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University of Wisconsin – Eau Claire

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Silviana Amethyst

Professional Experience

2017 - **Assistant Professor**

Department of Mathematics,
University of Wisconsin – Eau Claire

Fall 2019 **Visiting Scholar**

Institute for Computational and Experimental Research in Mathematics (ICERM),
Brown University, Semester Program: Visualizing Mathematics

Fall 2018 **Visiting Scholar**

Institute for Computational and Experimental Research in Mathematics (ICERM),
Brown University, Semester Program: Nonlinear Algebra

2014 - 2017 **Postdoctoral Research Associate**

Department of Applied and Computational Mathematics and Statistics,
University of Notre Dame, Notre Dame

Department of Mathematics, North Carolina State University, Raleigh

Applications of numerical algebraic geometry

Mentor – Jonathan Hauenstein

2013 **Postdoctoral Researcher**

Department of Mathematics, Colorado State University, Fort Collins

Real numerical algebraic geometry.

Mentor – Dan Bates

Fall 2009 **Research Assistant**

Huygens Laboratorium, Universiteit Leiden, Holland

Mentor – Martin Van Hecke

2007 - 2012 **Graduate Research Assistant, Graduate Teaching Assistant**

Department of Mathematics, Colorado State University, Fort Collins

Advisors – Vakhtang Putkaradze, Tony Maciejewski

Education

- 2012 **Doctor of Philosophy, Mathematics**
Colorado State University, Fort Collins,
 Applied Mathematics
 Advisors – Vakhtang Putkaradze (Mathematics) & Tony Maciejewski (Electrical & Computer Engineering)
- 2009 **Master of Science, Mathematics**
Colorado State University, Fort Collins,
 Applied Mathematics
 Advisor – Vakhtang Putkaradze
- 2004 **Bachelor of Arts, Liberal Arts**
Colorado State University, Fort Collins
 - Minor in Mathematics

Students & mentees

Undergraduate research mentees – UWEC

Samantha Maurer & William O'Brien – A 3D printed Arduino powered electronic Barth Sextic
 Foong Min Wong – Singularity-Aware Solidification of Algebraic Surfaces
 Foong Min Wong – 3D stereoscopic animations of algebraic surfaces using Bertini real and Blender through Python
 Foong Min Wong & Dan Hessler – Visualization of Algebraic Surfaces Using Python and Bertini_real
 Sarah Ericson & Dan Hessler – Application of machine learning to NAG
 Foong Min Wong & David Bachmeier – A 3D printed gallery of algebraic surfaces

Undergraduate research mentees – Notre Dame

Michael Padala – Porting Bertini_real to Windows under Cygwin
 Pierce Cunneen – Importing data from Bertini_real to Python
 Elizabeth Sudkamp – Documentation, symbolics for Bertini_real
 Nicole Ho – Porting Bertini_real visualization to Python
 Chris Lembo – Documentation, examples, and videos for Bertini_real
 Travis Wert – User-supplied critical point sets
 Sam Cavender – Usability and tuning of Bertini_real
 Alex Sievern – Porting Bertini_real to the CMake build system

Grants

- ✦ UWEC Student-Faculty Research Collaboration – “A 3D printed Arduino powered electronic Barth Sextic”
 Summer 2020
- ✦ UWEC Student-Faculty Research Collaboration – “Singularity-Aware Solidification of Algebraic Surfaces”
 Fall 2019
- ✦ UWEC Student-Faculty Research Collaboration – “3D stereoscopic animations of algebraic surfaces using Bertini real and Blender through Python”
 Summer 2019

- ★ UWEC Student-Faculty Research Collaboration – “Visualization of Algebraic Surfaces Using Python and Bertini_real”
September 2018 - May 2019
- ★ UWEC Student-Faculty Research Collaboration – “Application of machine learning to numerical algebraic geometry”
May 2018 - September 2018
- ★ UWEC Student-Faculty Research Collaboration – “Application of machine learning to numerical algebraic geometry”
September 2017 - May 2018
- ★ UWEC Student-Faculty Research Collaboration – “A 3D printed gallery of algebraic surfaces”
September 2017 - May 2018
NSF DMS 1547743
"Workshop on Software and Applications of Numerical Algebraic Geometry"
September 1, 2015 - August 31, 2016
\$19,020 PI: Hauenstein, co-PI: **Brake**, Sommese, and Wampler

