

VITA

James H. Curry

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Education:

- University of California at Berkeley, B.A. Mathematics, 1970
- University of California at Berkeley, M.A. Mathematics, 1973
- University of California at Berkeley, Ph.D. Mathematics, 1976, Thesis Advisor: O.E. Lanford III, Berkeley.

Professional Preparation: University of California at Berkeley Mathematics: BA (1970), MA (1973), and Ph.D. Dec. 1976; Postdoctoral advisor: Professor E.N. Lorenz (Deceased), Atmospheric Sciences, MIT: 1978-1980; Postdoctoral advisor: Professor Richard McGehee, Mathematics/Dynamical Systems; University of Minnesota; 1981.

Appointments:

- Professor, Applied Math, University of Colorado—Boulder, 1989—Present;
- Program Director—Division of Mathematical Sciences - National Science Foundation September 2012—August 2014;
- Chair, Department of Applied Mathematics, University of Colorado—Boulder 2003—June 2012; Associate Chair of Applied Mathematics August 1996 to June 2000.
- J.R. Woodhull/Logicon Teaching Professor of Applied Mathematics 1999 – June 2012;
- University of Colorado President's Teaching Scholar, 1993 – present;
- Professor, Applied Math, University of Colorado—Boulder 1989 - Present (Tenured)
- Associate Director of the Program in Applied Mathematics 1988-August 1996.
- Professor of Mathematics, University of Colorado-Boulder 1986 to 1989 (Tenured.)
- Visiting Research Associate Mathematical Sciences Research Institute, Berkeley, California, 1986, Sabbatical
- Associate Professor of Mathematics, University of Colorado-Boulder (with tenure) 1982 to 1986;
- Postdoctoral Associate: University of Minnesota, Professor Richard McGehee, Mathematics/Dynamical Systems; 1981;
- Assistant Professor of Mathematics, University of Colorado, Boulder, 1978 to 1982;
- Postdoctoral Appointment: MIT, Professor E.N. Lorenz (Deceased), Atmospheric Sciences, 1978-1980;
- Postdoctoral Associate: Boulder, Colorado; National Center for Atmospheric Research

(NCAR), Atmospheric Sciences, 1977-1978

- Assistant Professor Howard University: 1976-1977.

Interest: Dynamical Systems, Meteorology, Computing, Nonlinear Equations, Image Processing, Mathematics Education.

Academic Experience:

- Assistant Professor, Howard University, 1976-1977
- Assistant Professor, University of Colorado, 1978-1982
- Associate Professor, University of Colorado, 1982-1989
- Professor, University of Colorado, 1989-Present
- Chair, Department of Applied Mathematics University of Colorado-Boulder, 2003- 2012

Teaching Awards:

- Outstanding Faculty Award (Minority Engineering Program), 1991
- Outstanding Professor Award (Tau Beta Pi), 1991
- College of Engineering and Applied Sciences Outstanding Advisor Award, 1991
- Boulder Faculty Assembly University of Colorado Teaching Excellence Award, 1992
- University of Colorado-Boulder Outstanding Advisor Award, 1993
- Outstanding Professor Award (Tau Beta Pi), 1993
- Student Organization for Alumni Relations (SOAR) Teaching Award, 1993
- University of Colorado President's Teaching Scholar Award, 1993-present
- J. R. Woodhull/Logicon Teaching Professorship University of Colorado-Boulder College of Engineering, 1999-2012.

Honors and Awards

- *January 2012 -Marjorie Lee Browne Colloquium Lecture (University of Michigan).*
- *MAA William Claytor Lecture 1996.*

Software Awards:

- ICTCM software award 2003
- MERLOT Classic Award 2005
- MERLOT Editor's Choice Award (top award) 20

Fellowships:

Council on Research and Creative Work Fellowship, University of Colorado, September 1985-June 1986. (Member: Mathematical Sciences Research Institute - Berkeley)

- National Research Council Postdoctoral Fellowship (Ford Foundation: University of Minnesota, January 1982-July 1982), Senior Ford Fellow 2010-Present.
- Centre National de la Recherche Scientifique (Fellowship), Institute des Hautes Etudes Scientifiques, Bures-sur-Yvette, France, January 1981-September 1981.

Graduate Fellowships: National Fellowship Fund Fellow (Ford Foundation), 1973-1976.

Postdoctoral Study:

- Professor Richard McGehee, University of Minnesota, 1981.
- Postdoctoral Research Associate, MIT, Department of Meteorology, 1978-1980 (with E. N. Lorenz).
- Postdoctoral Fellow, National Center for Atmospheric Research, 1977-1978.

