Marc D. Riedel, Ph.D.

Academic Rank
Associate Professor with Tenure, Electrical & Computer Engineering
Graduate Faculty, Biomedical Informatics & Computational Biology
University of Minnesota, Twin Cities

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Websites

Main website: http://tinyurl.com/marc-riedel-group
Research: http://tinyurl.com/marc-riedel-research
Papers: http://tinyurl.com/marc-riedel-papers

EDUCATION

- Postdoctoral Fellow, Computation and Neural Systems, 2004–2005
  California Institute of Technology
  Funded by the NIH Human Genome Research Institute

- Ph.D., Electrical Engineering, 2004
  California Institute of Technology

  Dissertation Title: "Cyclic Combinational Circuits"
  Advisor: Jehoshua Bruck
  Committee: Yaser Abu-Mostafa, Jehoshua Bruck, Ali Hajimiri, Alain Martin, Erik Winfree, and Andrew Viterbi (external from the Viterbi School of Engineering, University of Southern California)

- M.S., Electrical Engineering, 1998
  California Institute of Technology

- B.Eng., Electrical Engineering, 1995
  Minor in Mathematics, 1995
  McGill University

POSITIONS

- Associate Professor with Tenure, 2012–present
  Electrical and Computer Engineering
  University of Minnesota, Twin Cities

- Assistant Professor, 2006–2012
  Electrical and Computer Engineering
  University of Minnesota, Twin Cities

- Faculty Member, 2006–present
  Digital Technology Center
  University of Minnesota, Twin Cities

- Graduate Faculty, 2008–present
  Biomedical Informatics and Computational Biology Program
  University of Minnesota, Twin Cities

- Lecturer, 2004–2005
  Computation and Neural Systems
  California Institute of Technology

- Research and Teaching Assistant, 2001–2004
  Electrical Engineering
  California Institute of Technology

HONORS AND AWARDS

- **CAREER Award** from the National Science Foundation.

- Paper titled "The Synthesis of Combinational Logic to Generate Probabilities" nominated for the **IEEE/ACM William J. McCalla Best Paper Award** at the International Conference on Computer-Aided Design (ICCAD), 2009.

- **Charles H. Wilts Prize** for the Best Doctoral Research in Electrical Engineering at Caltech, 2004.

- Paper titled "The Synthesis of Cyclic Combinational Circuits" received the **Best Paper Award** at the Design Automation Conference (DAC), 2003.

RESEARCH FUNDING

External Sponsored Funding

- Agency: **National Science Foundation**
  Program: Software and Hardware Foundations
  Title: "*Computing on Time-Encoded Data: A New Paradigm for Low-Power, Skew-Tolerant, Error-Tolerant Computing Systems*"
  Investigators: M. Riedel (PI), R. Harjani (co-PI), K. Bazargan (co-PI), D. Lilja (co-PI), and M. Asgari (co-PI)
  Amount: $1,200,000
  Duration: 2017–2021
  Status: Pending

- Agency: National Science Foundation
  Program: Software and Hardware Foundations
  Title: "Advanced Signal Processing with Molecular Reactions"

Investigators: Keshab Parhi (PI) and Marc Riedel (co-PI)
Amount: $300,000
Duration: 2014-2017

- Agency: National Science Foundation
  Program: Software and Hardware Foundations
  Title: "Back to the Future with Printed, Flexible Electronics Design in a Post-CMOS Era when Transistor Counts Matter Again"
  Investigators: K. Bazargan (PI), D. Frisbie (co-PI), R. Harjani (co-PI), and D. Lilja (co-PI), Marc Riedel (co-PI)
  Amount: $800,000
  Duration: 2013–2017

- Agency: National Science Foundation
  Program: Software and Hardware Foundations
  Title: "Digital Yet Deliberately Random – Synthesizing Logical Computation on Stochastic Bit Streams"
  Investigators: Marc Riedel (PI), K. Bazargan (co-PI), R. Harjani (co-PI), and D. Lilja (co-PI)
  Amount: $300,000
  Duration: 2012–2015

- Agency: National Science Foundation
  Program: Software and Hardware Foundations
  Title: "Digital Signal Processing with Biomolecular Reactions"
  Investigators: Keshab Parhi (PI) and Marc Riedel (co-PI)
  Amount: $400,000
  Duration: 2011–2014

- Agency: National Science Foundation
  Program: **NSF CAREER Award**
  Title: "Computing with Things Small, Wet, and Random – Design Automation for Digital Computation with Nanoscale Technologies and Biological Processes"
  Investigator: Marc Riedel (PI)
  Amount: $500,000
  Duration: 2009–2014

- Agency: National Science Foundation
  Program: Design Automation for Micro and Nano Systems
  Title: "Synthesizing Signal Processing Functions with Biochemical Reactions"
  Investigators: Keshab Parhi (PI) and Marc Riedel (co-PI)
  Amount: $200,000
  Duration: 2009–2011

- Agency: SRC Focus Center Research Program (FCRP)
  Program: Functional Engineered Nano-Architectonics (FENA)
  Title: "The Concurrent Logical and Physical Design of Nanoscale Digital Circuits"
  Investigator: Marc Riedel (PI)
  Amount: $325,000
  Duration: 2007–2010

University Sources

- Agency: University of Minnesota, Digital Technology Center
  Program: Digital Technology Initiatives (DTI) Seed Grant
  Title: "Computational Method for Forward Biological Engineering"
  Investigators: Y. Kaznessis (PI), C. Schmidt-Dannert (co-PI), and M. Riedel (co-PI)
  Amount: $97,800
  Duration: 2011–2012

- Agency: University of Minnesota
  Program: Biomedical Informatics and Computational Biology (BICB)
  Funding: Student Traineeships for Brian Fett and Adrianna Fitzgerald
  Investigator: Marc Riedel (PI)
  Amount: $78,000
  Duration: 2007–2009

PUBLICATIONS and PRESENTATIONS

Peer-Reviewed Journal Articles and Book Chapters

1. "Polysynchrous Clocking: Exploiting the Skew Tolerance of Stochastic Circuits"
   M. Hassan Najafi, David Lilja, Marc Riedel, and Kia Bazargan
   IEEE Transactions on Computers, under revision, 2017

