

# DAVID F. ANDERSON

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## EDUCATION

- Ph.D., Mathematics, Duke University, Durham, NC., Aug. 2005.  
Thesis Advisors: Michael C. Reed and Jonathan C. Mattingly.
- M.A., Mathematics, Duke University, Durham, NC., 2001.
- B.A., Mathematics, University of Virginia, Charlottesville, Va., 2000.

## EMPLOYMENT

- August 2009 – Present,
  - Assistant Professor in Department of Mathematics, University of Wisconsin, Madison.
  - Affiliate Professor in Department of Statistics, University of Wisconsin, Madison.
- January 2007 – August 2009, Van Vleck Visiting Assistant Professor.  
Department of Mathematics, University of Wisconsin, Madison. Under the direction of Tom Kurtz (Mathematics) and John Yin (Chemical and Biological Engineering).
- September 2005 – December 2006. Research Associate.  
Department of Mathematics, Duke University.

## GRANT SUPPORT

- September 2010 - August 2013, NSF-DMS-1009275, \$180,000, *Stochastic and deterministic models of intracellular reaction networks: analysis and algorithms*.

## AWARDS AND HONORS

- University Housing Honored Instructor, University of Wisconsin at Madison, Spring 2010.
- Burroughs Wellcome Fund Career Award at the Scientific Interface (Finalist), 2008.
- L.P. and Barbara Smith Award for Teaching Excellence, Duke University Mathematics Department, August 2004.
- National Science Foundation VIGRE grant support, Fall 2000 - Spring 2005.
- E.J. McShane prize in Mathematics, University of Virginia Mathematics Department, May 2000.

## WRITINGS (all available on arxiv.org and my departmental webpage)

1. David F. Anderson, *An Efficient Finite Difference Method for Parameter Sensitivities of Continuous Time Markov Chains*, submitted. Available on arxiv.org at <http://arxiv.org/abs/1109.2890>.

2. David F. Anderson and Masanori Koyama, *Weak error analysis of approximate simulation methods for multi-scale stochastic chemical kinetic systems*. Submitted. Available on arxiv.org at <http://arxiv:1102.2922>.
3. David F. Anderson and Desmond J. Higham, *Multi-level Monte Carlo for stochastically modeled chemical kinetic systems*, SIAM: Multiscale Modeling and Simulation, Vol. 10, No. 1, 146 - 179, 2012.
4. David F. Anderson, *A proof of the Global Attractor Conjecture in the single linkage class case*, SIAM J. Appl. Math., 71(4), 2011.
5. David F. Anderson, *Boundedness of trajectories for weakly reversible, single linkage class reaction systems*, Journal of Mathematical Chemistry, 10.1007/s10910-011-9886-4, 2011.
6. David F. Anderson and Thomas G. Kurtz, *Continuous time Markov chain models for chemical reaction networks*, chapter in Design and Analysis of Biomolecular Circuits: Engineering Approaches to Systems and Synthetic Biology, H. Koepl et al. (eds.), Springer, 2011.
7. David F. Anderson and Jonathan C. Mattingly, *A weak trapezoidal method for a class of stochastic differential equations*, Communications in Mathematical Sciences, **9**(1), 301 - 318, March 2011.
8. David F. Anderson, Arnab Ganguly, and Thomas G. Kurtz, *Error Analysis of the tau-leap simulation method for stochastically modeled chemical reaction systems*, Annals of Applied Probability, Vol. 21, No. 6, 2226 - 2262, 2011.
9. David F. Anderson, Gheorghe Craciun, and Thomas G. Kurtz, *Product-form stationary distributions for deficiency zero chemical reaction networks*, Bulletin of Mathematical Biology, **72**, 1947 - 1970, 2010.
10. David F. Anderson and Anne Shiu, *The dynamics of weakly reversible population processes near facets*, SIAM J. Appl. Math, **70**(6), 1840 - 1858, January 2010.
11. David F. Anderson, *Global asymptotic stability for a class of nonlinear chemical equations*, Siam J. Appl. Math., **68**(5), 1464 - 1476, May 2008.
12. David F. Anderson, *Incorporating postleap checks in tau-leaping*, Journal of Chemical Physics, **128**(5), 054103, Feb. 2008.
13. David F. Anderson, *A modified Next Reaction Method for simulating systems with time varying rate constants and systems with delays*, Journal of Chemical Physics, **127**(21), 214107, Dec. 2007.
14. David F. Anderson and Jonathan C. Mattingly, *Propagation of Fluctuations in Biochemical Reaction Systems, II: Nonlinear Chains*, IET Systems Biology, **1**(6), 313 - 325, Nov. 2007.
15. David F. Anderson, Jonathan C. Mattingly, H. Frederik Nijhout, Michael Reed, *Propagation of Fluctuations in Biochemical Systems, I: Linear SSC Networks*, Bulletin of Mathematical Biology, **69**(6), 1791 - 1813, Aug. 2007.
16. H. Frederik Nijhout, Michael C. Reed, David F. Anderson, Jonathan C. Mattingly, S. Jill James, and Cornelia M. Ulrich, *Long-Range Allosteric Interactions between the Folate and Methionine Cycles Stabilize DNA Methylation Reaction Rate*, Epigenetics, **1**(2), 81 - 87, April/May 2006.

