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Department of Mathematics  
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**EDUCATION:**

09/1999—09/2003 Ph.D. in Applied and Computational Mathematics, Princeton University.

09/1994—07/1999 B.S. in Computational Mathematics and Its Applied Softwares, Peking University.

**EXPERIENCE:**

07/2017—present Professor, Department of Mathematics, Michigan State University.

07/2010—07/2017 Associate Professor, Department of Mathematics, Michigan State University.

04/2013 Visiting Fellow, Program in Applied and Computational Mathematics, Princeton University.

08/2005—06/2010 Assistant Professor, Department of Mathematics, Michigan State University.

08/2003—08/2005 Visiting Member and Courant Instructor, Courant Institute of Mathematical Sciences, New York University.

**CURRENT RESEARCH:**

Multi-Physical Modeling and Multi-Scale Computation of Nano-Optics  
Stochastic Simulation of Intra-Cellular Bio-Chemical Reacting Networks

**SELECTED GRANTS:**

- NSF-DMS 1720002, \$147,994, PI, 2017-2020,  
Multiscale modeling and computation of nano-optics.
- NSF-DMS 1418959, \$280,000, PI, 2014-2017,  
Numerical methods for multi-scale modeling of nano-optics.
- NSF-DMS 0968360, \$900,000, Co-PI, 2010-2015,  
FRG: Modeling, computation, and analysis of optical responses of nano structures.
- NSF-DMS 0845061, \$410,016, PI, 2009-2014,  
CAREER: Modeling, analysis and computation of stochastic intracellular reactions.
- NSF -DMS 0609315, \$101,199, PI, 2006-2009,  
AMC-SS: Analysis and Computation of Multi-Scale Stochastic Chemical Kinetic Systems  
with Application to Genetic Regulatory Networks.

**AWARDS:**

NSF Career Award, 2010.

**PUBLICATIONS:**

- [1] G. Bao, D. Liu and S. Luo, *Multiscale modeling and computation of light driven nano devices under metal enhancement*, in preparation.
- [2] G. Bao, G. Hu and D. Liu, *Simulating high order harmonic generations using Finite Element methods for time-dependent Kohn-Sham equations*, in preparation.
- [3] J. Du and D. Liu, *Transition states of stochastic chemical reaction networks*, preprint.
- [4] C. Chen and D. Liu, *Error analysis for D-leaping scheme of chemical reaction systems with delay*, submitted.
- [5] G. Bao, G. Hu, D. Liu and S. Luo, *Modeling and computation of Nano-optics*, submitted.
- [6] G. Bao, D. Liu and S. Luo, *Multiscale modeling and computation of light driven nano devices*, Journal of Computational Physics, 316, 558-572, 2016.
- [7] G. Bao, G. Hu and D. Liu, *Towards translational invariance of total energy with Finite Element Methods for Kohn-Sham equations*, Communications in Computational Physics, 19, 1-23, 2016.
- [8] S. Pouya, D. Liu, and M. Koochesfahani, *Effect of finite sampling time on estimation of Brownian fluctuation*, Journal of Fluid Mechanics, 767, 65-84, 2015.
- [9] G. Bao, G. Hu and D. Liu, *Real-time adaptive Finite Element solution of time-dependent Kohn-Sham equation*, Journal of Computational Physics, 281, 743-758, 2015.
- [10] C. Huang, M. Wu, J. Du, D. Liu and C. Chan, *Systematic modeling for insulin signaling network mediated by IRS1 and IRS2*, Journal of Theoretical Biology, 355, 40-52, 2014.
- [11] C. Huang and D. Liu, *Strong convergence and Speed-up of Nested Stochastic Simulation Algorithm*, Communications in Computational Physics, 15, 1207-1236, 2014.
- [12] G. Bao, D. Liu and S. Luo, *A multiscale method for optical responses of nano structures*, SIAM Applied Mathematics, 73, 741-756, 2013.
- [13] G. Bao, G. Hu, D. Liu and S. Luo, *Multi-physical modeling and multi-scale computation of nano-optical responses*, Recent Advances in Scientific Computing and Applications, Contemporary Mathematics, 586, 43-55, 2013.
- [14] G. Bao, G. Hu and D. Liu, *Numerical solution of the Kohn-Sham equation by finite element methods with an adaptive mesh redistribution technique*, Journal of Scientific Computing, 55, 372-391, 2013.
- [15] G. Bao, G. Hu and D. Liu, *An h-adaptive finite element solver for the calculations of the electronic structures*, Journal of Computational Physics, 231, 4967-4979, 2012.
- [16] D. Liu, *Strong convergence rate of principle of averaging for jump-diffusion processes*, Frontiers of Mathematics in China, 7, 305-320, 2012.
- [17] D. Liu, *Stochastic simulation of the cell cycle model for budding yeast*, Communications in Computational Physics, 9, 390-405, 2011.

