Tobin A. Driscoll

tobydriscoll.net

Research interests

Numerical analysis & scientific computing
Applications of mathematics and computing to the life sciences and medicine
Mathematical software in MATLAB and Julia

Education

Cornell University   1996

Ph.D. in Applied Mathematics
Dissertation: Domain decomposition methods for conformal mapping and eigenvalue
  problems
Advisor: Lloyd N. Trefethen

Cornell University   1993

M.S. in Applied Mathematics

Pennsylvania State University   1991

B.S. in Mathematics with honors

  Honors thesis title: Comparison of computational efficiency and sensitivity of several
    solution algorithms for the linear–quadratic optimal control problem
  Advisor: John E. Dzielski

B.S. in Physics

Professional experience

University of Delaware   2010–present

Professor, Department of Mathematical Sciences
Affiliated Faculty, Department of Biomedical Engineering

University of Delaware   2004–2010

Associate Professor, Department of Mathematical Sciences

University of Delaware   2000–2004

Assistant Professor, Department of Mathematical Sciences

University of Colorado at Boulder   1996–2000

Postdoctoral research fellow, Department of Applied Mathematics

Honors and awards

Outstanding Scholar Award, College of Arts & Sciences, University of   2014
Delaware (sole winner for year)

Winner, 100 Digit Challenge (SIAM)   2002

NSF VIGRE Postdoctoral Fellow   1999–2000

NSF Mathematical Sciences Postdoctoral Research Fellow	1996–1999
SIAM Outstanding Paper Prize	1999
Runner-up, Richard C. DiPrima Dissertation Prize	1998
Second Prize, Leslie Fox Competition	1997
SIAM Student Paper Prize Honorable Mention	1995
NSF Graduate Fellow	1991–1994
A. D. White Fellow (Cornell graduate study)	1991–1994
Braddock Scholar (Penn State undergraduate study)	1987–1991

Grants

R. J. Braun (PI), T. A. Driscoll (co-PI). Models for Tear Film Structure, Dynamics and Parameter Identification. NSF DMS-1909846, $375,000.	2019-2022
R. J. Braun (PI), T. A. Driscoll, and K. L. Maki (co-PIs). Collaborative Research: Tear Film Dynamics: Modeling, Blinking, and Computation. NSF DMS-1412085, $375,003.	2014–2017
M. McCulloch (PI), T. A. Driscoll, and G. Schleiniger (co-PIs). Data driven mathematical modeling of the hypoplastic left heart syndrome circulation. NIH Delaware INBRE III, $60,724.	2014–2016
T. A. Driscoll. Special support from The MathWorks, Inc.	2013–2015
M. McCulloch (PI), T. A. Driscoll, and G. Schleiniger (co-PIs). Computer simulation of the single ventricle anatomy and physiology explaining mechanisms for sudden cardiac death. NIH Delaware INBRE Grant, $44,182.	2013–2014
T. A. Driscoll (PI) with 5 other key personnel. Meeting the need in mathematics at the University of Delaware. U.S. Department of Education Graduate Assistance in Areas of National Need, $527,700.	2012–2015
R. J. Braun (PI) and T. A. Driscoll (co-PI), Modeling tear film dynamics. NSF DMS-1022706, $444,000.	2010–2013
L. F. Rossi, T. Driscoll, and R. Luke (co-PIs), Strengthening mathematics instruction with automated algorithmic mastery activities. Center for Teaching Effectiveness (UD), $20,000.	2007
R. Braun (PI), L. P. Cook, and T. A. Driscoll (co-PIs), Modeling the blink cycle and lipid dynamics in the tear film. NSF DMS-0616483, $325,000.	2006–2009
H. B. White et al. (co-PIs), with T. A. Driscoll and others as senior personnel. Howard Hughes Medical Institute Undergraduate Science Education grant, $1,500,000.	2006–2010
R. Braun, T. A. Driscoll, P. Monk, L. F. Rossi (co-PIs). NSF Scientific Computing Research Environments for the Mathematical Sciences. NSF DMS-0322583, $68,460.	2003
University of Delaware International Travel Award	2003
T. A. Driscoll (PI). Novel fast and accurate methods for partial differential equations. NSF DMS-0104229, $88,407.	2001–2004
T. A. Driscoll (PI). Fast time stepping for the computational simulation of differential equations. University of Delaware Research Foundation, $21,042.	2001–2002
T. A. Driscoll (PI). NSF Mathematical Sciences Postdoctoral Research Fellowship (University of Colorado). NSF DMS-9627677, $75,000.	1996–1999

Publications

For a filterable list with live links, go to my web site. Or you can visit my Google Scholar site.

