
Brian Sutton

Department of Mathematics
Randolph-Macon College
P.O. Box 5005
Ashland, VA 23005
bsutton@rmc.edu

Academic appointments

Randolph-Macon College

- Professor 2019–present
- Associate Professor 2011–2019
- Assistant Professor 2005–2011

Massachusetts Institute of Technology

- Recitation Instructor 2003–2004
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Education

Massachusetts Institute of Technology

- Ph.D., Mathematics 2005

Virginia Tech

- B.S., Mathematics, and B.S., Computer Science 2001
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Selected honors, grants, and appointments

Fourteenth Leslie Fox Prize

- First Place for computing the CS matrix decomposition 2009
 - An international, biennial prize in numerical analysis for a researcher under the age of thirty-one, awarded by the Institute of Mathematics and Its Applications, United Kingdom.

National Science Foundation

- Grant DMS-2012216: “RUI: Commutativity in Numerical Computation” 2020–2022
- Grant DMS-0914559: “Stable and efficient computation of the CS decomposition” 2009–2013
- Graduate Research Fellowship 2002–2005

SIAM Journal on Matrix Analysis and Applications

- Associate Editor 2013–2018

Virginia Tech College of Science

• Outstanding Recent Alumnus

2010–2011

SIAM Conference on Applied Linear Algebra

• Best Poster Blitz Presentation

2015

Publications

Books

- *Numerical Analysis: Theory and Experiments*. Society for Industrial and Applied Mathematics, Philadelphia, PA, 2019. viii+434.
 - On the Basic Library List of the Mathematical Association of America.

Manuscripts in progress or under review

1. “Low-rank completion of a partial matrix with a missing rectangular block,” with M. Gunn and C. Kent. Submitted.

Peer-reviewed journal articles

1. “Numerical construction of structured matrices with given eigenvalues.” *Spec. Matrices*. 7 (2019), no. 1, 263–271.
2. “A backward stable algorithm for computing the CS decomposition via the polar decomposition,” with E. Gawlik and Y. Nakatsukasa. *SIAM J. Matrix Anal. Appl.* 39 (2018), no. 3, 1448–1469.
3. “Low-temperature random matrix theory at the soft edge,” with A. Edelman and P-O. Persson. *J. Math. Phys.* 55 (2014), no. 6.
4. “Simultaneous multidagonalization for the CS decomposition,” with K. Kang, W. Lothian, and J. Sears. *Numer. Algor.* 66 (2014), no. 3, 479–493.
5. “Divide and conquer the CS decomposition.” *SIAM J. Matrix Anal. Appl.* 34 (2013), no. 2, 417–444.
6. “Stable computation of the CS decomposition: simultaneous bidiagonalization.” *SIAM J. Matrix Anal. Appl.* 33 (2012), no. 1, 1–21.
7. “On the minimum semidefinite rank of a simple graph,” with M. Booth, P. Hackney, B. Harris, C. R. Johnson, M. Lay, T. Lenker, L. H. Mitchell, S. K. Narayan, and A. Pascoe. *Linear Multilinear Algebra* 59 (2011), no. 5, 483–506.
8. “Computing the complete CS decomposition.” *Numer. Algorithms*. 50 (2009), no. 1, 33–65.
9. “Implicit construction of multiple eigenvalues for trees,” with C. R. Johnson and A. J. Witt. *Linear Multilinear Algebra*. 57 (2009), no. 4, 409–420.
10. “The beta-Jacobi matrix model, the CS decomposition, and generalized singular value problems,” with A. Edelman. *Found. Comput. Math.* 8 (2008), no. 2, 259–285.
11. “On the minimum rank among positive semidefinite matrices with a given graph,” with M. Booth, P. Hackney, B. Harris, C. R. Johnson, M. Lay, L. Mitchell, S. K. Narayan, A. Pascoe, K. Steinmetz, and W. Wang. *SIAM J. on Matrix Anal. Appl.* 30 (2008), no. 2, 731–740.