- [18] D. Liu, *Strong convergence of principle of averaging for multiscale stochastic dynamical systems*, Communications in Mathematical Sciences, 8, 999-1020, 2010.
- [19] D. Liu, *Analysis of multiscale methods for stochastic dynamical systems with multiple time scales*, SIAM Multiscale Modeling and Simulation, 8, 944-964, 2010.
- [20] D. Liu, *A numerical scheme for optimal transition paths of stochastic chemical kinetic systems*, Journal of Computational Physics, 227, 8672-8684, 2008.
- [21] W. E, D. Liu, and E. Vanden-Eijnden, *Response to "Communications on 'Nested stochastic simulation algorithm for chemical kinetic systems with disparate rates' [Journal of Chemical Physics 123, 194107(2005)]"*, Journal of Chemical Physics, 126, 137102, 2007.
- [22] W. E, D. Liu and E. Vanden-Eijnden, *Nested stochastic simulation algorithms for chemical kinetic systems with multiple time scales*, Journal of Computational Physics, 221, 158-180, 2007.
- [23] D. Liu, *Optimal transition paths of stochastic chemical kinetic systems*, Journal of Chemical Physics, 124, 164104, 2006.
- [24] W. E, D. Liu and E. Vanden-Eijnden, *Nested stochastic simulation algorithm for chemical kinetic systems with disparate rates*, Journal of Chemical Physics, 123, 194107, 2005.
- [25] W. E, D. Liu and E. Vanden-Eijnden, *Analysis of multiscale methods for stochastic differential equations*, Communications on Pure and Applied Mathematics, 58, 1544-1585, 2005.
- [26] D. Liu and C. García-Cevera, *Magnetic switching of ferromagnetic thin films under thermal perturbation*, Journal of Applied Physics, 98, 023903, 2005.
- [27] D. Liu, *Convergence of the spectral method for stochastic Ginzburg-Landau equation driven by space-time white noise*, Communications in Mathematical Sciences, 1, 361-375, 2003.
- [28] W. E and D. Liu, *Gibbsian dynamics and invariant measures for stochastic dissipative PDEs*, Journal of Statistical Physics, 108, 1125-1156, 2002.

**RECENT PRESENTATIONS:**

1. SIAM Conf. on Applications of Dynamical Systems, 2017.
2. KI-Net Conf.: Kinetic Descriptions of Chemical and Biological Systems, Iowa State U, 2017.
3. Summer School on Quantum and Kinetic Theory for Complex Systems, UCSB, 2016.
4. SIAM Conf. on Mathematical Aspects of Materials Science, 2016.
5. Applied and Computational Mathematics Seminar, UC Irvine, 2016.
6. Applied Math Colloquium, U Arizona, 2016.
7. Wksp. on Inverse Problems and Related Topics, Zhejiang U, 2015.
8. Computational and Applied Mathematics Colloquium, Penn State U, 2015.
9. AMS Fall Eastern Sectional Meeting, 2015.

10. Applied Math Seminar, UCSB, 2015.
11. CORE-CM seminar, Michigan State U, 2015.
12. Morningside Center of Mathematics, Chinese Academy of Sciences, 2015.
13. Beijing Computational Science Research Center, 2015.
14. Intl. Conf. on Numerical Mathematics and Scientific Computing, Nanjing U, 2015.
15. Intl. Congress on Industrial and Applied Mathematics, 2015.
16. Intl. Conf. on Inverse Problems, Imaging, and Applications, Zhejiang U, 2015.
17. Intl. Conf. on Computational Math and Sciences, Xian Jiaotong U, 2015.
18. SIAM Conf. on Applications of Dynamical Systems, 2015.
19. SIAM Great Lakes Conf., 2015.
20. Annual Meeting of SIAM Central States Section, 2015.
21. Wksp. on Scattering and Inverse Scattering Problems, Zhejiang U, 2014.
22. Applied and Interdisciplinary Math Seminar, U Michigan-Ann Arbor, 2014.
23. Intl. Conf. on Interdisciplinary Applied and Computational Math, Zhejiang U, 2014.
24. Applied and Computational Math Seminar, U South Carolina, 2014.
25. Numerical Analysis Seminar, U Texas Austin, 2014.
26. Wksp. on Modeling Rare Events in Complex Physical Systems, NU Singapore, 2013.
27. Wksp. on Numerical Analysis and Inverse Problems, Michigan Technological U, 2013.
28. Math Seminar, Fudan U, 2013.
29. Pacific Rim Mathematical Association Congress, Shanghai Jiaotong U, 2013.
30. Intl. Conf. on Interdisciplinary Applied and Computational Math, Zhejiang U, 2013.
31. Young Mathematician Forum, BICMR, Peking U, 2013.
32. ICMSEC Seminar, Chinese Academy of Sciences, 2013.
33. HPC in CSE Seminar, U Mass Amherst, 2012.
34. Intl. Conf. on Inverse Problems and Applications, Zhejiang U, 2012.
35. SIAM Conf. on Life Sciences, 2012.
36. SIAM Annual Meeting, 2012.
37. Wksp. on Computational Problems in Materials Science, Chinese Academy of Sciences, 2012.
38. ICMSEC Colloquium, Chinese Academy of Sciences, 2012.