17. David F. Anderson, *Stochastic Perturbations of Biochemical Reaction Systems*, PhD Thesis, Duke University Mathematics Department, Aug. 2005.

## CURRICULUM DEVELOPMENT

- **Math 605: Stochastic Methods in Biology**, University of Wisconsin - Madison. This course is an introduction to stochastic processes, with applications to biology. It covers discrete and continuous time Markov chains, and diffusion processes. In the continuous time setting, we formulate and utilize the random time change representation of Tom Kurtz.

## PROFESSIONAL SERVICE

1. 2011 - 2014, IMS Committee on New Researchers.
2. Conferences organized.
  - (I.) SIAM Conference on Life Sciences minisymposium, August 7th - 10th, 2012. Minisymposium: Stochastic Dynamics in Cell Biology: Simulation, Analysis, and Experiment.
  - (II.) 14th Meeting of New Researchers in Statistics and Probability. U. of California, San Diego, July 26th - 28th, 2012.
  - (III.) 2010 SIAM Conference on Life Sciences minisymposium: Computational Methods for Biochemical Systems parts I and II.
3. Journals reviewed for:
  - (I.) Annals of Applied Statistics.
  - (II.) Communications in Mathematical Sciences.
  - (III.) SIAM journal on Applied Mathematics.
  - (IV.) SIAM Applied Dynamical Systems.
  - (V.) SIAM journal on Mathematical Analysis.
  - (VI.) SIAM: Multiscale Modeling and Simulation.
  - (VII.) Mathematical Biosciences.
  - (VIII.) Mathematical Biosciences and Engineering.
  - (IX.) Journal of Chemical Physics.
  - (X.) Journal of Computational Physics.
  - (XI.) IEEE Transactions on Automatic Control.
  - (XII.) IEEE Transactions on Circuits and Systems I.
  - (XIII.) IEE Proceedings Systems Biology.
  - (XIV.) Computers and Mathematics with Applications.

## TEACHING EXPERIENCE

- An introduction to Brownian Motion and Stochastic Calculus, U. of Wisconsin Math 635, Spring 2012.
- Stochastic Methods in Biology, U. of Wisconsin Math 605, Fall 2011.
- Introduction to the Theory of Probability, U. of Wisconsin math 431, Spring 2011.
- Calculus II, Wisconsin math 222, Fall 2011.
- Introduction to Stochastic Processes, U. of Wisc. math 632, Fall 2011.

- Stochastic Models in Biology, U. of Wisconsin math 801 (topics course), Spring 2010.
- Introduction to the Theory of Probability, U. of Wisconsin math 431, Spring 2010.
- Calculus I, U. of Wisconsin math 211, Fall 2009.
- Introduction to probability and Markov chain models, U. of Wisconsin math 331, Fall 2008.
- Introduction to probability and Markov chain models, U. of Wisconsin math 331, Spring 2008.
- Linear Algebra & Differential Equations, Duke math 107, Fall 2006 (2 sections).
- Ordinary & Partial Differential Equations, Duke math 108, Spring 2006 (2 sections).
- Applied Mathematical Analysis I, Duke math 111, Fall 2005.
- Calculus I, Duke math 31L, Fall 2003 (3 sections).
- Calculus I, Duke math 25L, Fall 2002.
- Calculus I Lab Instructor, Fall 2001.