12. “From random matrices to stochastic operators,” with A. Edelman. *J. Stat. Phys.* 127 (2007), no. 6, 1121–1165.
13. “Tails of condition number distributions,” with A. Edelman. *SIAM J. Matrix Anal. Appl.* 27 (2005), no. 2, 547–560.
14. “Hermitian matrices, eigenvalue multiplicities, and eigenvector components,” with C. R. Johnson. *SIAM J. Matrix Anal. Appl.* 26 (2004/05), no. 2, 390–399.
15. “On the relative position of multiple eigenvalues in the spectrum of an Hermitian matrix with a given graph,” with C. R. Johnson, A. Leal Duarte, C. M. Saiago, and A. J. Witt. *Linear Algebra Appl.* 363 (2003), 147–159.
16. “Identification problem for the wave equation with Neumann data input and Dirichlet data observations,” with X. Feng, S. Lenhart, V. Protopopescu, and L. Rachele. *Nonlinear Anal.* 52 (2003), no. 7, 1777–1795.

Conference proceedings

- “Random matrix theory, numerical computation and applications,” with A. Edelman and Y. Wang. *Modern Aspects of Random Matrix Theory*, 53–82, *Proc. Sympos. Appl. Math.*, 72, American Mathematical Society, Providence, RI, 2014.

Ph.D. thesis

- “The stochastic operator approach to random matrix theory,” Ph.D. thesis, MIT, Cambridge, MA, 2005.

Software

LAPACK routine xORCSD

- Implements the Fox Prize-winning method in publication “Computing the Complete CS Decomposition.”
- Included with LAPACK, the standard package of linear algebra routines underlying MATLAB, NumPy, etc.

LAPACK routine xORCSD2BY1

- Computes the reduced 2-by-1 CS decomposition.

Selected presentations, posters, and workshops

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| SIAM Conference on Computational Science and Engineering, Fort Worth, TX
(virtual) | Mar 2021 |
| <ul style="list-style-type: none"> • “Simultaneous diagonalization of nearly commuting Hermitian matrices:
Do-one-then-do-the-other” | |
| Householder Symposium XX, Blacksburg, VA | Jun 2017 |
| <ul style="list-style-type: none"> • “On the cut locus of a flag manifold” | |
| SIAM Conference on Applied Linear Algebra, Atlanta | Oct 2015 |
| <ul style="list-style-type: none"> • “Computing geodesic rotations” | |

University of Tokyo	Jan 2014
<ul style="list-style-type: none"> • “A numerical look at quotients of the orthogonal manifold” 	
SIAM Conference on Applied Linear Algebra, Universitat Politècnica València	
<ul style="list-style-type: none"> • “Divide and conquer the CS decomposition” 	Jun 2012
SIAM Conference on Parallel Processing for Scientific Computing, Savannah, GA	
<ul style="list-style-type: none"> • “Divide and conquer the CS decomposition” • “The cosine-sine decomposition in parallel computing,” with K. Kang, W. Lothian, and J. Sears 	Feb 2012
Householder Symposium XVIII, Tahoe City, CA	Jun 2011
<ul style="list-style-type: none"> • “CSD and GSVD: stability and efficiency” 	
United States Naval Academy	Jan 2011
<ul style="list-style-type: none"> • “The complete CS decomposition” 	
Brownian Motion and Random Matrices, American Institute of Mathematics, Palo Alto	Dec 2009
Fourteenth Leslie Fox Prize Meeting, Warwick University	Jun 2009
<ul style="list-style-type: none"> • “Computing the complete CS decomposition” 	
University of Colorado at Boulder	Apr 2009
<ul style="list-style-type: none"> • “From random matrices to stochastic operators” 	
University of Maryland	Mar 2009
<ul style="list-style-type: none"> • “The CS decomposition: random matrix theory and computation” 	
Householder Symposium XVII, Zeuthen, Germany	Jun 2008
<ul style="list-style-type: none"> • “Computing the complete CS decomposition” 	
Virginia Tech	Oct 2007
<ul style="list-style-type: none"> • “Computing the complete CS decomposition” 	
University of Virginia	Sep 2007
<ul style="list-style-type: none"> • “Computing the complete CS decomposition” 	
SAMSI Program on High Dimensional Inference and Random Matrices, Research Triangle Park, NC	Sep 2006
<ul style="list-style-type: none"> • “From random matrices to stochastic operators” 	
Naval Surface Warfare Division, Dahlgren, VA	Jul 2006
<ul style="list-style-type: none"> • “A new Central Limit Theorem? An introduction to random matrix theory” 	
Workshop on Stochastic Eigenanalysis and Applications, MIT	Jul. 2006
<ul style="list-style-type: none"> • “From random matrices to stochastic operators” 	
Recent Perspectives in Random Matrix Theory and Number Theory, Isaac Newton Institute, Cambridge, UK	Mar–Apr 2004
Rocky Mountain Mathematics Consortium summer workshop, University of Wyoming	Jul 2001
<ul style="list-style-type: none"> • “Graphs and eigenvalue multiplicities” 	