Publications:

1. *Chaotic Response to Periodic Modulation in a Model of a Convecting Fluid*, Physical Review Letters, Vol. 43, No. 14 (1979).
2. *An Algorithm for Numerically Finding Closed Orbits*, Proc. Int. I. Conf. Global Theory of Dynamical Systems, Lecture Notes in Math, No. 819.
3. *Some Systems Motivated by the Lorenz Model*, Proc. Int. I. Conf. in Math. Physics - Laussane, 1979, Lecture Notes in Physics, Vol. 80.
4. *A Generalized Lorenz System*, Communication in Math Physics, Vol. 60, 193 (1978).
5. *Bounded Solutions of Finite Dimensional Approximations to the Boussinesq Equations*, SIAM Journal of Math. Analysis, Vol. 10, Jan. 1979.
6. *On Hénon's Transformation*, Communications in Math Physics, Vol. 68, 129 (1979).
7. *The Entropy of the Hénon Attractor*, Journal of Statistical Physics, 1981, Vol. 26, No. 4.
8. *The Hopf Bifurcation and Chaos*, with J.A. Yorke, Springer Lecture Notes in Math, No. 668.
9. *On the Rate of Approach to Homoclinic Tangency* (Physics Letters, 1982).
10. *Order and Disorder in the Rayleigh-Bénard Problem with Slip-Boundaries* [Joint work with J. Herring (NCAR) and S. Orszag (MIT)], Journal of Fluid Mechanics, Vol. 147 (1984), 1-38.
11. *On the Behavior of Real Newton's Method* (The Mathematical Analysis of Physical Systems. Editor: R. Micken).
12. *On the Iteration of a Rational Function: Computer Experiments with Newton's Method*, Curry, J.H., Garnett, L., and Sullivan, D.; Communications in Mathematical Physics, Vol. 91 (1983), 267-277.
13. *On the Nonpathological Behavior of Newton's Method*, Curry, J.H. and Wayne, E.; Contemporary Mathematics, Vol. 28, 407-418 (1983).
14. *Low Order Intermediate Models: Bifurcation, Recurrence and Solvability* (with D. Winsand). Journal of the Atmospheric Sciences, Vol. 43 (1986), 2360-2373.
15. *On Zero Finding Methods of Higher Order From Data at a Point*. Journal of Complexity (June 1989).
16. *On the Dynamics of Laguerre's Iteration* (with S.L. Fiedler). Physica D 30 (1988), pp. 124-134.
17. *On the Theory and Computation of Approximate Zeros* (with E.S. Van Vleck). Manuscript, 1989.
18. *On the Geometry of Factorization Algorithms* (with Sharon L. Blish). American Mathematical Society Conference Proceedings - Nonlinear Equations (1990).
19. *On Computing Solutions of the Kuramoto-Sivashinsky Equation: Shooting and Finite Differences*. (Manuscript, Sept. 1989).
20. *Eye of Newton: The Movie* (1989-September).
21. *Initialization: Lorenz's Algorithm and Intermediate Model Equations*. (Curry, Haupt, and Nesbitt), (Tellus, 1995, 47A, pp. 145-161).

22. *On the Dynamics of Shooting Methods for Solving Regular Sturm-Liouville Problems* (with M.N. Limber). *Communications on Applied Nonlinear Analysis*, Vol. 1 (1994), pp.1-24.
23. *On Noninvertible Mappings of the Plane: Eruptions* (James H. Curry and Lora Merck-Billings), *CHAOS*, 1996, Vol. 6 pp. 108-120.
24. *Bifurcations in a Class of Noninvertible Mappings of the Plane* (James H. Curry and Lora Billings), *Computational Engineering in Systems Applications (CESA) 1996*, conference proceedings. Lille, France.
25. *Lypunov Exponents, Singularities and a Riddling Bifurcation* (James H. Curry, with Lora Billings and Eric Phipps), *Physical Review Letters*, 1997, 11 August 1997, Volume 79, Number 6.
26. *Symmetric Functions, blowout bifurcations, and on-off intermittency* (James Curry, with Lora Billings and Eric Phipps), *Applied Mathematics Report # 338*, in *Physica D*, 1998.
27. *Relaxed Newton's Method: A Simple Study in Chaotic Dynamics*. (James Curry, with Lora Billings and Vanessa Robins), *Applied Mathematics Report # XXX*, . CAARMS 1998 conference proceedings.
28. *Stochastic Aspects of One Dimensional Discrete Dynamical Systems: Benford's Law* (James H. Curry, with Mark Snyder, and Anne Dougherty) *Applied Mathematics Report #4WW*, *Physical Review E*, Sept 2001.
29. *Stochastic Aspects of Dynamics: Dynamical Systems that Satisfy Benford's Law* (James H. Curry, with Mark Snyder, and Anne Dougherty) *Applied Mathematics Report #4XX*.
30. *Properties of de Rahm-Chaikin Fractals* (James H. Curry. with Geoff Goehle, and Anne Dougherty) *Applied Mathematics Report #4YY*.
31. *Seeding Non Negative Matrix Factorization (with Stefan Wild, and Anne Dougherty, Pattern Recognition, vol 37, 2004)*
32. *Non Negative Matrix Factorization: Ill-posedness and a geometric algorithm (with Bradley Klingenberg, and Anne Dougherty, Pattern Recognition, vol 42, 2009)*
33. *Nonnegative Matrix Factorization applied to reordered pixels of single images based patches to achieve structured nonnegative dictionaries,, Richard M. Charles, Kye M. Taylor, James H. Curry, (August 2015, under review.)*