Books

L. N. Trefethen, A. Birkisson, and T. A. Driscoll. Exploring ODEs, SIAM	2018
T. A. Driscoll and R. J. Braun. Fundamentals of Numerical Computation, SIAM	2017
T. A. Driscoll, N. Hale, and L. N. Trefethen, eds. Chebfun Guide, 1st edition. Oxford, UK.	2014
T. A. Driscoll, Learning MATLAB, Society for Industrial and Applied Mathematics	2009
T. A. Driscoll and L. N. Trefethen. Schwarz–Christoffel Mapping, Cambridge University Press	2002

Book chapters

R. J. Braun, T. A. Driscoll, and C. G. Begley, "Mathematical Models of the Tear Film," in Ocular Fluid Dynamics: Anatomy, Physiology, Imaging Techniques, and Mathematical Modeling, Springer-Birkhauser, 2019.	2019
T. A. Driscoll and B. Fornberg. Padé-based interpretation and correction of the Gibbs phenomenon. In Advances in the Gibbs Phenomenon, ed. by A. Jerri, Sigma Sampling Publishing, Potsdam, NY.	2007
T. A. Driscoll and L. N. Trefethen. Numerical construction of conformal maps. Appendix to Fundamentals of Complex Analysis with Applications to Engineering, Science, and Mathematics, 3rd edition, by E. D. Saff and A. D. Snider, Prentice Hall.	2002

Journal articles

[61] R. J. Braun, R. A. Luke, T. A. Driscoll, and C. G. Begley, "Dynamics and mechanisms for tear breakup (TBU) on the ocular surface," Mathematical Biosciences and Engineering, vol. 18, no. 5, Art. no. mbe-18-05-262.	2021
[60] T. A. Driscoll, R. J. Braun, and C. G. Begley, "Automatic detection of the cornea location in video captures of fluorescence," Modeling and Artificial Intelligence in Ophthalmology, vol. 3, no. 1, Art. no. 1.	
[59] R. A. Luke, R. J. Braun, T. A. Driscoll, D. Awisi-Gyau, and C. G. Begley, "Parameter estimation for mixed-mechanism tear film thinning," Bull Math Biol, vol. 83, no. 5, p. 56.	
[58] K. W. Aiton and T. A. Driscoll, "Preconditioned nonlinear iterations for overlapping Chebyshev discretizations with independent grids," SIAM J. Sci. Comput., vol. 42, no. 4, pp. A2360–A2370.	2020
[57] R. A. Luke, R. J. Braun, T. A. Driscoll, C. G. Begley, and D. Awisi-Gyau, "Parameter estimation for evaporation-driven tear film thinning," Bull Math Biol, vol. 82, no. 6, p. 71.	
[56] T. Driscoll, "ComplexRegions.jl: A Julia package for regions in the complex plane," JOSS, vol. 4, no. 44, p. 1811.	2019
[55] K. L. Maki, W. D. Henshaw, A. McManus, R. J. Braun, D. M. Chapp, and T. A. Driscoll, "A model for tear film dynamics during a realistic blink," J. Modeling Ophthalmology, vol. 3, pp. 21–27.	

[54] K. W. Aiton and T. A. Driscoll, "An adaptive partition of unity method for multivariate Chebyshev polynomial approximations," SIAM J. Sci. Comput., vol. 41, no. 5, pp. A3230–A3245.

[53] T. A. Driscoll, R. J. Braun, and J. K. Brosch. Simulation of parabolic flow on an eye-shaped domain with moving boundary. J. Eng. Math. 111 (1): 111–126.

2018

[52] K. Aiton, T. A. Driscoll. An adaptive partition of unity method for Chebyshev polynomial interpolation. SIAM J. Sci. Comput. 40 (1): A251–A265.

[51] R. J. Braun, T. A. Driscoll, C. G. Begley, P. E. King-Smith, and J. I. Siddique. On tear film breakup (TBU): dynamics and imaging.* Math. Med. Biol.* 35 (2): 145–180.

[50] J. K. Brosch, Z. Wu, C. G. Begley, T. A. Driscoll, R. J. Braun. Blink characterization using curve fitting and clustering algorithms. J. Modeling Ophthalmology 1: 60–81.

2017

[49] T. A. Driscoll, E. Süli, and A. Townsend, eds., New Directions in Numerical Computation. Notices of the Amer. Math. Soc. 63 (4): 398–400, 2016.

2016

[48] L. Li, R. J. Braun, T. A. Driscoll, W. D. Henshaw, J. W. Banks, and P. E. King-Smith, Computed tear film and osmolarity dynamics on an eye-shaped domain. Math. Med. Biol. 33 (2): 123–157.

[47] T. A. Driscoll and N. Hale, Rectangular spectral collocation. IMA J. Num. Analy. 36 (1): 108–132.