2. "Time-Encoded Values for Highly Efficient Stochastic Circuits,"
   M. Hassan Najafi, Shiva Jamali-Zavareh, David Lilja, Marc Riedel, Kia Bazargan, and Ramesh Harjani
   IEEE Transaction on Very Large Scale Integration Systems, to appear, 2017

3. "A Reconfigurable Architecture with Sequential Logic-based Stochastic Computing"
   M. Hassan Najafi, Peng Li, David Lilja, Weikang Qian, Kia Bazargan, and Marc Riedel, *ACM Journal on Emerging Technologies in Computing Systems*, to appear, 2017

4. "Chemical Reaction Networks for Computing Polynomials"
   S. Ahmad Salehi, Keshab Parhi, and Marc Riedel
   ACS Synthetic Biology, Vol. 6, No. 1, pp. 76–83, 2017

5. "Molecular Sensing and Computing Systems"
   S. Ahmad Salehi, Keshab Parhi, and Marc Riedel
   IEEE Transactions on Molecular, Biological, and Multi-Scale Communications, Vol. 1, No. 3, 2015

6. "Synthesizing Cubes to Satisfy a Given Intersection Pattern"
   Weikang Qian, Marc Riedel, and Ivo Rosenberg
   Journal of Discrete Applied Mathematics, Vol. 193, pp. 11–38, 2015

7. "Computation on Stochastic Bit Streams: Digital Image Processing Case Studies"
   Peng Li, David Lilja, Weikang Qian, Kia Bazargan, and Marc Riedel
   IEEE Transactions on VLSI Systems, Vol. 22, No. 3, pp. 449–462, 2014

8. "Logical Computation on Stochastic Bit Streams with Linear Finite State Machines"
   Peng Li, David Lilja, Weikang Qian, Marc Riedel, and Kia Bazargan
   IEEE Transactions on Computers, Vol. 63, No. 6., pp. 1474–1486, 2014

9. "Discrete-Time Signal Processing with DNA"
   Hua Jiang, S. Ahmad Salehi, Marc Riedel, and Keshab Parhi
   ACS Synthetic Biology, Vol. 2, No. 5, pp. 245–254, 2013

10. "Case Studies of Logical Computation on Stochastic Bit Streams"
    Peng Li, David Lilja, Weikang Qian, Kia Bazargan, and Marc Riedel
    Lecture Notes in Computer Science: Power and Timing Modeling, Optimization and Simulation Workshop,
    G. Goos, J. Hartmanis, and J. V. Leeuwen Editors., Springer, pp. 235–244, 2012

11. "Gene Regulatory Network Modeling Using Literature-Curated and High Throughput Data"
    Vishwesh Kulkarni, Reza Arastoo, Anupama Bhat, Kalyanasundaram Subramanian, Mayuresh Kothare, and Marc Riedel
    Systems and Synthetic Biology, Vol. 6, No. 3–4, pp. 69–77, 2012

12. "Synthesis of Cyclic Functional Dependencies"
    John Backes and Marc Riedel
    ACM Trans. on Design Automation of Electronic Systems, Vol. 17, No. 4, pp. 1–24, 2012

13. "Logic Synthesis for Switching Lattices"
    Mustafa Altun and Marc Riedel
    IEEE Transactions on Computers, Vol. 61, No. 11, pp. 1588–1600, 2012

14. "Digital Signal Processing with Molecular Reactions"
    Hua Jiang, Marc Riedel, and Keshab Parhi
    IEEE Design & Test of Computers, Vol. 29, No. 3, pp. 31–31, 2012

15. "Cyclic Boolean Circuits"
    Marc Riedel and Jehoshua Bruck
    Journal of Discrete Applied Mathematics, Vol. 160, No. 13–14, pp. 1877–1900, 2012

16. "Transforming Probabilities with Combinational Logic"
    Weikang Qian, Marc Riedel, Hongchao Zhou, and Jehoshua Bruck
    IEEE Trans. on CAD of Integrated Circuits & Systems, Vol. 30, No. 9, pp. 1279–1292, 2011

17. "Synthesizing Logic with Percolation in Nanoscale Lattices"
    Mustafa Altun and Marc Riedel
    Int'l Journal of Molecular and Nanoscale Computation, Vol. 3, No. 2, pp. 12–30, 2011

18. "Characterizing the Memory of the GAL Regulatory Network in *Saccharomyces cerevisiae*"
    Vishwesh Kulkarni, Venkatesh Kareenhalli, Ganesh Viswananthan, and Marc Riedel
    Systems and Synthetic Biology, Vol. 5, No. 3–4, pp. 97–104, 2011

19. "Rate-Independent Constructs for Chemical Computation"
    Philip Senum and Marc Riedel
    PLoS ONE, Vol. 6, Issue 6, 12 pages, 2011

20. "Uniform Approximation and Bernstein Polynomials with Coefficients in the Unit Interval"
Weikang Qian, Marc Riedel, and Ivo Rosenberg
European Journal of Combinatorics, Vol. 32, No. 3, pp. 448–463, 2011

21. "An Architecture for Fault-Tolerant Computation with Stochastic Logic"
Weikang Qian, Xin Li, Marc Riedel, Kia Bazargan, and David Lilja
IEEE Transactions on Computers, Vol. 60, No. 1, pp. 93–105, 2011

22. "Synthesizing Combinational Logic to Generate Probabilities: Theories and Algorithms"
Weikang Qian, Marc Riedel, Kia Bazargan, and David Lilja
Advanced Techniques in Logic Synthesis, Optimizations and Applications
Sunil Khatri and Kanupriya Gulati Editors, Springer Publishing, pp. 1–28, 2011

23. "The Synthesis of Stochastic Logic for Nanoscale Digital Circuits"
Weikang Qian, John Backes, and Marc Riedel
International Journal of Molecular and Nanoscale Computation
Vol. 1, Issue 4, pp. 39–57, 2010

24. "Computing in the RAIN: A Reliable Array of Independent Nodes"
Vasken Bohossian, Charles Fan, P. LeMahieu, Marc Riedel, Lihao Xu, and Jehoshua Bruck
IEEE Transactions on Parallel and Distributed Computing, Vol. 12, No. 2, pp. 99–114, 2001

