

BRUCE BARTLETT LENZ PECKHAM
Curriculum Vitae May 2020

Department of Mathematics and Statistics
University of Minnesota, Duluth
Duluth, MN 55812
(218)726-6188 (office)
Homepage: <http://www.d.umn.edu/~bpeckham>

Birthdate: October 20, 1954
Birthplace: Canton, NY
Citizenship: U.S.A.
(218)724-7899 (home)
Email: bpeckham@d.umn.edu

EDUCATION

Ph. D. School of Mathematics, University of Minnesota August 1988
Thesis Title: *The Closing of Resonance Horns for Periodically Forced Oscillators*
Thesis Advisor: Richard P. McGehee
Professional Degree: Associate in the Society of Actuaries (ASA) Completed May 1981
A. B. with honors in mathematics, Hamilton College, Clinton, NY May 1977

RESEARCH INTERESTS

Primary: Dynamical Systems \supset Bifurcation Theory \supset Resonance Phenomena
Forced and Coupled Oscillators, Noninvertible Maps, Ecological Modeling with Dynamical Systems
Secondary: Numerical Analysis, Mathematical Software, Curriculum Development

EXPERIENCE

Professor, Dept. of Mathematics and Statistics, U. Minn. Duluth Sept. 2009 - present
Department Head July 2016 - May 2019
Associate Department Head Sept. 2013 - June 2016
Director of Undergraduate Studies Sept. 2005 - Dec. 2013
Associate Professor, Dept. of Mathematics and Statistics, U. Minn. Duluth Sept. 1995 - Aug. 2009
Visiting Scholar, Dept. of Mathematics, U. of Auckland, New Zealand Jan. 2013 - May 2013
Visiting Scholar, Dept. of Engineering Mathematics, U. of Bristol, England Sept. 2004 - Dec. 2004
Visiting Scholar, Dept. of Applied Mathematics, University of Colorado Feb. 1997 - April 1997
Visiting Scholar, Institute Nonlineaire de Nice, France Sept. 1996 - Nov. 1996
Assistant Professor, Dept. of Mathematics and Statistics, U. Minn. Duluth Sept. 1990 - Aug. 1995
Visiting Assistant Professor, Dept. of Mathematics, Boston University Sept. 1988 - Aug. 1990

Collaborator, Center for Nonlinear Studies, Los Alamos National Lab 1987 - 1995
- involved with modeling and predicting behavior of low temperature helium dynamics

Teaching/Research Assistant, University of Minnesota Sept. 1982 - Aug. 1988
- special programs: UNITE - classes televised for area company employees
-University of Minnesota Talented (High School) Youth Mathematics Program

Teacher/Coach, Delbarton School, Morristown, N.J. Sept. 1979 - June 1982
- taught Math, Physics, Computer Science
- coached soccer (head varsity), hockey (head varsity), lacrosse head JV)

Actuarial Assistant/Research Analyst, The Paul Revere Life Insurance Company, Worcester, Ma.
July 1977 - Aug. 1979
- performed all phases--especially design and programming--of computer related special projects
- passed first five actuarial exams (Associate in the Society of Actuaries)

TEACHING HIGHLIGHTS

New Courses Developed: Calculus for Life Sciences: Math 1290, Dynamical Systems: Math 5260, Modeling with Dynamical Systems: Math 5270, Fractal Geometry: Math 5295, Freshman Seminar: Dynamical Systems: Math 1234

Other Specialty Courses: Differential Equations: Math 3280, Real Variables: Math 5201, Real Analysis: Math 8201