Teaching

Curriculum

- Led the creation of a Major in Applied Mathematics 2019–2020
- Introduced the following courses:
 - APMA 407 Methods and Models in Applied Mathematics: A topics-based advanced undergraduate seminar
 - MATH 106 Introduction to Optimization: A general education course on optimization without calculus
 - FYEC 191 Development and Disease: An interdisciplinary first-year seminar on health studies, co-taught with biologist Traci Stevens
 - RMCS 115 Now and Later: Using Mathematics to Plan for an Uncertain Future: A first-year seminar on the mathematics of personal finance
 - HONR 113 Mathematics of Money: An honors course on mathematical models for equities and interest rates
 - HONR 269 Infinity! An honors course on historical and modern approaches to infinity

Writing

- *Numerical Analysis: Theory and Experiments*: A textbook for an undergraduate course on numerical analysis that includes early and pervasive use of Chebyshev methods

Instruction

- Methods and Models in Applied Mathematics (R-MC APMA 407)
- Numerical Analysis (R-MC MATH 442)
- Real Analysis I/II (R-MC MATH 421/422)
- Mathematics Seminar (R-MC MATH 415)
- Probability (R-MC MATH 371)
- Statistical Inference (R-MC MATH 372)
- Differential Equations (R-MC MATH 307)
- Resources, Opportunities, and Careers (R-MC MATH 215)
- Calculus I/II (R-MC MATH 131/132)
- Introduction to Optimization (R-MC MATH 106)
- Introduction to Finite Mathematics (R-MC MATH 105)
- Introduction to Statistics (R-MC MATH 111/113)
- Development and Disease (R-MC FYEC 191)
- Mathematics of Money (R-MC HONR 113)
- Infinity! (R-MC HONR 269)
- Now and Later: Using Mathematics to Plan for an Uncertain Future (R-MC RMCS 115)
- Multivariable Calculus with Theory (MIT 18.022 recitation)
- Linear Algebra (MIT 18.06 recitation)

Undergraduate research and independent study advising

Daniel Barnard

- Senior seminar project on trajectory optimization in video games 2021

Megan Gunn and Casey Kent

- Summer research project on low-rank completion of a matrix with a missing rectangular block 2020–2021

Aaric Marks and Anshu Sharma

- Summer research project comparing and contrasting measures for nearness to commutativity 2020

John Stone

- Senior seminar project on the history of the catenary 2019

Luna Tran

- Senior seminar project on the law of succession, an example of Bayesian inference 2019

Erin Kober

- Senior seminar project on historical mathematical models for thermodynamics 2018

Julia Knapp

- Senior seminar project on computational quantum chemistry 2017
- Departmental honors project on time-series analysis in chemistry 2015

Dorie Parry

- Senior seminar project on a mathematical model for robot locomotion 2017

Elen Khachatryan

- Independent study on the gamma and zeta functions 2017

Dominic Kaopua

- Senior seminar project on ranking systems for sports leagues 2016

Tracy Moriconi

- Senior seminar project on statistical inference for auditing 2015

Shuyan Zhan

- Senior seminar project on population dynamics and policy in China 2014
 - Awarded First Prize in the student paper division at the spring meeting of the MD-DC-VA section of the MAA, Apr 2015.