[46] K. Maki, W. Henshaw, G. Barron, D. Chapp, R. J. Braun, T. A. Driscoll. A theoretical investigation of the influence of a blink on the tear film dynamics. Invest. Ophthamology Visual Sci. 57: 6173.

[45] L. Zhong, C. F. Ketelaar, R. J. Braun, T. A. Driscoll, P. E. King-Smith, C. G. Begley. Mathematical modeling of glob-driven tear film breakup. Invest. Ophthamology Visual Sci. 57: 6171.

[44] Q. Deng, R. J. Braun and T. A. Driscoll, Heat transfer and tear film dynamics over multiple blink cycles. Phys. Fluids 26, 071901.

2014

[43] T. A. Driscoll and J. A. C. Weideman. Optimal domain splitting for interpolation by Chebyshev polynomials. SIAM J. Numer. Anal. 52, 1913–1927. DOI: 10.1137/130919428.

[42] L. Li, R. J. Braun, T. A. Driscoll, W. D. Henshaw, J. W. Banks, and P. E. King–Smith. Coupling osmolarity dynamics within human tear film on an eye-shaped domain. Bull. Amer. Phys. Soc. 58 (18) (refereed abstract for Annual Meeting).

2013

[41] Q. Deng and T. A. Driscoll. A fast treecode for multiquadric interpolation with varying shape parameters. SIAM J. Sci. Comput. 34(2), A1126–A1140. DOI: 10.1137/110836225

2012

[40] W. M. Reid, T. A. Driscoll, M. F. Doty. Forming delocalized intermediate states with realistic quantum dots. J. Applied Phys. 111, 056102. DOI: 10.1063/1.3691113

[39] A. Birkisson and T. A. Driscoll. Automatic Fréchet differentiation for the numerical solution of boundary-value problems. ACM Trans. Math. Soft. 38, Article 26. DOI: 10.1145/2331130.2331134

[38] R. J. Braun, R. Usha, G. B. McFadden, T. A. Driscoll, L. P. Cook, and P. E. King–Smith. Thin film dynamics on a prolate spheroid with application to the cornea. J. Eng. Math. 73(1), 121–138. DOI: 10.1007/s10665-011-9482-4

2011

[37] A. M. Neves, T. A. Driscoll, A. R. H. Heryudono, A. J. Ferreira, C. M. Soares, and R. M. Jorge. Adaptive methods for analysis of composite plates with radial basis functions. Mech. Adv. Materials Struct. 18, 420–430. DOI: 10.1080/15376494.2010.528155

2010

[36] D. C. Usher, T. A. Driscoll, P. Dhurjati, J. A. Pelesko, L. F. Rossi, G. Schleiniger, K. Pusecker, and H. B. White. A transformative model for undergraduate quantitative biology education. CBE Life Sci. Educ. 9, 181–188. DOI: 10.1187/cbe.10-03-0029

[35] A. R. H. Heryudono and T. A. Driscoll. Radial basis function interpolation on irregular domain through conformal transplantation. J. Sci. Comput. 44, 286–300. DOI: 10.1007/s10915-010-9380-3

[34] T. A. Driscoll. Automatic spectral collocation for integral, integro-differential, and integrally reformulated differential equations. J. Comput. Phys. 229, 5980–5998. DOI: 10.1016/j.jcp.2010.04.029

2008

[33] T. A. Driscoll, F. Bornemann and L. N. Trefethen. The chebop system for automatic solution of differential equations. BIT 48, 701–723. DOI: 10.1007/s10543-008-0198-4

[32] K. L. Maki, R. J. Braun, T. A. Driscoll, and P. E. King-Smith. An overset grid method for the study of reflex tearing. Math. Medicine and Biology 25, 187–214. DOI: 10.1093/imammb/dqn013

[31] T. DeLillo, T. Driscoll, A. Elcrat, and J. Pfaltzgraff. Radial and circular slit maps of unbounded multiply connected circle domains. Proc. Roy. Soc. A 464, 1719–1737.

2007

[30] A. Heryudono, R. J. Braun, T. A. Driscoll, K. L. Maki and L. P. Cook. Single-equation models for the tear film in a blink cycle: realistic lid motion. Mathematical Medicine and Biology 24, 347–377. DOI: 10.1093/imammb/dqm004

[29] T. A. Driscoll and K. Maki. Searching for rare growth factors using multicanonical Monte Carlo methods. SIAM Review 49, 673–692.