PUBLICATIONS

1. Peckham B B, *The Closing of Resonance Horns for Periodically Forced Oscillators*, Thesis, University of Minnesota, 1988.
2. Peckham B B and Kevrekidis I G, "The Necessity of the Hopf Bifurcation in Families of Periodically Forced Oscillators," *Nonlinearity* (3), 261-280, 1990.
3. Peckham B B and Kevrekidis I G, "Period Doubling with Higher Order Degeneracies," *SIAM J Math Analysis*, Vol. 22, No. 6, 1552-1574, November 1991.
4. McGehee R P and Peckham B B, "Resonance Surfaces for Forced Oscillators," Geometry Center Research Report GCG70, Feb. 1995, and *Experimental Mathematics*, Vol.3, No. 3, 221-244, 1994.
5. Peckham B B, Frouzakis C E and Kevrekidis I G, "Bananas and banana splits: A parametric degeneracy in the Hopf bifurcation for maps," with, *SIAM J Math Analysis*, Vol. 26, No. 1, 190-217, 1995.
6. McGehee R P and Peckham B B, "Determining the topology of resonance surfaces for periodically forced oscillators," *Normal Forms and Homoclinic Chaos*, Fields Institute Communications series, AMS, Vol. 4, 233 - 251, 1995.
7. McGehee R P and Peckham B B, "Arnold Flames and Resonance Surface Folds," Geometry Center Research Report GCG84, July 1995, and *International Journal of Bifurcation and Chaos*, Vol. 6, No. 2, 315-336, 1996.
8. Peckham B B, "Real perturbation of complex analytic families: points to regions," University of Colorado Department of Applied Mathematics preprint APPM 312, April 1997, and *International Journal of Bifurcation and Chaos*, Vol. 8, No. 1, 73-93, 1998.
9. Peckham B B, "Global Parametrization and Computation of Resonance Surfaces for Periodically Forced Oscillators," *Numerical Methods for Bifurcation Problems and Large-scale Dynamical Systems*, IMA Volumes in Mathematics and Applications, Volume 119, Springer-Verlag, 385-405, 2000.
10. Peckham B B and Montaldi James, "Real continuation from the complex quadratic family: fixed-point bifurcation sets," *International Journal of Bifurcation and Chaos*, Vol. 10, No. 2, 391-414, 2000.
11. Peckham B B and Kevrekidis I G, "Lighting Arnold Flames: Resonance in Doubly Forced Oscillators," Vol. 15, *Nonlinearity*, 405-428, 2002.
12. Pastor J, Peckham B B, Bridgman S, Weltzin J, and Chen J, "Plant community dynamics, nutrient cycling, and alternative stable equilibria in peatlands," *The American Naturalist*, Vol. 160, No. 5, 553-568, 2002.
13. Frouzakis C E, Kevrekidis I G and Peckham B B, "A route to computational chaos revisited: noninvertibility and the breakup of an invariant circle," " arXiv.org: arXiv:math/0301301 [math.DS] Jan 2003, and *Physica D*, Vol. 177, 101-121, 2003.
14. Graves W G, Peckham B B and Pastor J, "A bifurcation analysis of a differential equations model for mutualism," *Bulletin of Mathematical Biology*, Vol. 68, no. 8, 1837-1850, 2006.
15. Schilder F and Peckham B B, "Computing Arnold Tongue Scenarios," *Journal of Computational Physics*, Vol. 220, 932-951, 2007.
16. Krauskopf B, Osinga H M, and Peckham B B, "Unfolding the Cusp-cusp bifurcation of planar endomorphisms," *SIAM Journal on Dynamical Systems*, Vol. 6(2), 403-440, 2007.
17. Zimmermann L, Peckham B B, Pastor J and Stech H W, "A producer-consumer model with stoichiometric elimination mechanisms," University of Minnesota Duluth Department of Mathematics and Statistics Technical Report, 2008.
18. Lin L, Peckham B B, Stech H W and Pastor J, "A stoichiometric model of two producers and one Consumer," *Journal of Biological Dynamics*, first published: 24 January 2011 (iFirst), pp 1-20 and University of Minnesota Duluth Department of Mathematics and Statistics Technical Report TR-2010-3 (extended version of the paper published in JBD).
19. Stech H W, Peckham B B and Pastor J, "Enrichment in a general class of stoichiometric producer-consumer population growth models," *Theoretical Population Biology*, Volume 81, Issue 3, 210-222, 2012.
20. Stech H W, Peckham B B and Pastor J, "Enrichment effects in a simple stoichiometric producer-consumer population growth model," *Communications in Applied Analysis*, Vol. 16, No. 4, 687-702, 2012.