Courses Taught

Calculus I, Math114, UWEC, Spring 2019, Spring 2020

Programming for Data Science, DS710, UWEC, Fall 2017 - Fall 2018, Fall 2019-Spring 2020

Introduction to Differential Geometry, Math338, UWEC, Spring 2019

Topological Data Analysis – Independent Study, Math399, UWEC, Fall 2017

Probability and Mathematical Statistics, Math345, UWEC, Fall 2017

Advanced Scientific Computing, Notre Dame, Spring 2017

Scientific Computing, Notre Dame, Fall 2014, Spring 2015, Fall 2015, Spring 2016, Fall 2016

Math Methods II, Notre Dame, Fall 2015

Calculus I for Life and Management Sciences, North Carolina State, Summer 2015

Computational Math for Life & Management Sciences, North Carolina State, Summer 2015

Calculus III for Scientists and Engineers, Colorado State, Fall 2013, Fall 2010

Calculus I for Scientists and Engineers, Colorado State, Fall 2008

Calculus I for Biological Scientists, Colorado State, Fall 2007, Spring 2008, Summer 2009

Publications

Accepted /
Appeared

- KM Nam, B. Gyori, S. Amethyst, D. Bates, J. Gunawardena, “Robustness and parameter geography in post-translational modification systems”. PLOS Computational Biology, 2020.
- D. Brake, N. Daleo, J. Hauenstein, S. Sherman. “Solving critical point conditions for the Hamming and taxicab distances to solution sets of polynomial equations.” ISSAC 2019.
- D. Brake, J. Hauenstein, FO. Schreyer, A. Sommese, and M. Stillman,. “Singular value decomposition of complexes.” SIAM Journal on Applied Algebraic Geometry 2019.
- D. Brake, J. Hauenstein, C. Vinzant. “Computing complex and real tropical curves using monodromy.” JPAA, 2019.
- D. Brake, D. Bates, W. Hao, J. Hauenstein, A. Sommese, C. Wampler. “Bertini_real: Software for Real Algebraic Sets.” ACM ToMS, 2017.
- D. Brake, J. Hauenstein, A. Murray, D. Myszka, C. Wampler. “The complete solution of Alt-Burmester synthesis problems for four-bar linkages.” ASME JMR, 2016.
- D. Brake, J. Hauenstein, A. Liddell. “Validating the Completeness of the Real Solution Set of a System of Polynomial Equations.” ISSAC, Waterloo, Canada. July 2016.
- D. Brake, J. Hauenstein, A. Liddell. “Decomposing Solution Sets of Polynomial Systems Using Derivatives.” ICMS, Berlin, Germany. July 2016.
- D. Brake, D. Bates, V. Putkaradze, A.A. Maciejewski. “Workspace Multiplicity and Fault Tolerance of Cooperating Robots.” Accepted to *Mathematical Aspects of Computer and Information Sciences (MACIS)*, Berlin, Germany. November 2015.
- D. Brake, J. Hauenstein, A. Sommese. “Numerical Local Irreducible Decomposition.” *MACIS*, Berlin, Germany. November 2015.
- D. Bates, D. Brake, W. Hao, J. Hauenstein, A. Sommese, C. Wampler. “Bertini_real: Software for One- and Two-Dimensional Real Algebraic Sets.” *International Congress on Mathematical Software (ICMS)*, Seoul, South Korea. August 2014.
- D. Bates, D. Brake, J. Hauenstein, A. Sommese, C. Wampler. “On Computing a Cell Decomposition of a Real Surface Containing Infinitely Many Singularities.” *ICMS*, Seoul, South Korea. August 2014.
- D. Brake, V. Putkaradze. “Reduced Systems for Intrinsic Localized Modes on an Infinite Oscillator Array.” *Nonlinear Theory and Its Applications (NOLTA)*, IEICE, 2013.
- D. Brake, H. Xu, A. Hollowell, G. Balakrishnan, C. Hains, M. Marconi, V. Putkaradze. “Intrinsic Localized Modes in Two-Dimensional Vibrations of Crystalline Pillars and Their Application for Sensing.” *Journal of Applied Physics*, 2012.
- D. Brake, V. Putkaradze. “Simplified Models for Intrinsic Localized Mode Dynamics.” *NOLTA 2012*, Palma de Mallorca, Spain, October 2012.