25. "Tolerating Faults in Counting Networks"
Marc Riedel and Jehoshua Bruck
Dependable Network Computing, Dimiter Avresky, Editor
Kluwer Academic Publishing, pp. 267–278, 2000

Peer-Reviewed Conference Papers

1. "Time-Encoded Values for Highly Efficient Stochastic Circuits"
M. Hassan Najafi, Shiva Jamali-Zavareh, David Lilja, Marc Riedel, Kia Bazargan, and Ramesh Harjani
IEEE International Symposium on Circuits & Systems, 2017

2. "Computing Polynomials with Positive Coefficients using Stochastic Logic by Double-NAND Expansion"
S. Ahmad Salehi, Yin Liu, Marc Riedel and Keshab Parhi
ACM Great Lakes Symposium on VLSI, 2017

3. "Synthesis of Correlated Bit Streams for Stochastic Computing"
Yin Liu, Megha Parhi, Marc Riedel, and Keshab Parhi
Asilomar Conference on Signals, Systems and Computers, 2016

4. "A Deterministic Approach to Stochastic Computing"
Devon Jenson and Marc Riedel
ACM/IEEE International Conference on Computer-Aided Design, 2016.

5. "Computing Polynomials using Chemical Reaction Networks"
S. Ahmad Salehi, Keshab Parhi, and Marc Riedel
IEEE Globecom Symposium, 2016

6. "Polysynchronous Stochastic Circuits"
   M. Hassan Najafi, David Lilja, Marc Riedel, and Kia Bazargan
   IEEE/ACM Asia and South Pacific Design Automation Conference, 2016

7. "Markov Chain Computations using Molecular Reactions"
   S. Ahmed Salehi, Marc Riedel, and Keshab Parhi
   IEEE International Conference on Digital Signal Processing, pp. 689–693, 2015

8. "Effect of Bit-Level Correlation in Stochastic Computing"
   Megha Parhi, Marc Riedel, and Keshab Parhi
   IEEE International Conference on Digital Signal Processing, pp. 463–467, 2015

9. "Asynchronous Discrete-Time Signal Processing with Molecular Reactions"
   Ahmed Salehi, Marc Riedel, and Keshab Parhi
   Asilomar Conference on Signals, Systems, and Computers, pp. 493–497, 2014

10. "IIR Filters Using Stochastic Arithmetic"
    Naman Saraf, Kia Bazargan, Davd Lilja, Marc Riedel
    IEEE/ACM Conference on Design, Automation and Test in Europe, pp. 1–6, 2014

11. "Digital Logic with Molecular Reactions"
    Hua Jiang, Marc Riedel and Keshab Parhi
    IEEE/ACM International Conference on Computer-Aided Design, pp. 721–727, 2013

12. "Stochastic Functions Using Sequential Logic"
    Naman Saraf, Kia Bazargan, David Lilja and Marc Riedel
    IEEE International Conference on Computer Design, pp. 507–510, 2013

13. "An Efficient Implementation of Numerical Integration Using Logical Computation on Stochastic Bit Streams"
    Weikang Qian, Chen Wang, Peng Li, David Lilja, Kia Bazargan, and Marc Riedel,
    IEEE/ACM International Conference on Computer-Aided Design, pp. 156–162, 2012

14. "The Synthesis of Complex Arithmetic Computation on Stochastic Bit Streams Using Sequential Logic"
    Peng Li, David Lilja, Weikang Qian, Kia Bazaragan and Marc Riedel
    IEEE/ACM International Conference on Computer-Aided Design, pp. 480–487, 2012

15. "The Synthesis of Linear Finite State Machine-based Stochastic Computational Elements"
    Peng Li, Weikang Qian, Marc Riedel, Kia Bazargan, David Lilja
    IEEE/ACM Asia and South Pacific Design Automation Conference, pp. 757–762, 2012

16. "Robust Tunable in vitro Transcriptional Oscillator Networks"
    Vishwesh Kulkarni, Theerachai Chanyaswad, Marc Riedel and Jongmin Kim
    Asilomar Conference on Signals, Systems, and Computers, pp. 114–119, 2012

17. "Asynchronous Computation with Molecular Reactions"
    Hua Jiang, Marc Riedel, and Keshab Parhi
    Asilomar Conference on Signals, Systems, and Computers, pp. 493–497, 2011

18. "Synchronous Sequential Computation with Molecular Reactions"
    Hua Jiang, Marc Riedel, and Keshab Parhi
    ACM/IEEE Design Automation Conference, pp. 836–841, 2011

19. "Rate-Independent Constructs for Chemical Computation"
Philip Senum and Marc Riedel
Pacific Symposium on Biocomputing, pp. 326–337, 2011

20. "Binary Counting with Chemical Reactions"
Aleksandra Kharam, Hua Jiang, Marc Riedel, and Keshab Parhi
Pacific Symposium on Biocomputing, pp. 302–313, 2011

21. "Networks of Passive Oscillators"
Vishwesh Kulkarni, Marc Riedel, and Guy-Bart Stan
Allerton Conference on Communication, Control, and Computing, 559–565, 2011

22. "A Synthesis Flow for Digital Signal Processing with Biomolecular Reactions"
Hua Jiang, Alexsandra Kharam, Marc Riedel, and Keshab Parhi
IEEE/ACM International Conference on Computer-Aided Design, pp. 417–424, 2010

23. "Digital Signal Processing with Biomolecular Reactions"
Hua Jiang, Aleksandra Kharam, Marc Riedel, and Keshab Parhi
IEEE/ACM International Conference on Computer-Aided Design, 8 pages, 2010

24. "Lattice-Based Computation of Boolean Functions"
Mustafa Altun and Marc Riedel
ACM/IEEE Design Automation Conference, pp. 609–612, 2010

25. "Writing and Compiling Code into Biochemistry"
Adam Shea, Brian Fett, Marc Riedel, and Keshab Parhi
Pacific Symposium on Biocomputing, pp. 456–464, 2010