[28] T. A. Driscoll and A. Heryudono. Adaptive residual subsampling methods for radial basis function interpolation and collocation problems. Computers Math. Appl. 53, 927–939. DOI: 10.1016/j.camwa.2006.06.005

2006

[27] R. Platte and T. A. Driscoll. Eigenvalue stability of radial basis function discretizations for time-dependent problems. Computers Math. Appl. 51, 1251–1268. DOI: 10.1016/j.camwa.2006.04.007

[26] T. DeLillo, T. A. Driscoll, A. Elcrat, and J. Pfaltzgraff. Computation of multiply connected Schwarz–Christoffel maps for exterior domains. Comput. Meth. Function Theory 6, 301–315.

2005

[25] J. A. Pelesko and T. A. Driscoll. The effect of the small-aspect-ratio approximation on canonical electrostatic MEMS models. J. Engng. Math. 53, 239–252. DOI: 10.1007/s10665-005-9013-2

[24] R. Platte and T. A. Driscoll. Polynomials and potential theory for Gaussian radial basis function interpolation. SIAM J. Num. Analy. 43, 750–766. DOI: 10.1137/040610143

[23] T. A. Driscoll. Algorithm 843: Improvements to the MATLAB toolbox for Schwarz–Christoffel mapping. ACM Trans. Math. Soft. 31, 239–251. DOI: 10.1145/1067967.1067971

[22] R. Platte and T. A. Driscoll. Computing eigenmodes of elliptic operators using radial basis functions. Computers Math. Appl. 48, 561–576. DOI: 10.1016/j.camwa.2003.08.007

[21] C. R. Collins, T. A. Driscoll, and K. Stephenson. Curvature flow in conformal mapping. Comput. Meth. Function Theory 3, 325–347.

[20] T. A. Driscoll and H. P. W. Gottlieb. Isospectral shapes with Neumann and alternating boundary conditions. Phys. Rev. E 68, 016702.

[19] T. A. Driscoll. A composite Runge-Kutta method for the spectral solution of semilinear PDE. J. Comp. Phys. 182, 357–367.

[18] T. A. Driscoll and B. Fornberg. Interpolation in the limit of increasingly flat radial basis functions. Computers Math. Appl. 43, 413–422.

[17] B. Fornberg, T. A. Driscoll, G. Wright, and R. Charles. Observations on the behavior of radial basis function approximations near boundaries. Computers Math. Appl. 43, 473–490.

[16] M. Goano, F. Bertazzi, P. Caravelli, G. Ghione, and T. A. Driscoll. A general conformal-mapping approach to the optimum electrode design of coplanar waveguides with arbitrary cross-section. IEEE Microw. Theory Tech. 49, 1573-1580.

[15] T. A. Driscoll and B. Fornberg. A Padé-based algorithm for overcoming the Gibbs phenomenon. Numerical Algorithms 26, 77–92.

[14] T. A. Driscoll and B. Fornberg. Note on nonsymmetric finite differences for Maxwell's equations. J. Comput. Phys. 161, 723–727.

[13] M. Ghrist, T. A. Driscoll, and B. Fornberg. Staggered time integrators for wave equations. SIAM J. Num. Analy. 38, 718–741.

[12] B. Fornberg and T. A. Driscoll. A fast spectral algorithm for nonlinear wave equations with linear dispersion. J. Comput. Phys. 155, 456–467.

[11] T. A. Driscoll and B. Fornberg. Block pseudospectral methods for Maxwell's equations: II. Two-dimensional, discontinuous-coefficient case. SIAM J. Sci. Comput. 21, 1146–1167.

[10] T. A. Driscoll. A nonoverlapping domain decomposition method for Symm's equation for conformal mapping. SIAM J. Num. Analy. 36, 922–934.

[9] T. A. Driscoll and B. Fornberg. A block pseudospectral method for Maxwell's equations: I. One-dimensional case. J. Comput. Phys. 140, 47–65.

[8] T. A. Driscoll, K.-C. Toh, and L. N. Trefethen. From potential theory to matrix iterations in six steps. SIAM Review 40, 547–578.

[7] T. A. Driscoll and S. A. Vavasis. Numerical conformal mapping using cross-ratios and Delaunay triangulation. SIAM Sci. Comp. 19, 1783–1803.

2004

2003

2002

2001

2000

1999

1998

[6] T. A. Driscoll. Eigenmodes of isospectral drums. SIAM Review 39, 1–17.   1997

[5] T. A. Driscoll. A MATLAB Toolbox for Schwarz–Christoffel mapping. ACM Trans. Math. Soft. 22, 168–186.   1996

[4] T. A. Driscoll and L. N. Trefethen. Pseudospectra for the wave equation with an absorbing boundary. J. Comp. Appl. Math. 69, 125–142.