- D. Brake, V. Putkaradze. “Intrinsic Localized Modes in Two-Dimensional Vibrations of Crystalline Pillars.” *NOLTA 2011*, Kobe, Japan, September 2011.
- D. Brake, D. J. Bates, V. Putkaradze, and A. A. Maciejewski. “Illustration of Numerical Algebraic Methods for Workspace Estimation of Cooperating Robots After Joint Failure.” *IASTED Technology Conferences*, Pittsburg, PN USA, November 2010.

Selected *student* research presentations

- **F.M. Wong**, S. Amethyst. “3D Visualization of Algebraic Surfaces Using Bertini real, Python and Blender” at JMM 2020, Denver, CO.
- **F.M. Wong**, S. Amethyst. “3D Visualization of Algebraic Surfaces Using Bertini real, Python and Blender” at CERCA 2019.
- **F.M. Wong**, D. Bachmeier, D. Brake. “3D Printing Herwig Hauser’s Gallery of Algebraic Surfaces with Bertini_real” at SIAM AN18, Portland, OR.
- **D. Hessler**, S. Ericson, D. Brake. “Using Machine Learning to Control a Path Tracker” at SIAM AN18, Portland, OR.
- **F.M. Wong**, **D. Bachmeier**. “3D Printing Herwig Hauser’s Gallery of Algebraic Surfaces with Bertini_real”. Poster at CERCA 2018.
- **D. Hessler**, **S. Ericson**. “Application of Machine Learning to Numerical Algebraic Geometry” Poster at CERCA 2018.
- **F.M. Wong**, **D. Bachmeier**, **D. Brake**. Presented prints at UWEC GeekCon 2017.

Shows and displays

- Display ○ Canceled due to COVID19: 2nd Annual Mathapalooza! Art Show 2020. *Georgia Tech*. 3d models
- Display ○ Geekcon 2019. *UWEC*. Snap-together Barth Sextics
- Juried show ○ Math+Art Exhibit. *The Granoff Center at Brown University*. 70 paths to a sphere
- Display ○ Geekcon 2018. *UWEC*. 3d printed algebraic surfaces
 - Talk ○ “Techniques for real solutions to nonlinear algebraic systems”. *ICERM Semester Program on Nonlinear Algebra*, Providence. September 2018.
- Display ○ Geekcon 2017. *UWEC*. Makerspace and 3d model gallery
- Show ○ **Museum Display** *South Bend Center for History*, 2014 - 2015
 “150 Years of Science at Notre Dame”
 - 3D printed models of singular surfaces.

Selected Presentations

- “Printing Algebraic Geometry”. *LG&TBQ 2019*, Ann Arbor. June 2019.
- “Multiprecision – solving and causing problems”. *Invited talk*, CUNY. March 2019.