Invited Addresses:

- *On Computer Simulation of Some Dynamical Systems, International Conference on Mathematical Physics, August, 1979.*
- *Transition to Turbulence in a Simple Fluid Model, Midwinter Solid State Physics Conference, January 1979.*
- *The Third Instability, Gordon Conference, August 1979.*
- *Unstable Systems: Butterfly Wings, Convection, Chaos, University of California, Berkeley, April 1980.*
- *University of Minnesota, November 1980, Minneapolis-St. Paul, 1-hour Colloquium.*
- *The Entropy of the Henon Attractor, April 1981, Bures-sur-Yvette, France, 1 1/2 hour talk;*
- *La Jolla Institute, December 1981, Conference, 20-minute talk;*
- *Dynamics Days, January 1982, Conference, 20-minute tal;*
- *Workshop on the Predictability of Fluid Motion: La Jolla Institute, February 1983, 1-hour*

talk.

- *The Theory of Approximate Zeros*, MSRI, 1986.
- *On Arcs of Zero finding Algorithms*, University of Pittsburgh, 1987.
- *Computation of Fixed Points*, University of Tennessee-Knoxville, 1987.
- *On the Theory and Computation of Approximate Zeros*, Georgia Tech, 1988.
- *Existence and Computation of the Slow Manifold*, National Center for Atmospheric Research, 1988.
- *On Factorization Algorithms*, AMS Conference, Fort Collins, 1988.
- *Chaos and Strange Attractors*, University of Colorado-Denver, 1988.
- *The Numerical Solution of Simple Equations*, Clarkson University, 1988.
- *On Bairstow's Algorithm*, University of Minnesota, 1989.
- *On Polynomial Factorization Algorithms*, University of California-Davis, May 1989.
- *Bairstow Methods: Factoring Polynomials Iteratively*, NAM/AMS Claytor Lecture-San Francisco, California, January 1995.
- *Data Analysis and Intermediate Models*, DOE/OSE Applied Mathematics Workshop, Albuquerque, New Mexico, February 26-March 1, 1995.
- *Bifurcations in Noninvertible Mappings*, CSEA 1996, Lille, France July, 1996. (Lecture presented by Lora Billings)
- *Bifurcations in Noninvertible Mappings*, Colorado School of Mines, April 1997.
- *MAA-NAM David Blackwell Lecture*, 2003
- *What can matrix Factorization tell you?*, Vietnam National University, Hanoi, June 2005.
- *What can matrix Factorization tell you?*, Vietnam Academy of Science and Technology, Ho Chi Min City, June 2005.
- *Non Negative Matrix Factorization: Ill-posedness and a geometric algorithm*, Vietnam Academy of Science and Technology, Ho Chi Min City, June 2007.
- *Non Negative Matrix Factorization: Ill-posedness and a geometric algorithm: Parts are parts*, Vietnam National University, Hanoi, June 2007.
- *January 2012 -Marjorie Lee Browne Colloquium Lecture (University of Michigan).*

Ph.D. Students:

- *Dr. Lora Merck Billings. Ph.D. awarded May 1998. (Dissertation: Dynamical Systems Methods Applied to Polynomial Factorization Families: A Study in Chaotic Attractors)*
- *Dr. Martha Nesbitt Limber. Ph.D. awarded December 1991. (Dissertation: On the Dynamics of Shooting Methods for Sturm-Liouville Problems)*
- *Dr. Fathi Allan. Ph.D. awarded May 1992. (Dissertation: On the Transition to Turbulence in a Boundary Layer Flow)*
- *Dr. Arthur Paul Mizzi. Ph.D. awarded May 1994. (Dissertation: Vertical Spectral Representation in Numerical Models of the Atmosphere)*
- *Dr. Linda Ethel Sundbye. Ph.D. awarded May 1994. (Dissertation: Global Existence of Solutions for the Viscous Shallow Water Equations)*
- *Dr. Scott Alexander Herod. Ph.D. awarded August 1994. (Dissertation: Computer Assisted Determination of Lie Point Symmetries with Application to Fluid Dynamics)*
- *Dr. Richard Charles degree August 2015. (Matrix Patch Reordering as a strategy for Image Compression, Factorization and Pattern Detection using Nonnegative Matrix*

Factorization Applied to Single Images.

