

# Brian Lins

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Department of Math and Computer Science  
Hampden-Sydney College  
Box 131  
Hampden-Sydney, VA 23943

home: (804) 601-0806  
office: (434) 223-6264  
blins@hsc.edu  
<https://bclins.github.io>

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## Research Interests

Nonlinear functional analysis, nonlinear Perron-Frobenius theory, nonexpansive maps, matrix analysis, numerical ranges

## Education

**Ph.D. in Mathematics**, received October 2007; advisor: Roger D. Nussbaum  
**Rutgers University**, New Brunswick, New Jersey  
Dissertation title: **Asymptotic behavior and Denjoy-Wolff theorems for Hilbert metric nonexpansive maps**

**B.S. in Mathematics**, received May 2001  
**College of William & Mary**, Williamsburg, Virginia  
Minor in physics; Graduated with highest honors

## Positions Held

**Professor**, Department of Math and Computer Science,  
Hampden-Sydney College, *Fall 2021 - present*

**Associate Professor**, Department of Math and Computer Science,  
Hampden-Sydney College, *Fall 2014 - Spring 2021*

**Assistant Professor**, Department of Math and Computer Science,  
Hampden-Sydney College, *Fall 2008 - Spring 2014*

**Visiting Assistant Professor**, Department of Math and Computer Science,  
Dickinson College, *Fall 2007 - Spring 2008*

**Instructor and Teaching Assistant**, Department of Mathematics,  
Rutgers University, New Brunswick, New Jersey, *Fall 2003 - Spring 2007*

## Publications

- Brian Lins. Bounded fixed point sets and Krasnoselskii iterates of Thompson metric nonexpansive maps. *submitted*
- Brian Lins. Convergence of iterates in nonlinear Perron-Frobenius theory. *Discrete Contin. Dyn. Syst. Ser. B*, 28(7):3868–3886, 2023
- Brian Lins. A unified approach to nonlinear Perron-Frobenius theory. *Linear Algebra Appl.*, 675:48–89, 2023
- Brian Lins. Nonexpansive maps with surjective displacement. *J. Fixed Point Theory Appl.*, 24(1), 2022
- Brian Lins. The essential numerical range and a theorem of Simon on the absorption of eigenvalues. *ArXiv preprint*

- Brian Lins. Numerical ranges encircled by analytic curves. *Oper. Matrices*, 15(1):381–386, 2021
- Brian Lins and Ilya M. Spitkovsky. Inverse continuity of the numerical range map for Hilbert space operators. *Oper. Matrices*, 14(1):77–90, 2020
- Brian Lins, Ilya M. Spitkovsky, and Siyu Zhong. The normalized numerical range and the Davis-Wielandt shell. *Linear Algebra Appl.*, 546:187–209, 2018
- Bas Lemmens, Brian Lins, and Roger Nussbaum. Detecting fixed points of nonexpansive maps by illuminating the unit ball. *Israel J. Math.*, 224(1):231–262, 2018
- Brian Lins. Whose turn is it to drive today? *Math Horiz.*, 23(2):16–19, 2015
- Brian Lins and Parth Parihar. Continuous selections of the inverse numerical range map. *Linear Multilinear Algebra*, 64(1):87–99, 2016
- Bas Lemmens, Brian Lins, Roger Nussbaum, and Marten Wortel. Denjoy-Wolff theorems for Hilbert’s and Thompson’s metric spaces. *J. Anal. Math.*, 134(2):671–718, 2018
- Charles R. Johnson, Brian Lins, Victor Luo, and Sean Meehan. Ordering graphs in a normalized singular value measure. *Involve*, 8(2):263–273, 2015
- Timothy Leake, Brian Lins, and Ilya M. Spitkovsky. Inverse continuity on the boundary of the numerical range. *Linear Multilinear Algebra*, 62(10):1335–1345, 2014
- Timothy Leake, Brian Lins, and Ilya M. Spitkovsky. Pre-images of boundary points of the numerical range. *Oper. Matrices*, 8(3):699–724, 2014
- Craig Larson, Brian Lins, and Lon Mitchell. Graphs of unitary matrices and positive semidefinite zero forcing. *Rep. Math. Phys.*, 72(3):311–320, 2013
- Dan Corey, Charles R. Johnson, Ryan Kirk, Brian Lins, and Ilya Spitkovsky. Continuity properties of vectors realizing points in the classical field of values. *Linear Multilinear Algebra*, 61(10):1329–1338, 2013
- Philip Chodrow, Cole Franks, and Brian Lins. Upper and lower bounds for the iterates of order-preserving homogeneous maps on cones. *Linear Algebra Appl.*, 439(4):999–1005, 2013
- Daniel Corey, Charles R. Johnson, Ryan Kirk, Brian Lins, and Ilya Spitkovsky. The product field of values. *Linear Algebra Appl.*, 438(5):2155–2173, 2013
- Charles R. Johnson, Brian Lins, and Olivia Walch. The critical exponent for continuous conventional powers of doubly nonnegative matrices. *Linear Algebra Appl.*, 435(9):2175–2182, 2011
- Eduard Einstein, Charles R. Johnson, Brian Lins, and Ilya Spitkovsky. The ratio field of values. *Linear Algebra Appl.*, 434(4):1119–1136, 2011
- Brian Lins. Asymptotic behavior of nonexpansive mappings in finite dimensional normed spaces. *Proc. Amer. Math. Soc.*, 137(7):2387–2392, 2009
- Brian Lins and Roger Nussbaum. Denjoy-Wolff theorems, Hilbert metric nonexpansive maps and reproduction-decimation operators. *J. Funct. Anal.*, 254(9):2365–2386, 2008
- Brian Lins. A Denjoy-Wolff theorem for Hilbert metric nonexpansive maps on polyhedral domains. *Math. Proc. Cambridge Philos. Soc.*, 143(1):157–164, 2007
- Brian Lins and Roger Nussbaum. Iterated linear maps on a cone and Denjoy-Wolff theorems. *Linear Algebra Appl.*, 416(2-3):615–626, 2006