21. Stech H W, Peckham B B and Pastor, J ``Quasi-equilibrium reduction in a general class of stoichiometric producer-consumer models," *Journal of Biological Dynamics*, Vol. 6, Issue 2, 992-1018, 2012.
22. Bozyk B D and Peckham B B, "Dynamics of nonholomorphic singular continuations: a case with radial symmetry," *International Journal of Bifurcation and Chaos*, Vol. 23, No. 11, 22 pages, 2013.
23. Nien C-H, Peckham B B and McGehee R P, ``Classification of critical sets and their images for quadratic maps of the plane," arXiv.org: arXiv:1507.02732 [math.DS] 2015, and *Journal of Difference Equations and Applications*, 2016.
24. Nien C-H, Peckham B B and McGehee R P, ``Affine map equivalence versus critical set equivalence for quadratic maps of the plane," arXiv.org: arXiv:1708.09506 [math.DS] 2017.

SOFTWARE DEVELOPED

"To Be Continued ...," a phase space and bifurcation continuation software package for discrete dynamical systems, continually under development since 1986. See http://www.d.umn.edu/~bpeckham/tbc_home.html.

OTHER PROFESSIONAL PRODUCTS

"Periodically forced oscillators and resonance surfaces," with R. P. McGehee, a 15-minute movie of resonance surfaces for periodically forced oscillators, made at the Geometry Center, Minneapolis, Minnesota, 1992.

EXTERNALLY SPONSORED RESEARCH - as Principal Investigator

National Science Foundation, "Noninvertible Dynamical Systems: A Computer-Assisted Study," Division of Mathematical Sciences, Computational Mathematics Program, Grant no. NSF/DMS-9973926, \$140,000, 1999--2004.

National Science Foundation, "Global Bifurcations of Forced Oscillator Systems," (renewal) Division of Mathematical Sciences, Applied Mathematics and Computational Mathematics, Grant no. NSF/DMS-9020220, \$60,000, 1995-2000.

National Science Foundation, "Global Bifurcations of Forced Oscillator Systems," Division of Mathematical Sciences, Applied Mathematics and Computational Mathematics, Grant no. NSF/DMS-9505051 \$40,000, 1992-95.

AWARDS AND FELLOWSHIPS (excluding NSF grants)

Citation for Excellence in Teaching (as grad. student)	Fall 1985
School of Mathematics Summer Fellowship (as grad. student)	1985, 1986, 1987
University of Minnesota Grant-in-Aid (\$21,000 for research equipment, RA)	1991-92
University of Minnesota Faculty Summer Research Fellowship	Summer 1991
University of Minnesota Single Quarter Leave	Fall Quarter 1992
Minnesota Supercomputer Center	1993-95
70 hours of supercomputing time (6 separate grants)	
University of Minnesota Grant-in-Aid (\$12,500 for Research Assistant)	1994-96
UMD Digital Imaging Lab Proposal: "Computation and Display of Global Bifurcation Surfaces" (for use of facilities)	2000-01
2010 UMD Blehart Distinguished Teaching Award (all UMD award)	March 2010
2010 UMD Swenson College of Science and Engineering Advising Award	March 2010
2015 UMD SCSE Sabra S. and Dennis L. Anderson Scholar/Teacher Award	April 2015

LECTURES

1. "Global Properties of Resonance Horns," Fall Meeting of the Midwest Dynamical Systems Conference, Boston University, Boston, Ma., October 1987.
2. "The Closing of Resonance Horns for Periodically Forced Oscillators," Colloque Bifurcations et Attracteurs, Sophia-Antipolis, France, September 1988.
3. "A Topological Argument to Prove Existence of the Hopf Bifurcation for Periodically Forced Oscillators," Monday Dynamical Systems Seminar, Boston University, October 1988.