[3] J. S. Baggett, T. A. Driscoll, and L. N. Trefethen. A mostly linear model of transition to turbulence. Physics of Fluids A 7, 833–838.   1995

[2] L. N. Trefethen, A. E. Trefethen, S. C. Reddy, and T. A. Driscoll. Hydrodynamic stability without eigenvalues. Science 261, 578–584.   1993

[1] J. E. Dzielski and T. A. Driscoll. Error bound on the solution of a linear-differential equation in Chebyshev series. Int. J. Systems Sci. 24, 1317–1327.

Refereed proceedings
and posters

R. A. Luke et al., "Fitting Simplified Models to Machine Learning-Identified Tear Film Breakup," in Investigative Ophthalmology & Visual Science, Jun. 2021, vol. 62, p. 1315. R. J. Braun, L. Zhong, T. A. Driscoll, C. G. Begley, D. Antwi, P. E. King-Smith. Models for Tear Break Up Dynamics and Imaging. 7th European Conference on Computational Fluid Dynamics.   2021 / 2018

Joseph Brosch, T. A. Driscoll, Richard Braun. Simulation of Thin Film Equations on an Eye-Shaped Domain with Moving Boundary. APS March Meeting Abstracts.   2016

Lan Zhong, C. F. Ketelaar, R. J. Braun, T. A. Driscoll, P. E. King-Smith, C. G. Begley. Mathematical Modeling of Glob-Driven Tear Film Breakup. Investigative Ophthalmology & Visual Science.

L. Zhong, C. F. Ketelaar, R. J. Braun, T. A. Driscoll, P. E. King-Smith, and C. G. Begley. A Model Problem for Blob-Driven Tear Film Breakup (TBU). Bull. Amer. Physical Soc. 60: 68th Annual Meeting of the APS Division of Fluid Dynamics, Boston, 2015.   2015

M. Stapf, R. J. Braun, C. G. Begley, T. A. Driscoll, and P. E. King-Smith. Modeling Tear Film Evaporation and Breakup with Duplex Films. Bull. Amer. Physical Soc. 60: 68th Annual Meeting of the APS Division of Fluid Dynamics Boston, 2015.

R. J. Braun, L. Li, W. Henshaw, T. A. Driscoll, and P. E. King-Smith. Solute Dynamics and Imaging in the Tear Film on an Eye-shaped Domain, Bull. Amer. Physical Soc. 60: 68th Annual Meeting of the APS Division of Fluid Dynamics, Boston, MA, 2015.

C. Ketelaar, L. Zhong, R. J. Braun, T. A. Driscoll, P. E. King-Smith, and C. G. Begley. Tear Film Dynamics Around a Rigid Model Blob, Bull. Amer. Physical Soc. 60: 68th Annual Meeting of the APS Division of Fluid Dynamics, Boston, 2015.

2014

M. McCulloch, G. Schleiniger, L. Chen, S. Gidding, and T. A. Driscoll. Data driven mathematical modeling of the single ventricle anatomy and

physiology. Highlighted Poster (refereed), NISBRE IDeA Conference,
2014.

L. N. Trefethen and T. A. Driscoll. Schwarz–Christoffel mapping in the
computer era. Proceedings of the International Congress of
Mathematicians, Vol. III (Berlin, 1998). Doc. Math. 1998, Extra Vol. III,
533–542 (electronic).

1998

G. Wojcik, B. Fornberg, R. Waag, J. Mould, T. A. Driscoll, and L.
Nikodym. Pseudospectral methods for large-scale bioacoustic models.
Proceedings of the 1997 IEEE Ultrasonics Symposium.

1997

Other works

T. A. Driscoll. Review of Elements of Scientific Computing, by Tveito, Langtangen,
Nielsen, and Cai. SIAM Review 53, 807–808, 2011.

M. Hassner, D. V. Leykin, and T. A. Driscoll. An analytic model of MR/GMR head sensitivity
function. IBM Research Report RJ 10167, 1999.

T. A. Driscoll. Review of Computational Conformal Mapping, by P. K. Kythe. SIAM Review
41 (1999), 832–834.

T. A. Driscoll. Uses of the Berenger PML in pseudospectral methods for Maxwell's
equations. Proceedings of the 1997 IUTAM Symposium on Computational Methods for
Unbounded Domains, T. L. Geers, ed.

T. A. Driscoll. Domain Decomposition Methods for Conformal Mapping and Eigenvalue
Problems. Ph.D. thesis, Center for Applied Mathematics, Cornell University, 1996.

T. A. Driscoll and B. Land. Vibrations of isospectral drums. Computer animation video
produced at the Cornell Theory Center, 1995.

T. A. Driscoll. Schwarz–Christoffel Toolbox user's guide. Cornell Computer Science
Technical Report TR 94-1422, 1994.

Software

L. N. Trefethen and others, http://www.chebfun.org. (Major Driscoll contributions noted
for the releases below.)

2014: Version 5.0 (with many collaborators): Design and rewrite of software for object-
oriented modularity.

