

# Christopher J. Swierczewski

# Curriculum Vitae

Department of Applied Mathematics  
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## Areas of Interest

- General:** Complex Algebraic Geometry, Partial Differential Equations  
Numerical Analysis, Computational Mathematics
- Emphasis:** Riemann Surfaces, Computational Geometry, Abelian Functions  
Symbolic and Numerical Computation, Nonlinear Waves

## Education

- *Ph.D. in Applied Mathematics*, University of Washington, Seattle, Expected December 2015  
Advisor: Bernard Deconinck
- *M.S. in Applied Mathematics*, University of Washington, Seattle, June 2010  
Masters Project: *A Python Implementation of Chebyshev Functions*
- *B.S. in Mathematics (Comprehensive) with Distinction*, University of Washington, Seattle, June 2008  
Thesis: *Connections Between the Sato-Tate Conjecture and the Generalized Riemann Hypothesis*  
Advisor: William Stein

## Publications

- B. Deconinck, M. S. Patterson, C. Swierczewski, *Computing the Riemann Constant Vector*, Submitted for publication, 2015, <http://www.cswiercz.info/assets/files/rcv.pdf>.
- C. Swierczewski, *Introduction to Differential Equations Using Sage (Book Review)*, SIAM Review, Book Reviews, 56(2), 373–382. <http://dx.doi.org/10.1137/140973669>.
- C. Swierczewski, B. Deconinck, *Computing Riemann theta functions in Sage with applications*, Mathematics and Computers in Simulation, Available online 16 May 2013, ISSN 0378-4754, <http://dx.doi.org/10.1016/j.matcom.2013.04.018>.

## Presentations

### Invited Speaker

- *Calculus on Riemann Surfaces in Python*, Symbolic Computation Seminar, North Carolina State University, Raleigh, North Carolina. 18-20 March 2013.

## Conferences and Workshops

- *Calculus on Riemann Surfaces in Python*, The Eighth Annual IMACS Conference on Nonlinear Evolution Equations and Wave Phenomena, Athens, Georgia. 25-28 March 2013.
- *Some Computational Problems Using Riemann Theta Functions in Sage*, AMS 2011 Fall Western Section Meeting, Salt Lake City, Utah. 22-23 October 2011.
- *Some Computational Problems Using Riemann Theta Functions in Sage*, SIAM Conference on Applied Algebraic Geometry, Chapel Hill, North Carolina. 6-9 October 2011.
- *A Python Implementation of Chebyshev Functions*, International Council for Industrial and Applied Mathematics (ICIAM), Vancouver, British Columbia, Canada. 18-20 July 2011.

- *Computing Bitangents of Quartics Using Riemann Theta Functions* (Poster), Algebraic Geometry in the Sciences, Center for Mathematics and Applications, Oslo, Norway. 10-14 January 2011.
- *Computing Bitangents of Quartics Using Riemann Theta Functions* (Poster), The Higher Genus Sigma Function and Applications, International Center for Mathematical Sciences, Edinburgh, UK. 11-15 October 2011.

## Seminars and Colloquia

- *Object-Oriented Design in Scientific Software (Part 2)*, Numerical Analysis Research Group, Seattle, Washington. 24 April 2014.
- *Object-Oriented Design in Scientific Software (Part 1)*, Numerical Analysis Research Group, Seattle, Washington. 17 April 2014.
- *An Introduction to GPGPU Computing (Part 2)*, Applied Mathematics Special Topics Seminar, Seattle, Washington. 15 November 2012.
- *An Introduction to GPGPU Computing (Part 1)*, Applied Mathematics Special Topics Seminar, Seattle, Washington. 8 November 2012.
- *A Sample of Scientific Computing in Python*, Undergraduate Mathematical Sciences Seminar, Seattle, Washington. 17 May 2012.
- *Abelfunctions: Software for Computing with Riemann Surfaces*, Mathematical Methods Seminar, Seattle, Washington. 27 March 2012.
- *Determinantal Representations of Algebraic Curves and Riemann Theta Functions*, Convex Algebraic Geometry Seminar, Seattle, Washington. 18 February 2011.
- *Polynomial Approximations to Functions*, Undergraduate Mathematical Sciences Seminar, Seattle, Washington. 19 January 2011.
- *Computing Two-Phase Solutions to the Kadomtsev-Petviashvili Equation*, Mathematical Methods Seminar, Seattle, Washington. 4 January 2011.
- *Computing Three-Phase Solutions to the Kadomtsev-Petviashvili Equation*, Solitons and Nonlinear Waves Course: Final Talks, Seattle, Washington. 9 December 2010.