- Jeremy Brandman, James Fowler, Brian Lins, Ilya Spitkovsky, and Nahum Zobin. Convex hulls of Coxeter groups. In *Function spaces, interpolation theory and related topics (Lund, 2000)*, pages 213–240. de Gruyter, Berlin, 2002
- Brian Lins, Patrick Meade, Christian Mehl, and Leiba Rodman. Research problem: indefinite inner product normal matrices. *Linear and Multilinear Algebra*, 49(3):261–268, 2001
- Brian Lins, Patrick Meade, Christian Mehl, and Leiba Rodman. Normal matrices and polar decompositions in indefinite inner products. *Linear and Multilinear Algebra*, 49(1):45–89, 2001

## Awards and Honors

- John Peter Mettauwer excellence in research award, *Spring 2021*
- Six-year Elliott professorship, *Fall 2016 - Spring 2022*
- Three-year Elliott professorship, *Fall 2011 - Spring 2014*
- BIRS Research in Teams participant, *Fall 2012*
- Sectional Project NExT fellow, *Fall 2008*
- National Project NExT fellow, *Summer 2008*
- Rutgers Math Department TA teaching excellence award, *Spring 2004*
- VIGRE fellowship, *Fall 2001 - Spring 2003*
- William & Mary prize in mathematics, *Spring 2001*
- James Monroe scholar, awarded \$2000 research grant, *Summer 2000*

## Teaching Experience

### Hampden-Sydney College

Courses taught: algebraic structures, calculus I & II, complex analysis, graph theory, intermediate analysis, linear algebra, math and society, matrix analysis, measure theory, multivariable calculus, numerical analysis, prep for calculus, probability I & II, proofs and abstraction, quantum computing, statistics, statistical methods, theory of computing, topology

### Dickinson College

Courses taught: calculus I & II, differential equations

### Rutgers University, New Brunswick

Courses taught: advanced math for engineers, calculus I, linear algebra, multivariable calculus

## Presentations

- Recent developments in nonlinear Perron-Frobenius theory**, Positivity conference, *Summer 2023*
- The geothmetic meandian and other topical functions**, MD-DC-VA MAA section meeting, *Spring 2023*
- Nonexpansive maps with surjective displacement**, Invited talk, VOTCAM, *Fall 2021*
- Detecting fixed points of nonexpansive maps by illuminating the unit ball**, Special session on order-preserving operators on cones and applications, IWOTA Lisbon, *Summer 2019*

**e in a box of cereal**, Invited address, MD-DC-VA MAA section meeting, *Spring 2019*

**Inverse continuity of the numerical range map for Hilbert space operators**, AMS Special Session on Advances in Operator Theory, Operator Algebras, and Operator Semigroups, Joint AMS/MAA Meeting, Baltimore, *Winter 2019*