2011: Version 4.0 (with N. Hale): Rectangular formulations for robust ODE systems

2009: Version 3.0 (with A. Birkisson): Automatic differentiation and solution for
nonlinear operators

2008: Version 2.0 (with F. Bornemann): Chebop, for automatic solutions of differential
equations (BVP, eigenvalue, PDE)

T. A. Driscoll. http://github.com/tobydriscoll/sc-toolbox

2002: Module for solving Laplace's equation with piecewise constant boundary
conditions.

2000: Object-oriented interface for polygons and maps.

1996: Inclusion of CRDT algorithm for elongated regions.

1994: Initial release.

T. A. Driscoll. https://github.com/complexvariables/ComplexRegions.jl.
Complex regions and paths in Julia.

Presentations

"Analysis of tear-film breakup using fluorescence video recordings," Colloquium at Appalachian State University, 2022.

"Detection of tear film breakup using Julia," JuliaCon 2021.

"Simulation of tear film dynamics with blinking," SIAM Annual Meeting, 2020.

"Preconditioning nonlinear equations with domain decomposition," AMS Eastern Sectional Meeting, University of Delaware, September 2018.

"Exploring differential equations using Chebfun," SIAM Annual Meeting Minisymposium, Portland, OR, July 2018.

"Dynamics on a model blinking eye-shaped domain," SIAM Annual Meeting Minisymposium, Portland, OR, July 2018.

"Mathematical and computational modeling of the tear film," Center for Bioinformatics & Computational Biology Seminar, University of Delaware, 2017.

"Dynamics on a model blinking eye-shaped domain," SIAM Annual Meeting Minisymposium, Boston, July 2016.

"Data-driven systemic modeling of infant hypoplastic left heart syndrome," Center for Cardiovascular Health Symposium, University of Delaware, October 2015.

"Flipping the classroom for numerical computation," MathWorks Research Summit, Natick, MA, June 2015.

"Automatic multivariate approximation," SIAM Computational Science and Engineering Conference Minisymposium, Salt Lake City, AZ, April 2015.

"An open-source software project for numerical conformal mapping," BIRS Workshop on Modern Applications of Complex Variables, Banff, AL, January 2015.

"New directions in spectral methods," Numerical Analysis Seminar, Cornell University, November 2014.

"Optimal splitting in spectral collocation," Numerical Analysis Group Seminar, Oxford University, November 2013.

"Numerical computing with functions," Colloquium, Wichita State University, September 2013.

"Reflections on flipping a math classroom," Summer Faculty Institute, University of Delaware, June 2013.

"Optimal splitting in spectral collocation," Seminar, Arizona State, April 2013.

"Numerical computing with functions," Colloquium, Arizona State, April 2013.

"Numerical computing with functions," Colloquium, Temple University, December 2012.

"Chebfun beyond the ordinary (DE)," http://www2.maths.ox.ac.uk/chebfun/and_beyond/ Workshop, Oxford University, September 2012.

"Spectral deferred correction for time-dependent PDEs in Chebfun," http://www.siam.org/meetings/an12/, Minneapolis, July 2012.

"Chebfun for PDE," http://www.birs.ca/events/2012/5-day-workshops/12w5021, Banff International Research Station, June 2012.

"Optimal splitting in spectral collocation," Del-Mar Numerical Analysis Day, University of Delaware, April 2012.

"Differential equations in Chebfun," http://www.iciam2011.com, Vancouver, July 2011 (minisymposium).

2011

"Rectangular projections for reliable spectral collocation," http://www.iciam2011.com, Vancouver, July 2011 (minisymposium).

"Chebfun: A software system for interacting with functions," NSF-CBMS Conference on Radial Basis Functions, Dartmouth, MA, June 2011.

"Approximation Theory, Spectral Methods, and Chebfun" (with L. N. Trefethen), [http://www.dmi.units.it/dobbiaco11/index.php?section=page&action=inc&name=aims](Fifth annual Dobbiaco Summer School), Dobbiaco, Italy, June 12-17, 2011.

"Automatic Fréchet differentiation for the spectral solution of boundary-value problems," SIAM Annual Meeting, July 2010 (minisymposium).

2010

"Automatic solution of differential equations in the Chebfun system," Meeting of the Canadian Applied and Industrial Mathematics Society, University of Western Ontario, June 2009.

2009

"Automatic solution of differential equations in the Chebfun system," SIAM Southeastern-Atlantic Section Conference, University of South Carolina, April 2009.

"Automatic solution of differential equations in the Chebfun system," Courant Institute Seminar, February 2009.

