Michael **Musty**

Ph.D. Candidate, Mathematics, Dartmouth College

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Education

Ph.D. Mathematics, Dartmouth College, Hanover, New Hampshire, USA — expected 2019

M.Sc. Mathematics, University of Vermont, Burlington, Vermont, USA — 2014

B.A. Mathematics/Scientific Computing, Boston College, Chestnut Hill, Massachusetts, USA — 2008

Research Experience

2-Group Belyi Maps, Ph.D. Thesis — expected 2019

In this thesis, I develop and implement an algorithm to compute a database of Galois Belyi maps with monodromy group a 2-group. This database contains Belyi maps up to degree 256. I use this data to pose conjectures about these objects. For instance, every 2-group Belyi map up to degree 256 has refined passport size 1, and partially proven results point towards the possibility that this is true in general. In addition to forming conjectures, I use this data to search for number fields unramified away from 2.

- repository: https://github.com/michaelmusty/solvabledessins
- visualization: https://dessin-explorer.org

Computing Canonical Rings of Hilbert Modular Forms, Programmer — 2018

I worked on a large (10 person) team to implement techniques to compute canonical rings of Hilbert modular forms. I was responsible for the data structure to store and compute with Fourier expansions of Hilbert modular forms necessary to support these computations.

- repository: https://github.com/edgarcosta/hilbertmodularforms

A Database of Belyi Maps, Co-author — 2018

In this paper, we compute a database of thousands or Belyi maps up to degree 9. On top of the group effort to compute an exhaustive list of Belyi maps, my main responsibility in this project was implementing the database backend using Magma (see repository below) to save the results. I then worked in a team of 4 to migrate the data over to the LMFDB (www.lmfdb.org).

- Awarded Selfridge Prize at ANTS-XIII: http://www.math.grinnell.edu/~paulhusj/ants2018/index.html
- repository: https://github.com/michaelmusty/BelyiDB
- LMFDB: http://beta.lmfdb.org/Belyi

Understanding the cost of dermatologic care: A survey study of dermatology providers, residents, and patients, Co-author — 2017

Using R, I ran the statistical analysis for survey results in this dermatology study and generated Likert scale visualizations to analyze the data.

Numerical calculation of three-point branched covers of the projective line, Co-author — 2014

In this paper, we implement a general numerical method to compute Belyi maps using power series expansions of modular forms. I implemented code to visualize Belyi maps as (equivalent) dessins d'enfants conformally embedded in the hyperbolic unit disk. My code produced figures drawn using PSTricks (see Figure 1).

Computing Iwasawa λ-Invariants, M.Sc. Thesis — 2014

In my M.Sc. thesis I implemented an algorithm to compute the Iwasawa λ-invariant of an abelian number field in Magma. Using these computations, I was able to correct some mistakes in the literature.

Publications

Peer-Reviewed Articles

[Mus+19] A Database of Belyi Maps
Michael Musty, Sam Schiavone, Jeroen Sijsling, John Voight
(to appear in conference proceedings for ANTS-XIII) The Open Book Series 2 (2019). Mathematical Sciences Publishers, 2019

[Ste+17] Understanding the cost of dermatologic care: A survey study of dermatology providers, residents, and patients
Aaron J Steen, Julianne A Mann, Valerie M Carlberg, Alexa B Kimball, Michael J Musty, Eric L Simpson
Journal of the American Academy of Dermatology 76.4 (2017) pp. 609–617. Elsevier, 2017

[Klu+14] Numerical calculation of three-point branched covers of the projective line
Michael Klug, Michael Musty, Sam Schiavone, John Voight
LMS Journal of Computation and Mathematics 17.1 (2014) pp. 379–430. London Mathematical Society, 2014

Selected Talks

[1] 2-Group Belyi Maps
JMM Special Session on Number Theory, Arithmetic Geometry, and Computation, Baltimore, MD, January 2019

[2] A Database of Belyi Maps
Simons Collaboration Short Talks, Cambridge, MA, August 2018

[3] 2-Group Belyi Maps
Quebec Maine Number Theory Seminar, October 2017

[4] Computing Iwasawa λ-Invariants
Dartmouth Number Theory Seminar, Hanover, NH, February 2015