26. "The Synthesis of Combinational Logic to Generate Probabilities"
Weikang Qian, Marc Riedel, Kia Bazargan, and David Lilja
IEEE/ACM International Conference on Computer-Aided Design, pp. 367–374, 2009
(Nominated for **IEEE/ACM William J. McCalla Best Paper Award**)

27. "Synthesizing Sequential Register-Based Computation with Biochemistry"
Adam Shea, Brian Fett, Marc Riedel, and Keshab Parhi
IEEE/ACM International Conference on Computer-Aided Design, pp 136–143, 2009

28. "Nanoscale Digital Computation Through Percolation"
Mustafa Altun, Marc Riedel, and Claudia Neuhauser
ACM/IEEE Design Automation Conference, pp. 615–616, 2009

29. "A Reconfigurable Stochastic Architecture for Reliable Computing"
Xin Li, Weikang Qian, Marc Riedel, Kia Bazargan, and David Lilja
IEEE Great Lakes Symposium on VLSI Design, pp. 315–320, 2009

30. "Estimation and Optimization of Reliability of Noisy Digital Circuits"
Satish Sivaswamy, Kia Bazargan, and Marc Riedel
IEEE International Symposium on Quality Electronic Design, pp 213–219, 2009

31. "Stochastic Transient Analysis of Biochemical Systems"
Bin Cheng and Marc Riedel
Pacific Symposium on Biocomputing, pp. 4–14, 2009

32. "Module Locking in Biochemical Synthesis"
Brian Fett and Marc Riedel
IEEE/ACM International Conference on Computer-Aided Design, 758–764, 2008

33. "The Analysis of Cyclic Circuits with Boolean Satisfiability"
John Backes and Marc Riedel
IEEE/ACM International Conference on Computer-Aided Design, pp. 143–148, 2008

34. "The Synthesis of Robust Polynomial Arithmetic with Stochastic Logic"
Weikang Qian and Marc Riedel
ACM/IEEE Design Automation Conference, pp. 648–653, 2008

35. "Synthesizing Stochasticity in Biochemical Systems"
Brian Fett, Jehoshua Bruck, and Marc Riedel
ACM/IEEE Design Automation Conference, 640–645, 2007

36. "The Synthesis of Cyclic Combinational Circuits"
Marc Riedel and Jehoshua Bruck
ACM/IEEE Design Automation Conference, pp. 163–168, 2003
(Received the **DAC Best Paper Award**)

Peer-Reviewed Workshop Papers

1. "A Deterministic Approach to Stochastic Computing"
Devon Jenson and Marc. D. Riedel,
IEEE/ACM International Workshop on Logic and Synthesis, 7 pages, 2016
Nominated for Best Student Paper Award

2. "Using a Two-Dimensional Finite-State Machine for Stochastic Computation"
Peng Li, Weikang Qian, David Lilja, Marc Riedel, and Kia Bazargan
IEEE/ACM International Workshop on Logic and Synthesis, 8 pages, 2012

3. "Resolution Proofs as a Data Structure for Logic Synthesis"
John Backes and Marc Riedel
IEEE/ACM International Workshop on Logic and Synthesis, 8 pages, 2011

4. "Synthesizing Cubes to Satisfy a Given Intersection Pattern"
Weikang Qian and Marc Riedel
IEEE/ACM International Workshop on Logic and Synthesis, pp. 217-224, 2010

5. "Two-Level Logic Synthesis for Probabilistic Computation"
Weikang Qian and Marc Riedel
IEEE/ACM International Workshop on Logic and Synthesis, pp. 95–102, 2010

6. "Reduction of Interpolants for Logic Synthesis"
John Backes and Marc Riedel
IEEE/ACM International Workshop on Logic and Synthesis, 6 pages, 2010

7. "Digital Signal Processing with Biomolecular Reactions"
Hua Jiang, Marc Riedel, and Keshab Parhi
IEEE Workshop on Signal Processing Systems, pp. 237–242, 2010

8. "The Synthesis of Cyclic Dependencies with Craig Interpolation"
   John Backes and Marc Riedel
   IEEE/ACM International Workshop on Logic and Synthesis, pp. 24–30, 2009

9. "Synthesizing Sequential Register-Based Computation with Biochemistry"
   Adam Shea, Brian Fett, Marc Riedel, and Keshab Parhi
   IEEE/ACM International Workshop on Logic and Synthesis, 8 pages, 2009

10. "The Synthesis of Combinational Logic to Generate Probabilities"
    Weikang Qian, Marc Riedel, Kia Bazargan, and David Lilja
    IEEE/ACM International Workshop on Logic and Synthesis, 8 pages, 2009

11. "The Synthesis of Stochastic Logic to Perform Multivariate Polynomial Arithmetic"
    Weikang Qian and Marc Riedel
    IEEE/ACM International Workshop on Logic and Synthesis, pp. 79–86, 2008

12. "The Synthesis of Stochastic Circuits for Nanoscale Computation"
    Weikang Qian, John Backes, and Marc Riedel
    IEEE/ACM International Workshop on Logic and Synthesis, pp. 176–183, 2007

13. "Application of LUT Cascades to Numerical Function Generators"
    Tsutomu Sasao, Jon Butler, and Marc Riedel
    Workshop on Synthesis & System Integration of Mixed Information, 7 pages, 2004

14. "Timing Analysis of Cyclic Combinational Circuits"
    Marc Riedel and Jehoshua Bruck
    IEEE/ACM International Workshop on Logic and Synthesis, pp. 446–453, 2004

15. "Cyclic Combinational Circuits: Analysis for Synthesis"
    Marc Riedel and Jehoshua Bruck
    IEEE/ACM International Workshop on Logic and Synthesis, pp. 105–112, 2003

Patents

1. "Polysynchrous Stochastic Logic"
   M. Hassan Najafi, David Lilja, Marc Riedel, and Kia Bazargan
   Pending

2. "Method and Means for the Synthesis of Cyclic Combinational Circuits"
   Marc Riedel and Jehoshua Bruck
   U.S. Patent 7,249,341

3. "A Reliable Array of Distributed Computing Nodes"
   Vincent Bohossian, Charles Fan, Paul LeMahieu, Marc Riedel, Lihao Xu, and Jehoshua Bruck
   U.S. Patent 6,128,277