39. Wksp. on Scale Transitions in Chemistry and Biology, ICMS, Edinburgh, UK, 2012.
40. Applied Math Seminar, Georgia Institute of Technology, 2012.
41. Math Colloquium, Wayne State U, 2011.
42. Wksp. on Multiscale Systems: Theory and Applications, U Warwick, UK, 2011.
43. Probability Seminar, Brown U, 2011.
44. Wksp. on Nucleation and Rare Events, BICMR, Peking U, 2011.
45. ICMSEC Seminar, Chinese Academy of Sciences, 2011.
46. SIAM Conf. on Applications of Dynamical Systems, 2011.
47. Math Colloquium, Central Michigan U, 2011.
48. AMS Central Sectional Meeting, 2010.
49. Intl. Conf. on Applied Math, City U Hong Kong, 2010.
50. Wksp. on Interdisciplinary Applied and Computational Math, Zhejiang U, 2010.
51. SIAM Conf. on Life Sciences, 2010.
52. SIAM Conf. on Mathematical Aspects of Materials Science, 2010.
53. SIAM Great Lakes Conf., 2010.
54. Wksp. on Multi-scale Stochastic Modeling of Cell Dynamics, Banff Station, Canada, 2010.

**TEACHING:**

GRADUATE: Numerical Methods for PDEs I&II, Numerical Linear Algebra, Numerical Methods for Stochastic Dynamics.

UNDERGRAD: Numerical Analysis, Partial Differential Equations, Analysis, Discrete Mathematics, Linear Algebra, Calculus.

**MENTORING:**

POSTDOCS: Ricardo Delgadillo (2016-), Chuchu Chen (2016-),  
Xinghui Zhong (2014-2015, Assis. Prof., Zhejiang U),  
Can Huang (2011-2013, Assis. Prof., Xiamen U),  
Guanghui Hu (2010-2012, Assis. Prof., U Macau),  
Songting Luo (2009-2012, Assis. Prof., Iowa State U).

VISITING SCHOLAR: Xianliang Hu (2012-2013, Assoc. Prof., Zhejiang U).

Ph.D. STUDENTS: Jun Du (2012-).

UNDERGRAD: Joshua Pang (2016), Aaron Bawol, Nick Scott, and Chuyang Liu (2016), Yutian Zhao (2015).

**SYNERGISTIC ACTIVITIES:**

IMA Wksp. on Emerging Topics in Optics (2016),  
MCIAM Wksp.s (2014, 2013, 2012, 2011, 2008),

Intl. Conf. on Interdisciplinary Applied & Computational Math (2011).

Mini-symposiums/Sections:

Intl. Congress on Industrial and Applied Math (2015),

Intl. Conf. on Interdisciplinary Applied & Computational Math (2015, 2013),

Intl. Conf. on Computational Physics (2013), SIAM Materials Science (2013),

SIAM Annual Meeting (2012).

Math Colloquium (2012, 2011, 2010, 2009), Applied Math Seminar (2009).

**COMMITTEE SERVICES:**

DEPARTMENT: Advisory (2011), Graduate (2012, 2009), Hiring (2015, 2012, 2010),  
Library (2016, 2015, 2014), Postdoc (2016), Personnel (2017),  
Undergraduate (2010).

UNIVERSITY: College of Natural Sciences Faculty Advisory Council (2017,2016),  
Strategic Partnership Grant Panel (2016, 2015),  
Honors Program Committee/Scholarship Review (2013, 2012, 2011).