Undergraduates Research Assistants 2006 to 2012:

Moorea Brega, Lauren Anderson, Amanda Plappert, Corry Lee, Laura Waterbury, David (Clay) Washington, Sarah Macumber, Sean McDivitt, Kristen Pfannenstiel, Michael Franklin, Vincent Ferrari, Alejandro Cantarero, Karl Obermeyer, Kris Tucker, Amy Hirshmann, Ian Derrington, Rachael Danson, Erik Brechen, Stefan Wild Bradley Klingenberg, Kye Taylor, Julia Whippo, Kirk Nicholes, Chris Ian Davis, Stephen Dalton, Jonathan Olsen, Joseph Adams, Ryan Schlit, Paul Fonia, Tiana Stastny, Margaret Noble Geoff (Colin) Peterson, George Emanuel, Anil Damle, Marshall Carpenter, Stephen Kissler, George Emanuel, Matthew Cullen.

Research and Students:

Over my career I have produced more than 25 Master's students who are employed by various companies and organizations, including General Dynamics and the National Center for Atmospheric Research. Several students, including Stuart Fielder and Eric Scott Van Vleck, have completed the Ph.D at other universities. My student, Stefan Wild completed a Ph.D student at Cornell University in Operations Research. My student Karl Obermeyer completed the PhD at U-Cal Santa Barbara. Dr. Lora Billings is Professor at Montclair State University. Dr. Richard Charles is administrator in the Colorado Cherry Creek School District—Director of Stem education.

Technology:

For the past 25 years I have worked with methods for solving systems of non-linear equations. This has lead to the infusion of computational tools methods and strategies in various of my own classes and classes that are central to the Department of Applied Mathematics at the University of Colorado-Boulder. For example, during my tenure, first as Associate Director of the Program in Applied Mathematics and then as Associate Chair of the Department, I introduced computational projects and labs into third and fourth semester lower division applied mathematics courses. More than 1000 students each semester now learn from hands on interactive projects that are designed and developed by undergraduate and graduate students in applied mathematics and engineering. These new modules are paid for by student fees and a partnership with Sun Microsystems that I was successful in bringing into the Department. This effort, intern lead to the Mathematical Visualization Toolkit (MVT) that won a prize for outstanding software in 2003.

Interactive IT based projects are important for not only stimulating practical problems such as the number of operations required to compute some quantity or search for some text string, but they also lead to theoretical questions and the possibly of more efficient algorithms.

Grants Received:

- *National Research Council, \$2,500.00.*
- *National Science Foundation grant No. PRM-8106833, Computed Aided Analysis of Dissipative Dynamical Systems and Their Attractor Sets, 1981-1985, \$43,980.00.*
- *National Science Foundation grant No. ATM-83 12719, Low Order Models, Invariant Manifolds and Initialization, 1983-1985, \$80,460.00.*
- *National Science Foundation grant No. ATM-85 19947, Intermediate Model Equations for Atmospheric Motion, 1986-1988, \$108,000.00.*