Work Experience

Graduate Research and Teaching Assistant, Dartmouth College, Hanover, NH, USA 2014-Present

Graduate Research and Teaching Assistant, University of Vermont, Burlington, VT, USA 2012-2014

Adjunct Professor, Norwich University, Northfield, VT, USA 2011-2013

Seasonal Landscaper, JM Landscaping, Bradford, VT, USA 2000-2011

Shipping Assistant, Pleasant View Gardens, Loudon, NH, USA 2009-2010

Permanent Substitute Teacher, Merrimack Valley High School, Penacook, NH, USA 2009-2010

Graduate Research and Teaching Assistant, McGill University, Montreal, QC, Canada 2008-2009

Misc Laborer, Glen Farm, Piermont, NH, USA 1990-2000

Community

Dartmouth Mathematics Youth Summer Program, Guest Lecturer, Hanover, NH, USA 2016
I gave four guest lectures on probability and knot theory and helped organize this two week summer program.

Johns Hopkins Program for Talented Youth, Guest Lecturer, Hanover, NH, USA 2015
I gave a guest lecture on group theory.

Joshua M. Stimson Math Program, Organizer, North Haverhill, NH, USA 2011-2012
I organized a four week long summer program for advanced middle school students. I was the organizer for the first two years of this summer program.

Teaching Experience

Below is a list of university level courses (21 classroom courses, 5 online courses) I have taught at Dartmouth College, University of Vermont (UVM), and Norwich University, from 2011 to present. This list does not include any grading, teaching assistantships, or summer programs.

- 2018 Fall
  - (Dartmouth) MATH001 Calculus with Algebra
- 2017 Summer
  - (Dartmouth) MATH022 Linear Algebra with Applications
    https://math.dartmouth.edu/~m22x17/
- 2016 Fall
  - (Dartmouth) MATH001 Calculus with Algebra
- 2014 Spring

  - (UVM) MATH017B Applications of Finite Mathematics
- 2013 Fall
  - (UVM) MATH019K Fundamentals of Calculus I
- 2013 Spring
  - (UVM) MATH017B Applications of Finite Mathematics
  - (Norwich) MA102-G Mathematics: A Liberal Art II
  - (Norwich) MA232-L Elementary Statistics (online)
- 2012 Fall
  - (UVM) MATH019H Fundamentals of Calculus I
  - (Norwich) MA101-B Mathematics: A Liberal Art I
  - (Norwich) MA212-A Finite Mathematics
  - (Norwich) MA212-B Finite Mathematics
  - (Norwich) MA232-L Elementary Statistics (online)
- 2012 Summer
  - (Norwich) MA102-A Mathematics: A Liberal Art II (online)
  - (Norwich) MA232-L Elementary Statistics (online)
- 2012 Spring
  - (Norwich) MA107-C Precalculus Mathematics
  - (Norwich) MA232-A Elementary Statistics
  - (Norwich) MA232-E Elementary Statistics
  - (Norwich) MA232-G Elementary Statistics
- 2011 Fall
  - (Norwich) MA101-A Mathematics: A Liberal Art I
  - (Norwich) MA101-E Mathematics: A Liberal Art I
  - (Norwich) MA107-B Precalculus Mathematics
  - (Norwich) MA232-L Elementary Statistics (online)
- 2011 Spring
  - (Norwich) MA102-G Mathematics: A Liberal Art II
  - (Norwich) MA102-K Mathematics: A Liberal Art II
  - (Norwich) MA108-B Applied Calculus

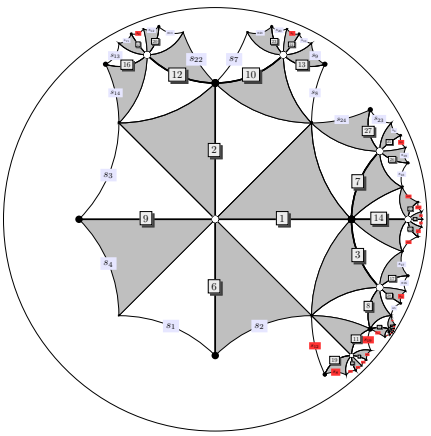

Figure 1: A genus 5 dessin d'enfant drawn using LaTeXand PSTricks.