## Research Projects

- **ABELFUNCTIONS: A Python library for computing with complex algebraic curves, Riemann surfaces, and Abelian functions.** <http://abelfunctions.cswiercz.info>
  - Implementation of routines and tools for computing with Riemann theta functions and Riemann surfaces in a Python-based open-source mathematical software package.
  - Open-source code available on GitHub: <https://github.com/cswiercz/abelfunctions>
- **ZIPPER Development**
  - ZIPPER is a collection of Fortran programs developed by Donald Marshall of the Department of Mathematics at the University of Washington for computing conformal maps.
  - Integrated the software into Sage and added a web-based, interactive front-end.
  - Added functionality to the core library including routines for computing the Carleson map.
- **Masters Project: A Python Implementation of Chebyshev Functions**
  - Studied the Chebfun system developed by Lloyd Trefethen et. al. and implemented core functionality in Python using the Numpy/Scipy Python libraries.
  - Collaborated with Trefethen on porting Chebfun to an open-source license.
- **CLAWPACK Development**
  - CLAWPACK is a Fortran program developed by Randall Leveque for numerical solutions to hyperbolic partial differential equations.
  - Performed foundational work on conversion of CLAWPACK to a dynamic library.
  - Attended Scipy 2009 conference on scientific computing in Python.

- *Senior Thesis: Connections Between the Sato-Tate Conjecture and the Generalized Riemann Hypothesis*
  - Proved equivalence of Sato-Tate conjecture and Generalized Riemann Hypothesis for elliptic curves over the rational numbers.
  - Performed computational verification of the Sato-Tate conjecture for rational elliptic curves. Results published in a paper by Barry Mazur in the AMS Bulletin v.45 no.2.

## Professional Experience

- *Research Mathematician*, Institute for Defense Analysis: Center for Communications Research, La Jolla, CA. June – August 2012
- *Software Developer*, Simulab Corporation, Seattle, WA. January 2009 – March 2009.
  - Researched theory and applications of Hidden Markov Models to problems in control theory.
  - Implemented Hidden Markov Model C/C++ library, GHMM, in the EDGE project: a surgical trainer for evaluating surgeon performance.
- *Sage: Mathematics Software Developer*, Department of Mathematics, University of Washington, Seattle, WA. September 2007 – September 2008.
  - Implemented the Opentick financial data acquisition API. Created a new mathematical finance package. Devised methods of wrapping asynchronous functions in a synchronous environment.
  - Designed tests and wrote documentation for advanced mathematical functions in Python, Cython, and C/C++ under a UNIX environment.
  - Collaborated with other Sage developers from Germany, France, and Canada.
- *Applied Research Mathematician*, National Security Agency, Ft. Meade, MD. June – August 2007.
  - Applied algebraic, probabilistic, and statistical methods to improve cryptanalytic attacks against telecommunication encryption standards.
  - Collaborated with mathematicians in researching cryptographic algorithm weaknesses. Implemented algorithms in C.
  - Received background check in Spring 2007 and TOP SECRET clearance.
- *Teaching Assistant and Math Camp Counselor*, Department of Mathematics, University of Washington, Seattle, WA. June – August 2005 and 2006.

## Professional Activities and Service

- SIAM University of Washington Student Chapter: President, University of Washington, (September 2013 – August 2014)
- SIAM University of Washington Student Chapter: Math Fair Co-Organizer, Lockwood Elementary School, Seattle, WA. (December 2011, 2012)
- Math Hour Olympiad: Judge, University of Washington, (June 2013, 2014)
- SIAM University of Washington Student Chapter: Webmaster, University of Washington, (September 2011 – August 2013)
- Applied Mathematics Systems Administrator, University of Washington, (September 2011 – March 2014)
- Numerical Analysis Research Club Moderator, University of Washington, Department of Applied Mathematics. (Winter – Spring 2009)

## Awards

- SIAM Student Chapter Certificate of Recognition, Society for Industrial and Applied Mathematics, 2014.
- Boeing Service Award, University of Washington, Applied Mathematics, 2013.
- American Mathematical Society Sectional Meeting Travel Grant, October 2011.

- University of Alaska Fairbanks Travel Grant, January 2011.

## Teaching Experience

- Instructor, University of Washington, Seattle:
  - AMATH 301: Beginning Scientific Computing Summer 2014
  - AMATH 301: Beginning Scientific Computing Summer 2011
- Teaching Assistant, University of Washington, Seattle:
 

- AMATH 301: Beginning Scientific Computing	Winter 2015
- AMATH 351: Introduction to Differential Equations and Applications	Autumn 2014
- AMATH 301: Beginning Scientific Computing	Winter 2011
- AMATH 301: Beginning Scientific Computing	Autumn 2010
- MATH 125: Calculus with Analytic Geometry II	Spring 2010
- MATH 124: Calculus with Analytic Geometry I	Winter 2010