"Solving continuous differential equations numerically: chebfun and chebop"

2008

SIAM Annual Meeting, San Diego, July 2008
University of Manchester Seminar, May 2008
Numerical Analysis Group Seminar, Oxford University, April 2008
University of Dundee Seminar, April 2008

"Least squares methods for conformal mapping and boundary value problems," SIAM Annual Meeting, San Diego, July 2008.

"Modeling and simulation of human tear film dynamics," Colloquium, SUNY Buffalo, November 2007.

2007

"Detection and approximation of jumps using complex-variable techniques," 7th International Conference on Spectral and High-Order Methods (ICOSAHOM), Beijing, China, June 2007 (minisymposium).

"Spectral least-squares for conformal mapping and potential theory," Computational and Conformal Geometry Workshop, SUNY Stony Brook, April 2007.

"Radial basis function methods for meshless PDE computation," Seminar, New Jersey Institute of Technology, January 2007.

"Radial basis function methods for meshless PDE computation," Oxford University Computing Laboratory, January 2007.

"Conformal mapping 2.0," Seminar, Dartmouth College, October 2006.

2006

"Developing a computational framework for conformal mapping," SIAM Annual Meeting, Boston, July 2006.

"Optimal node placement for Gaussian radial basis function interpolation," SIAM Annual Meeting, Boston, July 2006.

"Optimal node placement for Gaussian radial basis function interpolation," Seminar, Tufts University, February 2006.

"SVD-based importance sampling for finding rare events in noisy optical transmission," Rice University, October 2004.

"SVD-based importance sampling for an optics-based dynamical system," SIAM Nonlinear Waves and Coherent Structures, University of Central Florida, October 2004.

"Schwarz–Christoffel maps to surfaces in space," University of Maryland, Baltimore County, April 2004.

"High-order time stepping methods for electromagnetics," Computational Electromagnetics, Math. Forschungsinstitut Oberwolfach, February 2004.

"Solution of Laplace's equation by conformal mapping," Oxford University Computing Laboratory, 2003.

"The EigTool system for exploring matrix eigenmode problems," International Congress on Industrial and Applied Mathematics, Sydney, Australia, July 2003 (minisymposium).

"Numerical conformal mapping in 2003: A survey," International Congress on Industrial and Applied Mathematics, Sydney, Australia, July 2003 (minisymposium, organizer).

"Overdetermined formulations for eigenmode problems," International Congress on Industrial and Applied Mathematics, Sydney, Australia, July 2003 (minisymposium).

"Directed random walks and importance sampling for noisy optical communications," IMACS Nonlinear Evolution Equations and Wave Phenomena, April 2003.

"Schwarz–Christoffel mapping in MATLAB," European Microwave Week, Milan, Italy, September 2002.

"Use of the SVD for finding rare events in noisy optical communcations," SIAM Annual Meeting, July 2002.

"Schwarz–Christoffel conformal mapping," University of Delaware, 2002.

"Significant perturbations of NLS from SVD analysis," Northwestern University, January 2002.

"Significant perturbations of NLS from SVD analysis," University of Maryland, Baltimore County, August 2001.

"Schwarz–Christoffel conformal mapping," Computational Methods and Function Theory, University of Aveiro, Portugal, June 2001 (Plenary speaker).

"Fast time stepping methods for semilinear evolution equations," Northwestern University, June 2001.

"Wavenumber-dependent time stepping methods for semilinear evolution equations," IMACS Conference on Nonlinear Waves, University of Georgia, April 2001 (Minisymposium).

"Radial basis functions for the simulation of PDEs"

Courant Institute (NYU), November 2000

University of Delaware, November 2000
Brown University, October 2000

"High-order space and time methods for propagation problems"
University of California–Santa Barbara, 2000
University of Michigan, 2000
University of Delaware, 2000

"High-order space and time methods for propagation problems,"
Georgia Institute of Technology, 1999.

"An efficient spectral method for the solution of nonlinear wave equations"
Dundee Numerical Analysis Conference, 1999
Colorado Days at Los Alamos National Laboratory, 1999

"Staggered time integrators for wave equations," Oxford University Computing Laboratory, 1999.

"Block pseudospectral methods for Maxwell's equations in inhomogeneous media"
SIAM Annual Meeting, 1998
SIAM Conference on Wave Propagation, 1998
Los Alamos Days at Colorado, 1998

"Spectrally accurate summation of Fourier series for functions with jump discontinuities," University of Colorado, Boulder, 1998.

"Block pseudospectral methods for Maxwell's equations in inhomogeneous media," Oak Ridge National Laboratory, 1998.

"Schwarz–Christoffel mapping in MATLAB," University of Tennessee, Knoxville, 1998.