Presentations with Published Abstracts

1. "Stochastic Computing: A New Paradigm for Ultra Low Power, Fault-Tolerant, Skew-Tolerant Computing"
   Marc Riedel (**invited**)
   Energy Consequences of Information Workshop
   Sponsored by Air Force Office of Scientific Research, Santa Fe, NM, 2017

2. "A Deterministic Approach to Stochastic Computing"
   Devon Jenson and Marc Riedel (**invited**)
   Information Theory and Applications Workshop, UC San Diego, 2017

3. "Polysynchronous Clocking for Stochastic Computing"
   Marc Riedel (**invited**)
   CMOS Emerging Technologies Workshop, Montreal, Quebec, 2016

4. "Polysynchronous Clocking for Molecular Computing"
   Marc Riedel (**invited**)
   Workshop on Communications, Inference, and Computing in Molecular and Biological Systems, Los Angeles, CA, 2015

5. "Synchronous Computation and Signal Processing and DNA"
   Marc Riedel (**invited**)
   Workshop on Coding Techniques for Synthetic Biology, Urbana-Champaign, IL, 2015

6. "Probability as State Variable for Nanoscale Computation"
   Marc Riedel (**invited**)
   CMOS Emerging Technologies Workshop, Vancouver, BC, 2015

7. "Pipelining for Accuracy with Stochastic Computing"
   Marc Riedel (**invited**)
   Information Theory and Applications Workshop, UC San Diego, 2015

8. "Probability as State Variable for Nanoscale Computation"
   Marc Riedel (**invited**)
   Information Theory and Applications Workshop, UC San Diego, 2014

9. "A Biomolecular Implementation of Non-Linear Systems"
   Vishwesh Kulkarni, Hua Jian, Theerachai Chanyaswad, Angelina Shudy, and Marc Riedel
   International Workshop on Bio-Design Automation, San Fransisco, CA, 2012

10. "So Simple a Caveman Could Do It – Computing On Stochastic Bit Streams"
    Marc Riedel (**invited**)
    Information Theory and Applications Workshop, UC San Diego, 2012

11. "Synthesizing Logical Computation on Stochastic Bit Streams for Sensing Applications"
    Marc Riedel (**invited**)
    IEEE CANDE Workshop, San Jose, CA, 2011

12. "Digital Signal Processing with DNA"
    Hua Jiang, Marc Riedel, and Keshab Parhi
    International Conference on DNA Computing, Pasadena, CA, 2011

13. "Synthesizing Logical Computation on Stochastic Bit Streams"
    Marc Riedel (**invited**)
    CMOS Emerging Technologies Workshop, Whistler, BC, 2011

14. "Asynchronous Sequential Computation with Molecular Reactions"
    Hua Jiang, Marc Riedel, and Keshab Parhi
    International Workshop on Bio-Design Automation, San Diego, CA, 2011

15. "Biological Network Reconstruction Using Literature Curated and High Throughput Data"
Vishwesh Kulkarni, Kalyanasundaram Subramanian, Reza Arastoo,
Mayuresh Kothare, and Marc Riedel
International Workshop on Bio-Design Automation, San Diego, CA, 2011

16. "Rate-Independent Constructs for DNA Computing"
Philip Senum and Marc Riedel
Annual Institute of Biological Engineering Conference, Atlanta, GA, 2011

17. "Lattice-Based Computation with Percolation"
Mustafa Altun and Marc Riedel (**invited**)
IEEE/ACM International Symposium on Nanoscale Architectures, Anaheim, CA, 2010

18. "Signal Processing Functions with Biomolecular Reactions"
Hua Jiang, Marc Riedel, and Keshab Parhi
International Workshop on Bio-Design Automation, Anaheim, CA, 2010

19. Session Summary: "Engineering Biology: Fundamentals and Applications"
Marc Riedel, Soha Hassoun, and Ron Weiss (**invited**)
ACM/IEEE Design Automation Conference, Anaheim, CA, 2010

20. "Digital Signal Processing with Biochemistry"
Marc Riedel (**invited**)
Symposium on the Foundations of Nanoscience, Salt Lake City, UT, 2010

21. "Iterative Computation with Biomolecular Reactions"
Hua Jiang, Marc Riedel, and Keshab Parhi
Annual Institute of Biological Engineering Conference, Boston, MA, 2010

22. "Stochastic Logic and Stochastic Biological Processes"
Marc Riedel (**invited**)
Information Theory and Applications Workshop, UC San Diego, 2010

23. "Computing with Things Small, Wet, and Random"
Marc Riedel (**invited**)
IEEE CANDE Workshop, Monterey, CA, 2009

24. "Stochastic Chemical Reaction Networks"
Marc Riedel (**invited**)
International Workshop on Stochasticity, Banff, Alberta, 2009

25. "Synthesizing Sequential Register-Based Computation with Biochemistry"
Adam Shea, Brian Fett, Marc Riedel, and Keshab Parhi
International Workshop on Bio-Design Automation, San Francisco, CA, 2009

26. "Synthesizing Circuit Constructs with Chemical Reaction Networks"
Marc Riedel (**invited**)
Emergence in Chemical Systems Conference, Anchorage, AK, 2009

27. "Rate-Independent Biochemical Synthesis"
Adam Shea, Brian Fett, and Marc Riedel
Annual Institute of Biological Engineering Conference, Santa Clara, CA, 2009

28. "Modular Stochastic Biochemistry"
    Brian Fett and Marc Riedel
    Synthetic Biology 4.0, Hong Kong, 2008

29. "Biochemical Pathways from Generic Designs"
    Brian Fett and Marc Riedel
    Synthesis of Cells Meeting, Kobe, Japan, 2008

30. "The Computer-Aided Synthesis of Stochastic Biochemistry"
    Brian Fett and Marc Riedel
    Advances in Synthetic Biology Conference, Cambridge, UK, 2008

31. "Synthesizing Stochasticity"
    Brian Fett and Marc Riedel
    Synthetic Biology 3.0, Zürich, Switzerland, 2007