### COLLOQUIA, CONFERENCE PRESENTATIONS, AND INVITED TALKS

1. Talk. MCQMC (Monte Carlo and Quasi-Monte Carlo), Sydney, Australia. Feb. 17th, 2012.
2. Seminar on Probability and its Applications. Penn State, State College, PA. January 13th, 2012.
3. Statistics seminar, U. of Wisconsin, Madison. Dec. 7th, 2011.
4. Probability seminar at U. of Wisconsin, Madison. Nov. 10th, 2011.
5. Talk. Mathematical Biosciences Institute (MBI) workshop: Stochastic Processes in Cell and Population Biology, Columbus, Ohio. Oct. 24th - 28th, 2011.
6. Talk. SIAM: Conference on Applied Algebraic Geometry, Raleigh, NC. October 6 - 9th, 2011.
7. Talk. MATH BIO 3: MODELING, Wisconsin Institute for Discovery, Madison, Wi. September 30th, 2011.
8. Plenary talk. First OMI and OCCAM Joint Workshop, Oxford University, 8th-10th August, 2011.
9. Plenary talk. Conference on Stochastic Systems Biology. Monté Verita Switzerland (hosted by ETH Zurich), July 20th - 22nd, 2011.
10. Invited seminar talk. Applied Math Seminar at Simon Fraser University (Vancouver, Canada). April 1st, 2011.
11. Invited conference talk. Conference on Computational and Systems Biology. University of Florida, March 17th - 19th, 2011.
12. Invited seminar talk. Mathematical Biology seminar at the University of Illinois (Champaign-Urbana). Feb. 24th, 2011.
13. Colloquium in Mathematics department at Virginia Tech. February 11th, 2011.
14. Invited seminar talk. Computation and Informatics in Biology and Medicine (CIBM) seminar, Madison, Wi, Dec. 7th, 2010.
15. AMS 2010 Fall Central Section Meeting, Notre Dame, IN, November 5-7, 2010.
  - Talk: Numerical methods for stochastic models of biochemical reaction networks.
16. Colloquium talk in the Mathematics department at the University of Maryland, Baltimore County. Sept. 10th, 2010.
  - Talk title: Simulation of stochastically modeled biochemical networks.

17. SIAM: Annual Meeting and conference on the Life Sciences, Pittsburgh, Pa. July 15th, 2010.
  - Talk: Error analysis of tau-leap methods.
18. SIAM: Emerging Topics in Dynamical Systems and Partial Differential Equations, Barcelona, Spain. June 4th, 2010.
  - Talk: Simulation methods for stochastic models in chemistry.
19. SIAM: Emerging Topics in Dynamical Systems and Partial Differential Equations, Barcelona, Spain. June 3rd, 2010.
  - Talk: The Persistence and Global Attractor Conjectures.
20. Computational and Mathematical Methods in Science and Engineering (CMMSE), Madison, Wi. May 25th, 2010.
  - Talk: *Numerical methods for stochastic models of biochemical reaction networks.*
21. BACTER Institute, University of Wisconsin at Madison. April 27th, 2010.
  - Talk: *Stochastic models of biochemical reaction networks.*
22. Stochastic Networks Conference, Newton Institute, Cambridge, UK., March 22-26, 2010.
  - Invited Talk: *Simulation methods for stochastically modeled chemical reaction networks.*
23. Probability seminar, University of Wisconsin – Madison, September 10th, 2009.
  - Talk: *Error analysis of numerical methods for stochastically modeled chemical reaction systems.*
24. SAMSI, Stochastic Dynamics opening workshop. SAMSI, North Carolina. August 30th – September 2nd, 2009.
  - Invited Talk: *Error analysis of approximation methods for stochastically modeled chemical reaction systems.*
25. Max Planck Institute. Magdeburg, Germany. July 29th, 2009.
  - Invited Talk: *Error analysis of approximation methods for stochastically modeled chemical reaction systems.*
26. Stochastic Processes and their Applications (SPA), Berlin, July 27 - 31, 2009.
  - Invited Talk: *Error analysis of approximation methods for stochastically modeled chemical reaction systems.*
27. Workshop on Control Theory and Dynamics in Systems Biology, DIMACS, Rutgers, May 18 - 22, 2009.
  - Invited talk: *The deficiency zero theorem for stochastically modeled systems.*
28. North Carolina State University, Department of Mathematics Colloquium (Job Talk), January 21, 2009.
  - Invited talk: *Deterministic and Stochastic Methods for Biochemical Reaction Systems.*
29. Michigan State University, Department of Mathematics Colloquium (Job Talk), January 16, 2009.
  - Invited talk: *Deterministic and Stochastic Methods for Biochemical Reaction Systems.*
30. McGill University, Department of Mathematics Colloquium (Job Talk), January 12, 2009.
  - Invited talk: *Deterministic and Stochastic Methods for Biochemical Reaction Systems.*
31. The Ohio State University, Department of Mathematics and the Mathematical Biosciences Institute (Job Talk), January 7, 2009.