Eduardo Sartor

- Senior seminar project on thermal diffusivity 2013

Victoria Zimbardo

- Summer research project on a generalization of the CS decomposition to alternative partitionings of an orthogonal matrix, Schapiro Undergraduate Research Fellowship and NSF grant DMS-0914559 2013

Lisa Borum	
• Senior seminar project on quantum walks	2012
• Research assistantship on a parallel divide-and-conquer algorithm for the CS decomposition, NSF grant DMS-0914559	2013
Andrew Sloan	
• Independent study on actuarial science	2012
• Senior seminar project on the mathematics of blackjack	2011
Kingston Kang	
• Summer research project on accelerating computation of the CS decomposition on computer architectures with hierarchical memories and parallel processors, Schapiro Undergraduate Research Fellowship and NSF grant DMS-0914559	2011
William Lothian	
• Summer research project on accelerating computation of the CS decomposition, Schapiro Undergraduate Research Fellowship and NSF grant DMS-0914559	2011
• Senior seminar project on the numerical stability of a new method for simultaneous bidiagonalization	2011
Jessica Sears	
• Summer research project on accelerating computation of the CS decomposition, Schapiro Undergraduate Research Fellowship and NSF grant DMS-0914559	2011
Tyler Midwinter	
• Research assistantship, NSF grant DMS-0914559	2010
Tian Xu	
• Summer research project on the direction-of-arrival problem in wireless communications, Schapiro Undergraduate Research Fellowship and NSF grant DMS-0914559	2010
• Senior seminar project on mathematical finance	2009
James Olson	
• Senior seminar project on canonical correlation analysis	2009
Ronald Pandolfi	
• Senior seminar project on probability distributions and orthogonal polynomial systems	2008
• Departmental honors project on the numerical stability of determinant algorithms	2008
Kennard Stauffer	
• Departmental honors project in numerical linear algebra with applications to quantum mechanics	2006
Matthew Booth	
• Research Experiences for Undergraduates project on an inverse eigenvalue problem involving the zero/nonzero structure of a matrix, College of William and Mary	2003

Service

Mathematical community

- Associate Editor, *SIAM Journal on Matrix Analysis and Applications* 2013–2018
- National Science Foundation panelist, three times

Randolph-Macon College

- Assessment Committee (Chair, 2018–2021) 2008–2012, 2018–2021
- Faculty Search Committee, Mathematics 2020–2021
- Phi Beta Kappa (Vice President) 2016–2020
- Putnam Team (Coach) 2018
- Library Advisory Committee (Co-chair) 2015–2016
- Committee on Scholarships 2013–2016
- First-Year Academic Adviser 2009–2010, 2015–2016
- Faculty Search Committee, Library Director 2015
- Committee on Admissions, Credits, and Academic Status of Students 2010–2013
- Organizer of Research Day 2009–2012
- Faculty Marshal 2008–2012
- Assessment Committee 2008–2012
- Faculty Search Committee, Physics 2010–2011
- Faculty Search Committee, Mathematics 2007–2008

Intramural grants, fellowships, and honors

- Chenery Research Grant, R-MC 2016
- Walter Williams Craigie Grant for faculty research, R-MC 2007, 2009, 2014, 2019
- Rashkind Grant for faculty research, R-MC 2010–2011, 2012–2013
- U.S. Professor of the Year nomination by R-MC 2010, 2011
- MIT Presidential Fellowship 2001–2002

Additional education and employment

College of William and Mary Research Experiences for Undergraduates

- Assistant adviser 2002–2003
- Undergraduate researcher 2000

University of Tennessee and Oak Ridge National Laboratory Research Experiences for Undergraduates

- Undergraduate researcher 1999

Meridium, Inc., Roanoke, Va.

- Software tester and debugger 1996, 1998