32. "Using The Probability Gradient to Analyze Bifurcating Biochemical Systems"
    Brian Fett and Marc Riedel
    International Conference on Systems Biology, Yokohama, Japan, 2006

33. "Exact Stochastic Simulation with Event Leaping"
    Marc Riedel and Jehoshua Bruck
    International Conference on Systems Biology, Boston, MA, 2005

Invited Talks, Colloquia, and Panels (without published abstracts)

1. "Stochastic Computing: So Simple that a Caveman Could Do It"
   Paradise Workshop
   Host: Jehoshua Bruck
   California Institute of Technology, Feb. 15, 2017

2. "Polysynchronous Clocking for Molecular Computing"
   Bio Physics Seminar Series
   Host: Elias Puchner
   University of Minnesota, Sept. 29, 2016

3. "A Deterministic Approach to Stochastic Computing"
   Waterloo Workshop on Stochastic Computing
   Host: Vincent Gaudet
   University of Waterloo, May 25, 2016

4. "The Future of Computer Engineering"
   Keynote address to IEEE General Meeting, UMN Student Branch
   Host: Karel Kalthoff
   University of Minnesota, Jan. 25, 2016

5. "Towards a Computer Engineering Discipline with DNA"
   Biochemistry Seminar
   Host: Prof. Aseem Ansari
   University of Wisconsin, Sept. 30, 2013

6. "The Modest Mathematician: Anecdotes from the Personal and Professional Life of Ivo Rosenberg"
   Honorary Doctorate Ceremony for Ivo Rosenberg
   Host: Prof. Dietlinde Lau
   University of Rostock, Germany, May 15, 2013

7. "Towards a Computer Engineering Discipline with DNA"
   Computer Science Seminar
   Host: Prof. Jack Lutz
   Iowa State University, Nov. 30, 2012

8. "Logic Synthesis for Networks of Four-Terminal Switches"
   Computer Science Seminar
   Host: Prof. Alex Sprintson
   Texas A&M University, April 20, 2012

9. "Random and Loopy Circuits: Complexity in Electronic and Biological Circuit Design"
   Dept. of Defense Research and Engineering Complex Systems Study
   Host: Robert Bond
   Squam Lake, NH, July 27, 2010

10. Panelist: "CAD for Nanoelectronic Circuits and Architectures – Are We There Yet?"
    IEEE/ACM International Symposium on Nanoscale Architectures
    Organizer: Prof. Garrett Rose
    Anaheim, CA, June 17, 2010

11. "Robust Stochastic Computation with Biomolecular Reactions"
    NSF Workshop on Shared Organizing Principles in Biology
    Organizer: Prof. Melanie Mitchel
    Arlington, VA, May 25, 2010

12. "Computing with Things Small, Wet, and Random"
    Biological and Medical Physics Seminar Series
    Host: Prof. Vincent Noireaux
    University of Minnesota, March 30, 2010

13. "Computing with Things Small, Wet, and Random"
    Computer Science Seminar
    Host: Prof. Soha Hassoun
    Tufts University, March 1, 2010

14. Tutorial: "Programming Constructs for Chemical Reaction Networks"
    Pacific Symposium on Biocomputing
    Organizer: Dr. Gil Alterovitz
    Kona, Hawaii, Jan. 7, 2010

15. "Computing with Things Small, Wet, and Random"
    Electrical and Computer Engineering Seminar
    Host: Prof. Azadeh Davoodi
    University of Wisconsin, Feb. 27, 2009

16. "Computing with Things Small, Wet, and Random"
Electrical and Computer Engineering Seminar
Host: Prof. Lin Zhong
Rice University, Feb. 17, 2009

17. "Computing with Things Small, Wet, and Random"
Electrical and Computer Engineering Seminar
Host: Prof. Anxiao (Andrew) Jiang
Texas A&M University, Feb. 17, 2009

18. "Synthesizing Nearly Rate Independent Biochemical Computation"
NSF Expeditions in Computing – Molecular Programming Workshop
Organizer: Prof. Erik Winfree
Oxnard, CA, Jan. 10, 2009

19. "Computing with Things Small, Wet, and Random"
Electrical and Computer Engineering Seminar
Host: Prof. Rick Kiehl
UC Davis, Sep. 29, 2008

20. "Synthesizing Stochastic Logic"
SRC Center on Functional Engineered Nano-Architectonics (FENA) Annual Meeting
Organizer: Prof. Kang Wang
La Jolla, CA, June 13, 2008

21. Tutorial: "Synthesizing Stochastic Biochemical Reactions"
Tech Tune Up
Organizer: Prof. Ahmed Tewfik
University of Minnesota, May 26, 2008

22. "Synthesizing Stochasticity in Ciruits and in Biology"
DARPA MTO LIBRA Workshop
Organizer: Dr. John Damoulakis
Arlington, VA, Nov. 29, 2007

23. Public Lecture: "Circuit Engineers Doing Biology –
A Discourse on the Changing Landscape of Scientific Research"
Café Scientifique Public Seminar Series, Bell Museum of Natural History
Organizer: Peggy Korsmo-Kennon
Bryant-Lake Bowl, Minneapolis, MN, Nov. 20, 2007

24. "High-Performance Computing for the Analysis and Synthesis of Biochemistry"
IBM Company Seminar
Host: Tim Mullins
Rochester, MN, Oct. 8, 2007

25. Guest Lecture: "Molecular Computing"
IST 4, Information and Logic
Instructor: Prof. Jehoshua Bruck
California Institute of Technology, May 25, 2007

26. "Analysis and Synthesis of Biochemical Reactions"
Cadence Research Labs Seminar
Host: Dr. Andreas Kuelmann
Berkeley, CA, May 24, 2007

27. Tutorial: "Analysis and Synthesis of Stochastic Biochemical Reactions"
Tech Tune Up
Organizer: Prof. Kia Bazargan
University of Minnesota, May 23, 2007

28. "Analysis and Synthesis of Stochastic Logic for Nanoscale Computation"
SRC Center on Functional Engineered Nano-Architectonics (FENA) Workshop
Organizer: Prof. Kang Wang
UCLA, April 19, 2007

29. "Synthesizing Stochasticity in Biochemical Reaction Networks"
Mathematical Biology Seminar
Host: Prof. Hans Othmer
University of Minnesota, March 21, 2007