- Invited talk: *Deterministic and Stochastic Methods for Biochemical Reaction Systems*.
32. University of Wisconsin - Madison, Department of Mathematics Colloquium (Job Talk), December 12, 2008.
    - Invited talk: *On the dynamics of biochemical reaction systems*.
  33. Workshop on Discrete Models in Systems Biology, Statistical and Applied Mathematical Sciences Institute (SAMSI) in Research Triangle Park, NC, USA, December 3-5, 2008.
    - Invited talk: *Persistence and Stationary Distributions of Biochemical Reaction Networks*.
  34. Mathematical and Computational Models in Biological Networks, Mathematical Biosciences Institute (MBI), October 20-24, 2008.
    - Invited Talk: *The Deficiency Zero Theorem, Global Stability, and Stationary Distributions*.
  35. Applied Math seminar, University of Wisconsin - Madison, October 15th, 2008.
    - Talk: *Qualitative properties of biochemical reaction systems*.
  36. SIAM Conference on the Life Sciences, Montreal, Canada, Aug. 4th, 2008.
    - Invited Talk: *Product-form stationary distributions for complex balanced chemical reaction networks*.
  37. Stochastic Networks Conference, École Normale Supérieure, Paris, June 23-28, 2008.
    - Poster: *Product-form stationary distributions for deficiency zero chemical reaction networks*.
  38. Workshop on Stochastic Models for Intracellular Reaction Networks, Institute for Mathematics and its Applications (IMA), Minneapolis, Mn., May 11, 2008.
    - Poster: *Product-form stationary distributions for deficiency zero chemical reaction networks*.
  39. 2nd annual graduate probability conference at the University of Wisconsin, Madison, March 4, 2008.
    - Invited Talk: *Product-form stationary distributions for deficiency zero chemical reaction networks*.
  40. Probability seminar, University of Wisconsin - Madison, March 13, 2008.
    - Talk: *Product-form stationary distributions for deficiency zero chemical reaction networks*.
  41. Workshop on Protein Folding, Institute for Mathematics and its Applications (IMA), Minneapolis, Mn., January 14-18, 2008.
    - Invited Talk: *Simulation methods for stochastic chemical systems that arise from a random time change representation*.
  42. FRG group meeting. San Diego, Ca. January 3rd, 2008.
    - Talk: *Simulation methods for stochastically modeled chemical reaction systems*.
  43. Workshop on the practice and theory of stochastic simulation, American Institute of Mathematics, Palo Alto, Ca., October, 2007.
    - Talk: *Incorporating postleap checks in tau-leaping methods via a random time change representation*.

44. Computation and Informatics in Biology and Medicine, 6th Annual Retreat, Madison, Wi., October 19, 2007.
  - Poster: *Simulating discrete biochemical reaction systems.*
45. Workshop for Young Researchers in Mathematical Biology (WYRMB) at the Mathematical Biosciences Institute, MBI, Columbus, Oh., September 11-14, 2007.
  - Poster: *Simulating discrete biochemical reaction systems.*
46. Probability seminar, University of Wisconsin - Madison, September 6, 2007.
  - Talk: *Simulation methods for discrete stochastic chemical systems arising from a random time change representation.*
47. Applications of Analysis to Mathematical Biology: A conference in honor of the 65th birthday of Michael C. Reed, Duke University, May 21 - 23, 2007.
  - Invited Talk: *Using Random Forcing to Study the Out-of-Equilibrium Dynamics of Biochemical Reaction Systems.*
48. FRG Group Meeting, University of Wisconsin, March 27, 2007.
  - Talk: *Simulating Discrete Stochastic Systems with Delays.*
49. Probability seminar, University of Wisconsin - Madison, Nov. 16, 2006.
  - Talk: *Biochemical Reaction Systems and External Excitations.*
50. Probability and Differential Equations joint seminar, North Carolina State University, Raleigh, NC., October 16, 2006.
  - Talk: *Biochemical Reaction Systems and External Excitations.*
51. Recent advances in nonlinear partial differential equations and applications, Toledo, Spain, June, 2006.
  - Poster: *Propagation of Fluctuations in Biochemical Systems.*
52. Workshop on Applications of Methods of Stochastic Systems and Statistical Physics in Biology, University of Notre Dame, October, 2005.
  - Invited Talk: *Propagation of Fluctuations in Biochemical Systems.*
53. Society of Mathematical Biology annual meeting, University of Michigan, July 27, 2004.
  - Poster: *Stochastic Stability of Biochemical Reaction Systems (Poster)*