4. "Closed Resonance Horns for Periodically Forced Oscillators," Colloquium, Worcester Polytechnic Institute, October 1988.
5. "Closed Resonance Regions," Dynamical Systems Seminar, University of Colorado, Boulder, March 1989.
6. "The Necessity of the Hopf Bifurcation in Families of Periodically Forced Oscillators," International Conference on Dynamical Systems, Control Theory and Applications, Wright State University, June 1989.
7. "Degenerate Period Doubling Bifurcations," Monday Dynamical Systems Seminar, Boston University, October 1989.
8. "Bifurcation: Global pictures from local information," Summer Regional Institute in Dynamical Systems, Boston University, July 26, 1990.
9. "Some Bifurcations of Forced Oscillator Systems," Dynamical Systems Seminar, University of Colorado at Boulder, November 29, 1990.
10. "Life without chaos is death, Part I" UMD Undergraduate Colloquium, April 16, 1991.
11. "Life without chaos is death, Part II" UMD Undergraduate Colloquium, April 23, 1991.
12. "The Real Mandelbrot set vs. the real Mandelbrot set," UMD High School Math Contest, May 4, 1991.
13. "Resonance Surfaces and Arnold Horns," Catastrophe Theory Conference (part of Regional Geometry Institute), Boston University, July 1 1991.
14. "The chaos of multiplication by 2," UMD Undergraduate Colloquium, October 15, 1991.
15. "Multiplication by 2 and Chaos," Carleton College Mathematics Colloquium, September 1992.
16. "Resonance Surfaces for Periodically Forced Oscillators," Dynamics and Mechanics Research Seminar, University of Minnesota, Minneapolis, Minnesota, October 1, 1992.
17. "Resonance Surfaces for Periodically Forced Oscillators," Midwest Dynamical Systems Conference, Fall Meeting, University of Michigan, Ann Arbor, Michigan, Nov. 6, 1992.
18. "Resonance City," Normal Forms and Homoclinic Chaos Workshop, Fields Institute, Waterloo, Ontario, November 12, 1992.
19. "A parametric degeneracy in the Hopf bifurcation for maps," Dynamics and Mechanics Research Seminar, University of Minnesota, Minneapolis, Minnesota, November 19, 1992.
20. "Arnold Flames," Dynamics Seminar, University of Texas, Austin, Texas, March 1, 1994.
21. "Computing Homoclinic Surfaces," Noninvertible Dynamical Systems Conference, Geometry Center, Minneapolis, Minnesota, March 14, 1995.
22. "Arnold Flames and Resonance Surfaces," SIAM Dynamical Systems Activity Group Conference, Snowbird, Utah, May 24, 1995.
23. "Life without chaos is death," UMD Graduate/Undergraduate Colloquium, October 26, 1995.
24. "Arnold Flames and Resonance Surface Folds," 1996 Spring Topology and Dynamics Conference, Ball State University, Muncie, Indiana, March 7, 1996.
25. "The topology and geometry of surfaces of periodic points" or "Handling Arnold flames," Dynamics and Mechanics Research Seminar, University of Minnesota, Minneapolis, Minnesota, April 18, 1996.
26. "Periodically forced oscillators and Circle Maps," Dynamics Seminar, Physiology Department, McGill University, Montreal, July 31, 1996.
27. "Periodically Forced Oscillators and Resonance Surfaces," Mathematics Research Seminar, Institut Non-Linear de Nice, Sophia-Antipolis, France, Sept. 1996.
28. "Nonanalytic perturbations of $z^2 + C$ " or "Where are the Arnold tongues in the Mandelbrot set?," Geometry Center Seminar, The Geometry Center, Minneapolis, MN, Jan. 24, 1997.
29. "Periodically Forced Oscillators and Resonance Surfaces," Applied Math Colloquium, University of Colorado, Boulder, Colorado, Feb. 21, 1997.
30. "Real perturbation of the complex quadratic family," Dynamical Systems Research Seminar, Department of Applied Mathematics, University of Colorado, Boulder, CO, Feb. 27, 1997.
31. "Nonanalytic perturbation of complex analytic maps," Applications of Dynamical Systems, SIAM Dynamical Systems Activity Group Conference, Snowbird, Utah, May 18, 1997.
32. "Automatic computation of Resonance Surfaces," IMA Workshop on Numerical Methods for Bifurcation Problems, Sept. 18, 1997.
33. "Growing Arnold Tongues on the Mandelbrot Set," Midwest Dynamical Systems Conference Spring 1998 meeting: Global Analysis 30 Years Later, University of Cincinnati, Cincinnati OH, March 25-29, 1998.
34. "Only Chaos allows survival," UMD Undergraduate Colloquium, Department of Mathematics and Statistics, Jan. 14, 1999.
35. "Doubly Forced Oscillators," Applications of Dynamical Systems, SIAM Dynamical Systems Activity Group's Fifth Conference, Snowbird, Utah, May 23, 1999.