"Uses of the Berenger PML with psuedospectral methods for Maxwell's equations" (poster), IUTAM: Computational Methods for Unbounded Domains, Boulder, CO, 1997.

"Numerical conformal mapping using cross-ratios and Delaunay triangulation,"
Computational Methods and Function Theory, 1997
ISAAC Conference, University of Delaware, 1997

"Numerical conformal mapping using cross-ratios and Delaunay triangulation," Lesile Fox Prize Competition, 1997.

"Eigenmodes of isospectral drums"
Colorado State University, 1997
Colorado School of Mines, 1997
University of Colorado, Denver, 1997
MIT, 1997

"Numerical conformal mapping using cross-ratios and Delaunay triangulation," University of Colorado, Boulder, 1996.

"Schwarz–Christoffel mapping in MATLAB"
Wichita State University, 1996
University of Colorado, 1996

1999

1998

1997

1996

"Eigenmodes of isospectral drums" MATLAB conference, 1995 SIAM Annual Meeting, 1995 ICOSAHOM, 1995 Cornell Univeristy, 1995	1995
"Conformal mapping and the convergence of Krylov iterations," Colorado Conference on Iterative Methods, Breckenridge, CO, 1994. "Schwarz–Christoffel mapping in MATLAB" Universität Karlsruhe, 1994 ETH, Zürich, 1994	1994
"Pseudospectra of the wave operator with an absorbing boundary," SIAM Annual Meeting, July 1993. "Schwarz–Christoffel mapping in MATLAB," Cornell Numerical Analysis Day, 1993.	1993

Students supervised

Kevin Aiton, Ph.D., 2019

Shawn Abernethy, M.S. with thesis, 2013

Quan Deng, Ph.D., 2013

Alfa Heryudono, Ph.D., 2008

Rodrigo Platte, Ph.D., 2005

Teaching

Philosophy

While I enjoy lecturing, I no longer believe it should be the only or even primary way of teaching most math classes. The marginal benefits of a live lecture over a recorded one are overshadowed by supervised active learning, where the instructor shares expertise with students as they wrestle with the material themselves. I use techniques such as problem-based learning, laboratory exploration, personal response systems, and flipping the classroom to create active learning opportunities. In addition, I believe mathematics needs to embrace teaching computation throughout the curriculum, rather than quarantining it into a few courses or lab sections.

Undergraduate

Calculus A,B,C

Including special section of Calculus A for life sciences majors

Linear algebra (math and engineering majors)

ODEs (math and engineering majors)

PDEs (math and engineering majors)

Computational mathematics (two-semester sequence)

Complex analysis

Graduate

Numerical linear algebra and nonlinear equations

Numerical ODEs/PDEs
Spectral/high-order methods for PDEs
Radial basis functions

Service activities

Department of Mathematical Sciences

Director of Graduate Studies (Delaware), 2011–2014

Director of Undergraduate Studies (Delaware), 2018–2021

Member of ad hoc committee to create the B.S. degree in Quantitative Biology

Initial proposer of B.S. degree in Applied Mathematics

Chaired ad hoc committee to create B.S. degree in Data Science

FIrst to teach Math 219, Data Science I

College and university

ADVANCE Fellow and Senior Fellow, 2020–present

Faculty Senate Ad Hoc Subcommittee on Promotion Criteria for Continuing Track Faculty, 2021–2022

University Strategic Planning Working Group on Redefining Creativity, Innovation and Entrepreneurship, 2021

Faculty Senate Promotion and Tenure Committee, 2018–2020 (Chair for 2019–2020)

Faculty Senate Undergraduate Studies Committee, 2008–2010

Arts & Sciences Educational Affairs Committtee, 2004–2005

Profession

Communicating Editor of Advances in Computational Mathematics, 2019–present

At-Large Member of the SIAM Council, 2015–2018

Associate Editor of Journal of Engineering Mathematics, 2010–2015

Associate Editor of the SIAM Journal on Scientific Computing, 2008–2014

Organizing committee of Mathematical Problems in Industry, 2004 (Delaware)

Academic visits

Institute for Mathematics and Its Applications, University of Minnesota, September–December 2010

Oxford University Computing Laboratory, January–June 2008

Oxford University Computing Laboratory, Summer 1999

ETH Supercomputing Institute, Zürich, Summer 1994

Consultations

United Technologies, 2002–2003

Contact: Fabio Bertolotti. Use of spectral methods in investigating thermoacoustic instability in power-generating turbines.

Weidlinger Associates, 1998–2000
Contact: Greg Wojcik. High-order and spectral methods in space and time for the numerical simulation of acoustic wave propagation in tissue.

IBM Almaden Research Center, 1995–2001
Contact: Martin Hassner. Applications of conformal mapping to inductive and magnetoresistive read heads for hard drives.