- *National Science Foundation grant No. DMS-87-03282, Approximate Zeros Arcs of Zero finding Algorithms and Higher Order Methods, 1987-1988, \$72,300.00.*
- *National Science Foundation grant No. DMS-8712283, Mathematical Sciences: REU: Research Experiences for Undergraduates, 1987-1988, \$32,000.00.*
- *National Science Foundation grant No. DMS-8804749, Mathematical Sciences: REU: Research Experiences for Undergraduates, 1988-1991, \$120,000.00.*
- *National Science Foundation grant No. DMS-9403540, Scientific Computing Research Equipment in the Mathematical Sciences : SCREMS, 1994-1995, \$65,000.00 (one of five PIs).*
- *Office of Naval Research grant: Nonlinear Ocean Waves, 1992-1997, \$450,000.00 (joint with Mark Ablowitz, Harvey Segur, and Joe Hammack).*
- *Department of Energy grant: An Interdisciplinary Mathematical Approach to the Analysis and Development of Intermediate Models of Atmospheric and Oceanic Models, 1994-1996, \$108,000.00.*
- *Co-PI for NSF award for Vertical Integration of Research and Education (VIGRE), National Science Foundation, 1998-2003, \$2,500,000 (\$500,000/year.)*
- *Co-PI on Colorado Commission on Higher Education (CCH) Excellence award for Excellence in Applied Mathematics, State of Colorado, 1999-2004, \$1,000,000 (\$200,000/year.) (Joint with CU-Denver Mathematics Department)*
- *Co-PI and Project Director for National Science Foundation Alliance for Graduate Education and the Professoriate grant (October 2000 to March 2002). University of Colorado- Boulder,*
- *PI on NSF funded equipment grant (SCREMS) August 2002- August 2004, \$75,000,*
- *Co-PI on NSF Funded: Transforming Science and Mathematics Teacher Preparation (STEM-TP) June 1, 2003 - May 30, 2006, \$932,847,*
- *Co-PI on NSF Funded: Noyce Fellowship Program in Teacher Preparation, July 2005 - December 2008, \$500,000.*
- *PI on NSF Funded: Mentoring Through Critical Transition Points, July 2006 - June 2012, \$1,300,000.*
- *Co-PI on NSF Funded: CCLI-II Colorado Momentum October 2008 - December 2010, \$450,000.*

Consulting:

- *National Center for Atmospheric Research (Scientific Computing Division/Advanced Methods), 1981-1987.*
- *GuideStar Technologies, 2008-2010.*

Other Employment:

- *Visiting Scientist: National Center for Atmospheric Research (Atmospheric Analysis and Prediction), June 1983-August 1983.*
- *Visiting Faculty: Sun Educational Services Headquarters August 2000-December 2000.*
- *2012 September- 2014 August: Program Director, Division of Mathematical Sciences, National Science Foundation*

Service:

- *National Research Council/Ford Foundation Fellowship for Minorities Panel, 1985- 1989;*
- *National Science Foundation - American Mathematical Society Postdoctoral Review Panel,*

1990-1993;

- *American Mathematical Society Committee on Communications, 1991-1994;*
- *Various national panels, including: NSF Review and DOD Graduate Fellowship Panel (1991-present), etc;*
- *Council for Research and Creative Works, University of Colorado, 1986-1989;*
- *Dean's (College of Arts and Sciences) Personnel Committee, 1989-1992;*
- *Vice-Chancellor's Personnel Committee, 1992-1996;*
- *University of Colorado-Boulder Chancellor's Committee on Information Technology, most recent 2000-2001;*
- *Associate Director, Program in Applied Mathematics, 1987-1993;*
- *Interim Director of the Minority Arts and Sciences Program (MASP), August 1993-May 1994;*
- *CONNECT/SSI: Colorado Department of Education, September 1993-1998;*
- *Board of Governors, The Geometry Center (National Science Foundation Science and Technology Center), University of Minnesota, August 1994-1998;*
- *Various selection committees at CU-Boulder, both Department and Campus, 1988- present;*
- *Associate Chair, Department of Applied Mathematics, 1995-June 30, 2000;*
- *Sun Academic Initiative Coordinator for the University of Colorado-Boulder 1998-2005;*
- *CO-PI and Project Director, Alliance for Graduate Education and the Professoriate, University of Colorado-Boulder October 1, 2000-March 2002;*
- *Ford Foundation Fellows conference committee 2002-present;*
- *Associate Editor American Mathematical Monthly, July 2001-2006;*
- *American Math Society Committee on Academic Freedom, Tenure, and Employment Security (CAFTES), Sept 2001-2004;*
- *American Math Society Committee on the Professorate Sept 2007-2009;*
- *SIAM representative to the Frank and Bernie Morgan Prize for Outstanding Research in Mathematics by an Undergraduate Student selection Committee, 2005 through 2008;*
- *Board of Trustees of the University of Colorado Foundation, October 2002-present;*
- *National Research Councils Fellowship Advisory Board (AFPAC) October 2003-2012.*
- *Editorial SIAM Undergraduate Online Journal, 2008-2012;*
- *2012 September- 2014 August: Program Director, Division of Mathematical Sciences, National Science Foundation;*
- *Department of Applied Mathematics Undergraduate Committee; 2014-Preseent;*
- *Dean's Search Committee (Dean of the College of Media, Communication and information) 2014-2015;*
- *SIAM Membership Committee (November 2014-October 2017);*
- *Dean's Search Committee (Dean of the College of Engineering and Applied Sciences) University of Colorado Boulder. 2015-2016;*
- *Faculty Member, Campus Grand Challenge Initiative (Earth Lab) -University of Colorado 2014-Present.*