36. "The Breakup of Invariant Circles for Endomorphisms," with Christos E. Frouzakis, Swiss Federal Institute of Technology, Switzerland and I.G. Kevrekidis, Princeton University, SIAM Conference on Applications of Dynamical Systems, Snowbird, Utah, May 20, 2001.
37. "A Differential Equations Model of Peatlands," UMD Undergraduate Colloquium, presented with coauthor John Pastor, April 19, 2001.
38. "Life without chaos is death," UMD Graduate/Undergraduate Colloquium, October 11, 2001.
39. "A Differential Equations Model of Peatlands," Gustavus Adolphus College Mathematics Colloquium, March 19, 2002.
40. "The chaos of multiplication by 2," St. Lawrence University Mathematics Colloquium, April 29, 2002.
41. "Chaos, fractals, and dynamics," Program for monthly meeting of Duluth Freethinkers' Society, Nov. 3, 2002.
42. "The chaos of multiplication by 2," UMD Undergraduate Colloquium, Department of Mathematics and Statistics, February 20, 2003.
43. "The breakup of an invariant circle in the presence of non-invertibility," Workshop on Codimension-two bifurcations in Piecewise Smooth Dynamical Systems, July 25-6, 2003, University of Bristol, Bristol, England, July 25, 2003.
44. "Euler's Method: How bad can it be?" UMD Graduate Colloquium, Department of Mathematics and Statistics, Duluth, MN, April 15, 2004.
45. "Noninvertible Arnold Tongues," Bristol Centre for Nonlinear Mathematics Seminar, University of Bristol, Bristol, UK, November 19, 2004.
46. "Arnold tongue scenarios: form circle maps to noninvertible maps of the plane," Nonlinear Mathematics Seminar, University of Surrey, Guildford, Surrey, UK, Nov. 26, 2004.
47. "A differential equations model of mutualism," Mathematical Biology/Dynamics Seminar, Department of Mathematical Sciences, University of Loughborough, UK, December 1, 2004.
48. "A differential equations model of mutualism," Nonlinear Mechanics Seminar University of Bath, Bath, UK, December 14, 2004.
49. "Bifurcation Analysis of a Differential Equations Model for Mutualism," Population Dynamics and Epidemiology session, SIAM Conference on Applications of Dynamical Systems, Snowbird, UT, May 23, 2005.
50. "Bifurcation Scenarios for maps of the plane," Applied Analysis Seminar, UMD November 3, 2005.
51. "Some differential Equations models for peatland ecology," invited hour presentation, Global Ecology Workshop, Mathematical Biosciences Institute, Ohio State University, Columbus, OH, June 27, 2006.
52. "Peatland Models – Old and New," Applied Analysis Seminar, UMD, March 7, 2006.
53. "Stoichiometry Models," Applied Analysis Seminar, UMD March 21, 2006.
54. "Discussion of minisymposium talks," SIAM Conference on Applications of Dynamical Systems, Snowbird, Utah, May 30, 2007. (Session MS64: Modeling Nutrient Constraints: Stoichiometry of Cells Populations, and Ecosystems)
55. "Chaos in the plane: homoclinic tangles and loops," UMD Graduate Colloquium, Oct. 11, 2007.
56. "Bifurcations of noninvertible maps of the plane," Applied Analysis Seminar, UMD, October 16, 2007.
57. "The cusp-cusp bifurcation for noninvertible maps of the plane," Midwest Dynamical Systems Fall Seminar, University of Michigan, Ann Arbor, MI, October 21, 2007.
58. "Euler's Method: How bad can it be?" UMD Graduate Colloquium, Department of Mathematics and Statistics, Duluth, MN, March 11, 2010.
59. "Stoichiometric Population Models: Coexistence of two producers and one consumer," American Institute of Mathematical Sciences (AIMS) Conference, Dresden, Germany, May 27, 2010.
60. "Newton's method for cubics: How Spectacular can Failure Be?" UMD Undergraduate/Graduate Colloquium, Mar. 10, 2011.
61. "A Conjecture of Lorenz: Transitive plus Noninvertible implies Sensitive," SIAM Conference on Applications of Dynamical Systems, Snowbird, Utah, May 24, 2011. Coauthor: former master's student Garrett Taft.
62. "Newton's Method for Cubics: An Investigation of Blanchard's Spine," invited presentation at "Paulfest, A conference in honor of Paul Blanchard's 60th Birthday," Gustavus Adolphus College, Saint Peter MN, June 25, 2011.
63. "Breakup of an invariant circle in a noninvertible map of the plane," July 1, 2011, Institute for Mathematics and its Applications, New Directions Short Course on Invariant Objects in Dynamical Systems and their Applications, contributed presentation, Minneapolis, MN, July 1, 2011.
64. "Student Projects on Newton's method," MAA North Central Section Spring Meeting, Concordia University, St. Paul, April 21, 2012.