- “Numerical challenges to successful decomposition of real algebraic surfaces”. *SIAM AG17*, Atlanta. August 2017.
- “Regularizing Numerical Cell Decompositions”. *JMM 2017*, Atlanta. January 2017.
- “Printing Algebraic Geometry”. *Bertini Workshop*, Notre Dame. May 2016.
- “The Development of Bertini 2”. *Bertini Workshop*, Notre Dame. May 2016.
- “The Complete Solution of Alt-Burmester Synthesis Problems for Four-bar Linkages”. *AMS Spring Sectional*, UGA. March 2016.
- “Numerical Local Irreducible Decomposition”. *MACIS*, Berlin. November 2015.
- “Workspace Multiplicity and Fault Tolerance of Cooperating Robots”. *MACIS*, Berlin. November 2015.
- “Applications of Monodromy”. *Algebraic Geometry Seminar*, NC State. October 2015.
- “Advances in Software in Numerical Algebraic Geometry”. *SIAM Algebraic Geometry*, Daejeon, Korea. August 2015.
- “Applications of Real Algebraic Varieties to Tropical Geometry”. *AMA Meeting*, Colorado College. April 2015.
- “3D Printing Mathematical Surfaces”. *Notre Dame Research Symposium*, Notre Dame. April 2015. [First place in poster competition.](#)
- “Parametrized Polynomial Systems, and Real Numerical Algebraic Geometry”. *Applied Math Seminar*, University of Notre Dame. March 2015.
- “Applications of Real Algebraic Varieties”. *AMS Spring Sectional*, Michigan State University. March 2015.
- “Numerical challenges to decomposition of algebraic surfaces”. *Seminar at the School for Computing*, DePaul University. January 2015.
- “Numerically decomposing algebraic surfaces with an infinite number of singularities”. *Topology, Geometry, & Data Seminar*, Ohio State University. November 2014.
- “Printing Algebraic Surfaces with Singularities”. *AMS Fall Western Sectional*, San Francisco State University. October 2014.
- “Bertini_real: software for real algebraic sets”. *Solving Polynomial Equations*, The Simons Institute for the Theory of Computing. October 2014.
- “Bertini Real: real algebraic curve and surface cellular decomposition software”. *International Congress of Mathematical Software*, Hanyang University. August 2014.
- “Bertini_real – Numerical surface decomposition”. *East Coast Computer Algebra Day*, Duke University. April 2014. [First place in poster competition.](#)
- “A study in multistability, and criticality of real algebraic sets”. *Symbolic Computation*, North Carolina State University. April 2014.
- “From polynomials to 3D printing – How to print an algebraic surface”. *SUM Series*, North Carolina State University. February 2014.

- “Paramotopy: Parallel parameter homotopy through Bertini”. *SIAM AG13*. Colorado State University. August 2013.
- “Simplified models for Intrinsic Localized Mode dynamics”. *NOLTA 2012*. Palma de Mallorca, Spain. October 2012.
- “Nano oscillator array intrinsic localized mode pinning and travel”. *DTRA Technical Review*, Washington, DC. July 2012.
- “Nanocrystal detectors – simulation and analysis”. *Greenslopes Seminar*. Colorado State University. February 2012.
- “Intrinsic localized modes in nanocrystalline arrays”. *NOLTA Workshop 2011*, Kyoto, Japan. December 2011.
- “ILM formation in arrays of nonlinearly coupled bidirectional crystal oscillators”. *DTRA Technical Review 2011*, Washington, DC. July 2011.
- “Workspace estimation of cooperating robots after joint failure”. *SIAM Conference on Dynamical Systems, DS2011*, Snowbird. May 2011.
- “Vibrating crystals, failing robots, and Polysaurus”. *Greenslopes Seminar*, Colorado State University. April 2011.
- “Illustration of numerical algebraic methods for workspace estimation of cooperating robots after joint failure”. *Greenslopes Seminar*, Colorado State University. October 2010.
- “Foam elasticity”. *Greenslopes Seminar*, Colorado State University. February 2010.