**Nonexpansive maps and the illumination conjecture**, UVA operator theory seminar, *Fall 2017*

**Eigenvalue crossings in Hermitian pencils and the boundary of the numerical range**, ILAS conference, *Summer 2017*

**Nonexpansive maps and the illumination conjecture**, VCU discrete math seminar, *Spring 2017*

**Continuous selections of the inverse numerical range map**, ILAS conference, *Summer 2016*

**Whose turn is it to drive today?** MD-DC-VA MAA section meeting, *Spring 2015*

**Continuous selections of the inverse numerical range map** NYU - Abu Dhabi math seminar, *Spring 2015*

**Inverse continuity of the numerical range map** University of Kent colloquium, *Spring 2015*

**Inverse continuity of the numerical range map** UVA operator theory seminar, *Fall 2013*

**Life in the matrix**, Hampden-Sydney College Phi Beta Kappa lecture, *Fall 2013*

**Denjoy-Wolff type theorems on cones**, ILAS conference, *Summer 2013*

**e in a box of cereal**, MD-DC-VA MAA section meeting, *Spring 2013*

**Nonexpansive maps and the horofunction boundary**, UVA operator theory seminar, *Fall 2011*

**Upper bounds for order-preserving homogeneous maps**, ILAS conference, *Summer 2011*

**Liberal arts mathematics on a logarithmic scale**, MD-DC-VA MAA section meeting, *Spring 2011*

**Formal eigenvectors of order-preserving homogeneous maps**, AMS Southeastern sectional meeting, *Fall 2010*

**Nonexpansive maps and the horofunction boundary**, W&M math colloquium, *Fall 2009*

**The 2<sup>n</sup> conjecture**, VCU analysis seminar, *Fall 2009*

**Nonexpansive maps and the horofunction boundary**, VCU analysis seminar, *Spring 2008*

**Nonnegative matrices**, Longwood University math colloquium, *Fall 2008*

**Open source math software**, Dickinson College Pi Mu Epsilon address, *Spring 2008*

**Checkers and game theory**, Dickinson math & computer science chat, *Fall 2007*

**Denjoy-Wolff theorems for Hilbert metric nonexpansive maps on polyhedral domains**, AMS Session on Dynamical Systems, Joint AMS/MAA Meeting, New Orleans, *Winter 2007*

**The history of logarithms and slide rules**, Graduate student pizza seminar, *Fall 2005*

**The Birkhoff-Hopf bifurcation theorem**, Graduate student nonlinear analysis seminar, *Spring 2005*

**A proof of the Brouwer fixed point theorem using differential forms**, Graduate student nonlinear analysis seminar, *Spring 2005*

**The Hilbert metric on cones**, Graduate student nonlinear analysis seminar, *Fall 2004*

**The fundamental theorem of algebra with linear algebra**, Graduate student pizza seminar, *Fall 2003*

**The geometry of Coxeter groups**, Graduate student pizza seminar, *Fall 2002*

**Gerschgorin discs**, Graduate student pizza seminar, *Spring 2002*

### Professional Service

Associate editor, MAA Classroom Resource Materials, *Spring 2014 - Fall 2019*

Treasurer MD-DC-VA section MAA, *Fall 2011 - Spring 2017*

Faculty Advisor, William & Mary REU program, *Summers, 2009-2013*

Mentor, DIMACS Research Experiences for Undergraduates program, *Summer 2002*

### College Service

Hampden-Sydney College grievance committee, *Fall 2022 - present*

Hampden-Sydney College faculty affairs committee, *Fall 2022*

Hampden-Sydney College assessment committee, *Fall 2018 - Spring 2021*

Hampden-Sydney College human research committee, *Fall 2016 - Spring 2018*

Summer research project with Reuben Retnam '17 on the critical curves of matrices, *Summer 2016*

Department chair, Department of Math and Computer Science, *Fall 2015 - Spring 2021*

Hampden-Sydney College professional development committee, *Fall 2015 - Spring 2018*

Hampden-Sydney College athletics committee, *Fall 2013 - Spring 2017*

Hampden-Sydney College technology advisory committee, *Fall 2011 - Spring 2013*

Hampden-Sydney College international studies committee, *Fall 2011 - Spring 2013*

Hampden-Sydney College admissions committee, *Fall 2009 - Spring 2011*

Putnam exam coach, Hampden-Sydney College, *Fall 2009 - Fall 2015*

Co-organizer, Panel discussion of free and open source mathematics software and textbooks at the MD-DC-VA MAA section meeting, *Fall 2009*

Co-organizer, Hampden-Sydney faculty L<sup>A</sup>T<sub>E</sub>X/Beamer seminar, *Fall 2009*

Putnam exam coach, Dickinson College, *Fall 2007*

Co-organizer, Rutgers graduate student nonlinear analysis seminar, *Fall 2004 - Spring 2005*

### Affiliations

International Linear Algebra Society (ILAS)

Mathematical Association of America (MAA)

**Citizenship** United States citizen