65. “Nonholomorphic singular continuations: a case with radial symmetry,” Midwest Dynamical Systems Conference, University of Notre Dame, Notre Dame, IN, Oct. 27, 2012. Poster presentation with coauthor Brett D. Bozyk.
66. “The breakup of an invariant circle in a noninvertible map: do strange nonchaotic attractors exist?”, The Devonport Topology Festival, Devonport, New Zealand, Feb 22, 2013.
67. “The dynamics and bifurcations of maps close to z^2+c ,” University of Auckland Department of Mathematics Applied Analysis Seminar, March 7, 2013.
68. “Enrichment in producer-consumer population models with stoichiometry,” Natural and Mathematical Sciences Institute Colloquium, University of Massey, Albany, New Zealand, March 27, 2013.
69. “Dynamics of Certain Rational Maps of the Plane,” 2013 SIAM Conference on Applications of Dynamical Systems, Snowbird, Utah, May 22, 2013.
70. “Classification of critical sets and their images for quadratic maps of the plane,” Boulder Dynamics: Conference in honor of Jim Meiss’ 60th Birthday (JDM60), University of Colorado, Boulder CO, July 22, 2014 (talk given remotely via Skype).
71. “Classification of critical sets and their images for Quadratic Maps of the Plane,” 2015 SIAM Conference on Applications of Dynamical Systems, Snowbird, Utah, May 18, 2015.
72. “Introduction to Chaos and Dynamical Systems” UMD Math Club Epsilon Talk, University of Minnesota Duluth Math/Stat Department, April 2017.
73. “Dynamics of some non-analytic perturbations of z^2+c ,” 2017 SIAM Conference on Applications of Dynamical Systems, Snowbird, Utah, May 24, 2017.
74. “When is the smooth image of a smooth curve not smooth?” UMD Math Club Epsilon Talk, University of Minnesota Duluth Math/Stat Department, March 1, 2018.
75. “Dynamics of some maps of the (real) plane,” Midwest/McGehee Dynamical Systems Conference, November 1, 2018.
76. “When does a sequence of pictures have a limit: the Hausdorff metric and the Sierpinski triangle?” UMD Math Club Epsilon Talk, University of Minnesota Duluth Math/Stat Department, March 21, 2019.
77. “Dynamics of some Rational Real Maps of the Plane,” 2019 SIAM Conference on Applications of Dynamical Systems, Snowbird, Utah, May 23, 2019.

Conference Session Organized: “Modeling nutrient constraints: stoichiometry of cells, populations, and ecosystems,” Session MS64, SIAM Conference on Applications of Dynamical Systems, Snowbird, UT, May 30, 2007. Co-organized with I Loladze and J Pastor.

Conference Organized: “Midwest Dynamical Systems Fall 2018 Conference”, UMTC, Minneapolis, November 1-4, 2018. Co-organized with G R Hall, E Sander, J Walsh.