Service & Honors

- ∞ **University of Wisconsin System Women and Science (WaS) Program Member** *UWEC*, January 2020-
- ∞ **Queer and Trans Action Committee** *UWEC*, September 2017-
- ∞ **Program Affiliate** *UWEC*, Womens' Gender and Sexuality Studies Program, Spring 2019-
- ∞ **Scholarship Committee Member** *UWEC*, Math Dept, September 2018 -
- ∞ **Volunteer at Annual Sonya Kovalevsky Day** *UWEC*, 2017 -
- ∞ **Volunteer at Annual Math Meet** *UWEC*, 2017 -
- Software PC Member** *International Symposium on Symbolic and Algebraic Computation (ISSAC)*, Summer 2020
- ★ **P.B. Poorman Award for Outstanding Achievement on Behalf of LGBTQ People** *November 2019*
- Equity, Diversity, and Inclusion (EDI) Rapid Action Task Force Member** *UWEC*, December 2019 - January 2020
- Teacher** *ICERM*, Minicourse in `git`, Fall 2019, Fall 2018

CoPresenter *ICERM*, Session on mathematical illustration with OpenSCAD, Fall 2019

Q'nnect Faculty Member *UWEC*, Fall 2017-Spring 2019

MakeUWEC Faculty Advisor *UWEC*, Fall 2017-Spring 2018

PC Member *MACIS2017*, Vienna, November 2017

Session Organizer *SIAM AG17*, Atlanta, August 2017

- Applications of Numerical Algebraic Geometry in Math, Science, and Engineering

Conference Co-organizer *Polynomials, kinematics and robotics – a conference honoring Charles Wampler*

- Notre Dame, June 2017

Panel Member *Mentoring*, Notre Dame, January 2017

- Graduate student ethics training

Session Co-organizer *JMM 2017*, Atlanta, January 2017

- Theory and Applications of Numerical Algebraic Geometry (Special Session #62)

Session Co-organizer *ICMS 2016*, Berlin, July 2016

- Software for Numerically Solving Polynomial Systems.

Session Co-organizer *SIAM AN16*, Boston, July 2016

- Structured Polynomial Equations and Applications.

Conference Co-organizer *Software and Applications of Numerical Algebraic Geometry*

- Notre Dame, May 2016

Postdoc Focus Group *Notre Dame*, 2014 - 2015

★ **First Place** *Notre Dame Research Symposium*, 2015

- Poster Competition

Minisymposium Co-organizer *SIAM AG 15*, Daejeon, Korea, 2015

- Software and Applications in Numerical Algebraic Geometry.

Science Fair Judge *Indiana Regional Science Fair*, 2015

Tutor and Assistant *Riverbend Math Center*, 2014 - 2015

- Free tutor and teacher for students of all ages.

Session Co-organizer *AMS Fall Western Sectional*, San Francisco, 2014

- Computational Algebraic Geometry and Applications in Science and Engineering.

Poster Judge *NCSU Undergraduate Research Symposium*, 2014

★ **Best Poster Award** *East Coast Computer Algebra Day*, 2014

Poster and Presentation Judge *Colorado State University*, 2013

“Celebrate Undergraduate Research and Creativity”

Trail Worker *Volunteers for Outdoor Colorado*, 2013

Boy Scout Volunteer *Troop 96, Longs Peak Council*, 1993 - 2013

- Plant flags at American veteran's graves for Memorial Day.

- Attend advancement ceremonies.

Math Day Volunteer *Colorado State University, 2006 - 2012*

- Administer and grade PROBE exam.

Graduate Student Representative *Colorado State University, 2011 - 2012, Mathematics Department*

- Graduate student liaison on graduate committee; coordinated recruitment day.

Eagle Scout *Troop 96, Longs Peak Council, 1997*

- Leadership training, held all leadership positions. Once an Eagle, always an Eagle.

Software Products

Bertini 2

github.com/bertiniteam/b2

Homotopy continuation polynomial system solver with Python bindings, scripting, and symbolic engine. Collaborative NSF-funded project.

Bertini_tropical

silviana.org/tropical

Matlab software for decomposing real and complex tropical curves in any number of dimensions. Interfaces with Bertini for numerical solving.

Bertini_real – Software for real algebraic sets.

bertinireal.com

Console software for performing numerical cellular decomposition of real algebraic curves and surfaces, with singularities, in any dimension.

Paramotopy – Parameter homotopies in parallel.

paramotopy.com

Command line software for rapidly solving discretized parametrized polynomials