30. "Exact Stochastic Simulation with Event Leaping"
Mathematical Biology Seminar
Host: Prof. Hans Othmer
University of Minnesota, Nov. 2, 2006

31. "Cycles – The Good and the Bad in Logic Synthesis and Computational Biology"
Medtronic Technology Quarterly Seminar
Host: Sara Audet
Fridely, MN, Oct. 5, 2006

32. "Cycles – The Good and the Bad in Logic Synthesis and Computational Biology"
Electrical Engineering Seminar
Host: Prof. Mustafa Kamash
UC Santa Barbara, May 17, 2006

33. Job Talks: "Cyclic Combinational Circuits and Other Novel Constructs"
    - *Electrical and Computer Engineering Dept.*
      University of Minnesota
    - *Electrical and Computer Engineering Dept.*
      University of Utah
    - *Electrical Engineering and Computer Science Dept.*
      Case Western Reserve University
    - *Electrical and Computer Engineering Dept.*
      University of Connecticut
    - *Electrical and Computer Engineering Dept.*
      University of Rochester
    - *Electrical and Computer Engineering Dept.*
      University of British Columbia

- *Electrical Engineering and Computer Science Dept.*
  Washington State University
- *Electrical and Computer Engineering Dept.*
  Arizona State University
- *Electrical and Computer Engineering Dept.*
  University of Waterloo
- *Electrical and Computer Engineering Dept.*
  Purdue University
- *Electrical Engineering Dept.*
  University of Montreal École Polytechnique

February–March, 2005
(**11 interviews, 11 offers**)

TEACHING at the UNIVERSITY of MINNESOTA

Lecture-Based Courses

- EE 1301, "Introduction to Computing Systems": Fall 2009, Spring 2010, Fall 2010, Fall 2011, Fall 2012, and Fall 2013
- EE 2301, "Introduction to Digital System Design": Spring 2007, Spring 2008, Spring 2009, Fall 2014, and Fall 2016
- EE 2361, "Introduction to Microntrollers": Fall 2015
- EE 5393, "Circuits, Computation, and Biology": Spring 2008, Fall 2008, Spring 2011, Spring 2012, Spring 2013, Spring 2014, and Spring 2015, Spring 2016, Spring 2017
  (enrollment of 100+ students per semester since '12; 166 students for Spring '17)
- EE 5583, "Error Control Coding": Fall 2012
- EE 5950, "Special Topics in Electrical and Computer Engineering": Fall 2006

Project-Based Courses

- EE 4951, "Senior Design" Spring 2008, Spring 2009, Fall 2011, Fall 2012, Fall 2013, Fall 2014, Fall 2015, Spring 2017
- IT 1311, "Freshman Design" Fall 2006

ADVISING and MENTORING

Visiting Scholars Hosted

- Vishwesh Kulkarni (2011–2013)
  Funded through NSF CAREER Award.

Doctoral Students

- Devon Jenson (2016–)
  Received **Oswald Prize**, for outstanding undergraduate research, 2016
  Dissertation title: "A Deterministic Approach to Stochastic Computing"

- Ahmad Salehi (2012–)
  Jointly advised with Keshab Parhi
  Received a University of Minnesota **Doctoral Dissertation Award**, 2015–2016
  Dissertation title: "Advanced Digital Signal Processing with Molecular Reactions"

- John Backes (2009–2013)
  Received a University of Minnesota **Doctoral Dissertation Award**, 2012–2013
  Dissertation title: "SAT-Based Techniques for Logic Synthesis" Has accepted a position at Rockwell Collins Research, 2013.

- Hua Jiang (2009–2012)
  (jointly advised with Keshab Parhi)
  Dissertation title: "Digital Logic and Digital Signal Processing with Molecular Reactions"
  Has accepted a position at Synposys, 2012.

- Mustafa Altun (2008–2012)
  Dissertation title: "Logic Synthesis for Networks of Four-Terminal Switches"
  Has accepted a tenure-track faculty position at the Istanbul Technical University, 2012

- Weikang Qian (2006–2011)
  Dissertation title: "Synthesizing Logical Computation on Stochastic Bit Streams"
  Received a University of Minnesota **Doctoral Dissertation Award**, 2010–2011.
  Has accepted a tenure-track faculty position at the University of Michigan – Shanghai Jiao Tong University Joint Institute (SJTU), 2011.

Master's Students

- Vahbai Desai (2014–2016)
  Thesis title: "Data Cycling in Networks: Thoughts and Experiments"

- Brian Fett (2006–2008)
  Thesis title: "Synthesizing Stochasticity with Biochemical Reactions"

- Bin Cheng (2007–2008)
  Thesis title: "Stochastic Transient Analysis of Biochemical Systems"

Undergraduate Students

- NSF Research Experiences for Undergraduates (REUs): Lawrence Hessburg (2015–2016), and Michelle Kleckler (2015–2016)

- Directed Undergraduate Research Opportunities Program (UROP) projects for: John Backes (2008), Adam Shea (2008), Phil Greenberg (2009), Dan Hudrlik (2009), Kathleen Thurmes (2009), Aleksandra Kharam (2010), Joshua Krist (2010), Phillip Senum (2010), Jing Xiong (2010), Nick Gunderson (2011), Tor Anderson (2012), Grant Elbert (2012, 2013), Joe Connelley (2013), Caleb Sykes (2014), Blake Anderson (2014), Andrew Decker (2014), Megha Parhi (2015), Alex Keddy (2015), Ryan Mathison (2016), McKenzie van Derhagen (2016), and Owen Hoffend (2017)

- Directed Senior Honors projects for: Jason Heebl (2006–2007), Tim Pankratz (2006–2007), John Kablan (2008–2009), John Backes (2008–2009), Phil Greenberg (2010–2011), Caitlin

Race (2010–2011), Theerachai Chanyaswad (2011–2012), Phillip Senum (2012–2013), Thomas Daede (2013–2014), Megha Parhi (2014–2015), Andrew Erickson (2015–2016), Devon Jensen (2015-2016), Michelle Kleckler (2016–2016), Vendant Goyal (2016–2017), Michelle Kleckler (2016–2017), Ryan Mathison (2016–2017), and McKenzie van Derhagen (2016–2017)