STUDENTS SUPERVISED

A. GRADUATE STUDENT ADVISEES

1. B J Olsen, “Bifurcations of Piecewise Continuous Functions: A computer-aided case study,” M.S. thesis, 1994.
2. Jason Puckett, “Computing Periodic Orbits,” M.S. project, 1995.
3. Colleen Frost, “A Comparison Study of the SIS and SIRS Epidemic Models,” M.S. project, 1996.
4. Zbigniew Wdowiak, “Newton’s and Burgstahler’s Root Finding Methods,” M.S. project, 1996.
5. Jonathan Drexler, “A Nonanalytic Perturbation of the Complex Quadratic Family of Maps,” M.S. project, 1996.
6. Diana Colt, “Modeling viral infections in insect populations,” MS project, 1999. (Primary adviser: H. Stech.)
7. Angela Cates, “Modeling litter decay and root growth with dynamical systems,” MS project, 2000. (Primary adviser: H. Stech.)
8. Cosmin Deciu, “Computation of Homoclinic Orbits for the Henon Map,” MS thesis, 2000.
9. Wendy Graves, “A Comparison of some Simple Models of Mutualism,” MS thesis (but formally a project), 2003.
10. Steve Law, “Computation of Lyapunov Exponents,” MS project, 2003.
11. Karl Kruppstadt, “Newton’s method for Cubics,” MS project, 2004.
12. Laura Zimmermann, “A Producer–consumer model with stoichiometry,” MS project, 2006. (Coadvised with J. Pastor.)
13. Laurence Lin, “A stoichiometric model of two producers and one consumer with stoichiometry,” MS thesis, 2008. (Coadvised with H. Stech and J. Pastor.)

14. James Polsinelli, "Ergodic Theory and Dynamical Systems," MS project, 2010. (Coadvised with B. James.)
15. Garrett Taft, "Chaos, Attractors, and the Lorenz Conjecture: Noninvertible transitive maps of invariant sets are sensitive," MS thesis, 2010.
16. Xinyuan (Vinnie) Zhang, "Enrichment in a Producer-Consumer Model with varying rates of Stoichiometric Elimination," MS project, Nov. 2010.
17. Brett Bozyk, "Nonanalytic Singular Perturbations of Complex Analytic Maps," MS Thesis, August 2012.
18. Sarah Kabes, "From the Complex Quadratic maps to the Henon map, a bifurcation study," MS project, August 2012.
19. Evan Oman, "Dynamics of a singular perturbation of z^2+c ," MS Project, May 2015.
20. Erik Peterson, "Fractals, Nanotechnology, and Applications," MS Project, Aug. 2015.
21. Soleh Dib, "Dynamics of networks of Kuramoto Oscillators," MS Project, Jan. 2016.
22. Vaclav Hasenohrl, "Modeling of Ebola Control Strategies", MS Project, May 2016. (Coadvised with H. Stech)
23. Yujiong Liu, "A Connection between Analytic and Nonanalytic Singular Perturbations of the Quadratic Map: A Case Study", MS Project, May 2017.
24. Joseph Kell, "The breakup and continuation of invariant circles", MS Project, December 2017.
25. Noah Wong, "Newton's method for a nonanalytic perturbation of z^2-1 ", May 2020 (expected).

B. GRADUATE RESEARCH ASSISTANTS

1. Eric Nielsen, Dynamical systems software development, Research Assistant, 1992.
2. Cosmin Deciu, Dynamical Systems software and algorithm development, Research Assistant, 1999-2000.
3. Krishna Kotnana, Dynamical Systems software development and computer support, Research Assistant, 2002-03.
4. Joseph Erickson, Dynamical Systems software development and computer support, Research Assistant, 2004 and 2005.

