctorate 2017/18

Name: Franziskus Wiesnet

Supervisor: Prof. Dr. Peter Schuster

Name of the thesis: The computational Content of Abstract Algebra

Research Fields:

At the beginning of my PhD studies I have considered the signed digit representation of real numbers. I developed an algorithm which takes a sequence of reals and gives back its limit if it exists. To get this algorithm, I used the method of program extraction and the proof assistant Minlog. My results was submitted in a paper, which is now under review for the anthology of the Meeting CCC 2017 in Nancy. There I have given a talk which was also about the signed digit representation. In the 1st Swiss-Italian Workshop on Proof and Computation and ABM 2018 I gave a talk about my new work on the signed digit streams and the developed algorithm.

Form 01.06.2018 to 24.08.2018 I have visited the Hausdorff Institute in Bonn, where I have met many peoples who work in the same research field as me. There I have also started my research regarding the functional interpretation with states. It is based on a paper of Thomas Powell. One of my aims is to extend the definitions to the realizability of TCF (theory of computational functionals) and to look how far one can do program extraction with states. Another goal is to find applications and initiate case studies on the functional interpretation with states. Regarding this I have already proven Herbrand's theorem using this method. In the Münchenwiller Meeting Autumn 2018 I have given a talk about the program extraction with states.

Currently Thomas Powell an I try to expand the theory of program extraction in algebra. Here we are primarily interested in countable commutative algebra and our method is, to formalise some of the tricks used in reverse mathematics to show that a theorem is equivalent to arithmetical comprehension and to extract some bar recursive realizer for one or two of these theorems.

Courses at the University of Trento:

- **Homological Algebra** given by Edoardo Ballico

As exam I wrote a paper about Mitchell's embedding Theorem.

- **Algebraic Geometry II** given by Sola Conde

As exam I gave a talk about the Ax-Grothendick Theorem.

- **Model Theory** given by Stefano Baratella

As exam I gave a talk about saturated models.

Conferences, Workshops and Autumn School:

- **ABM 2017** in Munich from 14.12.2017 to 15.12.2018
<http://www.math.lmu.de/~petrakis/ABM17.php>
- **1st Swiss-Italian Workshop on Proof and Computation** in Verona from 18.01.2018 to 19.01.2018
<https://logicseminarverona.wordpress.com/2017/11/30/save-the-date-2/>
- **Computational Approaches to the Foundations of Mathematics** in Munich from 11.04.2018 to 13.04.2018
https://www.mathematik.uni-muenchen.de/aktuelles/news/workshop_schwichtenberg/index.html
- **ABM 2018** in Bern from 26.04.2018 to 27.04.2018
<http://abm.inf.unibe.ch/organization.html>
- **Types, Homotopy Type theory, and Verification** in Hausdorff Research Institute for Mathematics in Bonn from 04.06.2018 to 08.06.2018
<https://www.him.uni-bonn.de/programs/past-programs/past-trimester-programs/types-sets-constructions/workshop-types-homotopy-type-theory-and-verification/>
- **Proofs and Computation** in Hausdorff Research Institute for Mathematics in Bonn from 02.07.2018 to 06.07.2018
<https://www.him.uni-bonn.de/programs/past-programs/past-trimester-programs/types-sets-constructions/workshop-proofs-and-computation/>
- **Proof, Computation, Complexity** in Hausdorff Research Institute for Mathematics in Bonn from 19.07.2018 to 20.07.2018
<https://www.him.uni-bonn.de/programs/past-programs/past-trimester-programs/types-sets-constructions/workshop-proof-computation-complexity/>
- **Constructive Mathematics** in Hausdorff Research Institute for Mathematics in Bonn from 06.08.2018 to 10.08.2018
<https://www.him.uni-bonn.de/programs/past-programs/past-trimester-programs/types-sets-constructions/workshop-constructive-mathematics/>
- **Autumn School "Proof & Computation"** in Fischbachau from 16.09.2018 to 22.09.2018
<http://resources.illc.uva.nl/LogicList/newsitem.php?id=8906>
- **Münchenwiler Meeting Autumn 2018** in Münchenwiler from 24.10.2018 to 25.10.2018
<http://mw.inf.unibe.ch/index.html>

Publications

- **Introduction to Minlog** published by World Scientific in the volume "Proof and Computation"; Editors: Klaus Mainzer, Peter Schuster and Helmut Schwichtenberg; July 2018.
<https://www.worldscientific.com/worldscibooks/10.1142/11005>
- Under review: **Limits with Signed Digit Streams** <https://arxiv.org/abs/1807.10492>