Degree Committees

- Ph.D. Final Committee for:
  Mustafa Altun (EE), Baktash Boghrati (EE), Denis Foo Kune (CS), Shuo Guo (EE), Sakeet Gupta (EE), Jianxin Fang (EE), Hua Jiang (EE), Hyoung Kim (EE), Robert Knuesel (EE), Sanjay Kumar (EE), Qunzeng Liu (EE), Pongstorn Maidee (EE), Andrew Ness (EE), Weikang Qian (EE), Hung Pham (CS), Satish Sivaswamy (EE), Jing Wang (EE), Yao Wang (EE), Xiaofei Wang (EE), Chuan Zhang (EE), Ningyuan Wang (Psychology), Bo Yuan (EE), Yingjie Lao (EE) and Chi Xu (EE)

- Ph.D. Preliminary Committee for:
  Mustafa Altun (EE), John Backes (EE), Baktash Boghrati (EE), Hari Cherupalli (EE), Jianxin Fang (EE), Elaheh Ghassabani (CS), Chenjie Gu (EE), Shuo Guo (EE), Sakeet Gupta (EE), Hyoung Kim (EE), Robert Knuesel (EE), Denis Foo Kune (CS), Sanjay Kumar (EE), Peng Li (EE), Qunzeng Liu (EE), Pongstorn Maidee (EE), Huang Pham (CS), Weikang Qian (EE), Naman Saraf (EE), Jonghyeon Shin (Physics), Satish Sivaswamy (EE), Bennett Swiniarski (CEMS), Jing Wang (EE), Chi Xu (EE), En Yuan (EE), Bo Yuan (EE), Yingie Lao (EE), and Zhiheng Wang (EE)

- M.S. Committee for:
  Amit Bose (CS), David Boutcher (EE), Bin Chen (EE), Wuyang Dai (EE), Vaibhav Desai (EE), Brian Fett (EE), Brandon Hoffman (CS), Praveen Kambam (CS), Manas Mignas (CS), Andrew Ness (EE), Kwangsung Oh (CS), Bennett Swiniarski (CEMS), Nimish Agashiwala (CS), and Vaibhav Sharma (CS)

PROFESSIONAL SERVICE

Journal Paper Refereeing

- Served as referee for numerous journals, including: *Public Library of Science ONE, Science, Nature, Proceedings of the National Academy of Sciences, IEEE Transactions on Computers, IEEE Transactions on Computer-Aided Design of Circuits and Systems, IEEE Transactions on Information Theory, ACM Transactions on Design Automation of Electronic Systems, ACM Journal on Emerging Technologies, Bioinformatics, Journal of Chemical Physics, SIAM Journal on Scientific Computing, ACS Synthetic Biology, Journal of Discrete and Applied Math*

Editorships

- Guest Associate Editor, *IEEE Transactions on Emerging Topics in Computing*
  Special Issue on Approximate and Stochastic Computing, 2016

Chairing, Moderating, and Organizing Special Sessions, Panels, and Tutorials

- IEEE International Conference on Design, Automation and Test in Europe (2017)

  - Organized Tutorial: "Stochastic Computing: The Hype and the Hope"

- ACM/IEEE International Conference on Computer-Aided Design (2016)
  - **Chair** of Biological Systems and Electronics, Brain Inspired Computing, and New Computing Paradigms Track (2016).
  - **Moderator** of Special Session "Challenges and Opportunities of Stochastic Computing in the Dusk of Moore's Law and the Dawn of Big Data" (2016).

Technical Program Committee Memberships

- ACM/IEEE Design Automation Conference (2012, 2014, 2017)
- IEEE International Conference on Communication (2017)
- International Conference on Computational Methods in Systems Biology (2017)
- ACM/IEEE International Conference on Computer-Aided Design (2008, 2014, 2015, 2016)
- ACM International Conference on Nanoscale Computing and Communication (2016)
- ACM/IEEE International Workshop on Bio-Design Automation (2009–2014)
- IEEE Great Lakes Symposium on VLSI (2009–2010)
- IEEE International Workshop on Genomic Signal Processing and Statistics (2009)
- IEEE/ACM International Workshop on Logic and Synthesis (2006–2014)

Review Panels

- Served on review panel for
  - National Science Foundation's Biocomputation Cluster (2014, 2015, 2017)
  - National Science Foundation's Software and Hardware Foundations Cluster (2009, 2010, 2017)

Workshop Organization

- DAC International Workshop on Bio-Design Automation (IWBDA)
  - Initiated Workshop in 2009
  - Steering Committee Chair (2009–)
  - General Chair (2010)
  - Technical Program Chair (2009)

  Workshop attendance: **100 people** 2009, **85 people** in 2010, and **120 people** in 2011, more than 100 annually since.

- IEEE/ACM International Workshop on Logic and Synthesis (IWLS)
  - Program Chair (2009)
  - General Chair (2008)
  - Publications Chair (2007)
  - Panel Chair (2006)

- IEEE International Workshop on Genomic Signal Processing and Statistics

  - Finance Chair (2009)

Professional Interest Groups

- ACM Special Interest Group on Design Automation (SIGDA)
  - Associate Editor of SIGDA Newsletter (2006–)
  - Co-chair of Technical Committee on Logic/RTL Design (2006–2009)
  - Vice-Chair of CAD-athlon Programming Competition (2006–2007)

SERVICE to the UNIVERSITY of MINNESOTA

Electrical and Computer Engineering Department

- Standards & Awards Committee, Chair (2014–)
- Student Services and Advising Committee (2011–2014)
- Graduate Committee (2006–2011)
- Ph.D. Written Preliminary Exam (WPE) Committee: 2006–2007, 2007–2008, 2008–2009, 2010–2011, 2012–2013, 2014–2015, 2015–2016, and 2016–2017.

Biomedical Informatics and Computational Biology Program

- Member of Admissions Committee (2008–2009)

University-Wide

- Faculty Senator (2013–2016)
- Interdisciplinary Informatics Seed Grant Program Review Panel (2009)