C. UNDERGRADUATE RESEARCH PROJECTS

1. Zbigniew Wdowiak, "Newton's Method for Cubics," UROP project, 1992.
2. Ron Nelson, "Computing Fractal Basin Boundaries," UROP project, 1993.
3. Eric Nielsen, "Developing a GUI for a Dynamical Systems Software Package (TBC)", Research Assistant project, 1993.
4. Mircea Ungureanu, "Nonlinear Dynamics applied to Financial Markets," UROP project, 1999.
5. Tim Luthens, "Changing the topology of surfaces by folding the parameter space," related to NSF grant DMS-9020220, 1999.
6. Brian Ketelboeter, "The Cusp Bifurcation in Two Dimensions," UROP project, 2001.
7. Michael Dvorak, "Use of Dynamical Systems to Control Microorganism Populations," UROP project 2001.
8. Daniel Gastler, "The n-body problem," UROP project, 2002-4.
9. Joseph Erickson, "Dynamical Systems software development", Research Assistant, 2003-4.
10. J P Mc Bride, "Software for Dynamical Systems," UROP project, 2006.
11. Seth Slettedahl, "Numerical study of the breakup of an invariant circle in a noninvertible map of the plane," UROP project, 2007.
12. Jerod Lass, "Analysis of Traffic Circles", Honors project, 2009.
13. Heather Chopp, "Harvesting in a 2D Producer/Consumer Model", UROP project, 2009.
14. Jacob Yunker, "Statistical analysis for a proposed mechanism of protein-membrane interactions," Honors Project 2010.
15. Brock Burgeau, "Water Treatment and Pollution in Lake Superior," UROP and Honors project, May 2011.
16. Brett Bozyk, "The spine of Newton's Method for Cubics," UROP and Honors Project 2010.
17. Thomas Cameron, "Newton's Method for a Special Family of Quartics," Honors Project, 2012.
18. Jordan Maiers, "Singular Perturbations of the Quadratic Map: $z^2+c+B/zbar^2$ ", UROP and Honors Project, 2014.
19. Xinsheng Zhang, "The effect of hospital bed limitation on the spread of Ebola," UROP and Honors Project, May 2015.
20. Matt Arthur, "Perturbing z^2+c with a moving singularity," UROP and Honors project, May 2015.
21. Haitao Shang, "Dynamics of Quadratic Families," Independent study and Honors Project, July 2015.

22. Lesheng Wang, “Dynamics of a Singularly perturbed quadratic family: $(z^2+c+B/\bar{z}^d$ with $d=1$ or $2)$ ”, 2017.
23. Patrick Andresen, “Analyzing the Dynamics of z^2+A/\bar{z}^2 ”, 2017.
24. Michael Wroblewski, Perturbed Quadratic Maps: Transition from analytic to non-analytic: $f(z)=z^2+0.09(t/z^3+(1-t)/\bar{z}^3)$ ”, 2018.
25. Blake Shoemaker, “Reversing the Escape Algorithm in the Plane”, UROP project, May 2020.

PROFESSIONAL SERVICE ACTIVITIES

Referee for the following Journals: *Nonlinearity*, *Chaos*, *International Journal of Bifurcation and Chaos*, *IMA Journal of Applied Mathematics*, *Physica D*, *SIAM J. on Applied Dynamical Systems*, *SIAM J. Math Anal.*, *SIAM J. Num. Anal.*, *IEEE Transactions on Circuits and Systems*, *Journal of Mathematical Analysis and Applications*, *Proceedings of the AMS*, *Math Monthly*, *Journal of Biological Dynamics*, *College Mathematics Journal*, *Advances in Difference Equations*, *Journal of Difference Equations and Applications*

NSF Panelist for 2014 Applied Dynamical Systems Proposal Review

Referee for NSF proposals and NSERC (Canada) proposals.

Reviewer for *Math Reviews* and *Scholarpedia*.

PROFESSIONAL MEMBERSHIPS: American Mathematical Society, Mathematical Association of America, Society for Industrial and Applied Mathematics

UNIVERSITY SERVICE:

Department (Mathematics and Statistics): Department head (July 2016-May 2019), Associate Department Head (August 2013-June 2016), Acting Department Head, (July-August 2014), Director of Undergraduate Studies (2005-2012), Undergraduate Activities Committee, Scholarships and Awards Committee, Liberal/General Education committee, Bulletin committee, Constitution Committee, Webpage, Committee Math Club Advisor, Mathematical Contest in Modeling advisor, High School Math Contest organizer, New Faculty Mentor, Department Executive Committee, various search committees (chair of two tenure-track searches).

College (SCSE): Executive committee (2014-15), Senior Academic Leadership Committee (2016-2019)

Campus (UMD): Campus Athletic Committee (chair 2003-4), Liberal Education Subcommittee, Faculty Council (2013-2016)