

Xinfeng Liu (Last updated on September 14, 2012)

CONTACT INFORMATION

Department of Mathematics
University of South Carolina
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Columbia, SC 29208 USA

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EDUCATION

State University of New York at Stony Brook, Stony Brook, NY USA

Ph.D., Department of Applied Mathematics and Statistics, May 2006

- Thesis Topic: Turbulent mixing with scale breaking phenomena
- Advisor: Professor James Glimm

Southeast University, Nanjing, China

M.S., Department of Applied Mathematics, May 1999

- Thesis Topic: The critical exponent of doubly singular parabolic equations
- Advisor: Professor Mingxin Wang

Fudan University, Shanghai, China

B.S., Department of Mathematics, May 1997

- Major in Pure and Applied Mathematics

ACADEMIC AND PROFESSIONAL EXPERIENCE

University of South Carolina
Department of Mathematics
Assistant Professor, August 2009 to present

University of California at Irvine
Department of Mathematics
Visiting Assistant Professor, June 2006 to July 2009

RESEARCH INTERESTS

Numerical Partial Differential Equations

- Front Tracking Methods
- Integration Factor Methods and ETD Schemes
- Adaptive Mesh Refinement
- Finite Difference and Finite Volume Methods
- Parallel Scientific Computing

Computational and Mathematical Biology

- Regulation of Spatially Localized Scaffold Proteins in MAPK Cascades
- Mathematical Modeling of Breast Cancer Stem Cells
- Computational Analysis of Organ Biofabrication
- Morphogen Gradient Formation in Developmental Biology

Computational Fluid Dynamics

- Computational Analysis of Rayleigh-Taylor Instability
- Numerical Studies of Richtmyer-Meshkov Instability

Partial Differential Equations

- Critical Exponents of Parabolic Equations

RESEARCH GRANTS

1. Single PI, NSF Mathematical Biology DMS-1019544, 2010-2013, \$125,445
“Computational studies for spatial-temporal dynamics of cell signaling”.

2. Co-PI, South Carolina EPSCoR/IDeA GEAR Grants, 2011-2012, \$85,000
“Modeling and Simulation of Organ Biofabrication Processes”.
3. Co-PI, South Carolina EPSCoR/IDeA GEAR Grants, 2012-2013, \$50,000
“In Silico Analysis of Multicellular Aggregate Fusion Using Field and Agent-Based Models”.
4. One of the two multiple PIs, NIH R21, 2013-2015, Pending
“Modeling of cancer stem cell population dynamics: theoretical and clinical implications”.
5. One of the three multiple PIs, NSF/NIGMS, 2013-2017, Pending
“An integrated approach of mathematical modeling and experimental studies for proliferation kinetics and phenotypic transition in cancer cells”.

AFFILIATIONS AND AWARDS

- Society for Industrial and Applied Mathematics
- Society for Mathematical Biology
- Landahl Travel Awards, Society for Mathematical Biology, 2008
- International Travel Awards, International Conference on Modeling and Simulation, Xi’an, China, 2008
- Graduate Council Commendation to Distinguished Doctoral Students, SUNY at Stony Brook, 2006
- SIAM Student Travel Awards, Society for Industrial and Applied Mathematics, 2005
- Sigma Xi Travel Awards, SUNY at Stony Brook, 2005
- Peijing Scholarship, Southeast University, China, 1999

PUBLICATIONS

Published Papers

1. Kanadpriya Basu, **X. F. Liu**. Mathematical modeling for multisite phosphorylation with substrate sequestration in cell signaling. *Mathematical Methods in the Applied Sciences* (Impact factor: 0.743), Accepted.
2. C. Chan, **X. F. Liu**, L. M. Wang, L. Bardwell, Q. Nie, G. Enciso. Protein scaffolds can enhance the bistability of multisite phosphorylation systems. *PLoS Computational Biology* (Impact factor: 5.759), 8 (6), 2012.
3. P.-K. Lo, D. Kanojia, **X. F. Liu**, U. P. Singh, F. G. Berger, Qian Wang, H. X. Chen. CD49f and CD61 identify Her2/neu-induced tumor-initiating cells that are potentially derived from luminal progenitors and maintained by the integrin-TGF β signaling. *Oncogene* (Impact factor: 7.414), 31, pp 2614-2626, 2012.
4. S. Little, V. Mironov, R. Markwald, Y. Sugi, S. Lessner, M. Sutton, **X. F. Liu**, Q. Wang, X. F. Yang, J. Blanchette, M. Skiles, G. Khushf. Engineering a 3D biological construct representative research in the South Carolina project for organ biofabrication. *Journal of Biofabrication* (Impact factor: 1.857), 030202 (3), 2011.
5. S. Zhao, J. Ovadia, **X. F. Liu**, Y.-T. Zhang, Q. Nie. Operator splitting implicit integration factor methods for stiff advection-reaction-diffusion systems. *Journal of Computational Physics* (Impact factor: 2.949), 230 (15), pp 5996-6009, 2011.
6. **X. F. Liu**, Q. Nie. Compact implicit integration factor methods with complex domains and adaptive mesh refinement. *Journal of Computational Physics* (Impact factor: 2.949), 229 (16), pp 5962-5706, 2010.

7. **X. F. Liu**, L. Bardwell, Q. Nie. A combination of multisite phosphorylation and substrate sequestration produces switch-like responses. *Biophysical Journal* (Impact factor: 4.39), 98 (8), pp 1396-1407, 2010.
8. **X. F. Liu**, Q. Nie. Spatially-localized scaffold proteins may facilitate to transmit long-range signals. *Acta Mathematica Scientia*, 29 B (6), pp 1657-1669, 2009.
9. Q. Nie, F. Y.M. Wan, Y. T. Zhang, **X. F. Liu**. Compact integration factor methods in high spatial dimensions. *Journal of Computational Physics* (Impact factor: 2.949), 277 (10), pp 5238-5255, 2008.
10. W. Bo, H. Jin, D. Kim, **X. F. Liu**, H. Lee, N. Pestieau, Y. Yu, J. Glimm, J. W. Grove. Comparison and validation of multi phase closure models. *Computers and Mathematics with Applications* (Impact factor: 1.532), 56 (5), pp 1291-1302, 2008.
11. **X. F. Liu**, Y. H. Li, J. Glimm, X. L. Li. A front tracking algorithm for limited mass diffusion. *Journal of Computational Physics* (Impact factor: 2.949), 222 (2), pp 644-653, 2007.
12. Z. L. Xu, J. Glimm, Y. M. Zhang, **X. F. Liu**. A multiscale front tracking method for compressible free surface flows. *Chemical Engineering Science* (Impact factor: 2.533), 62 (13), pp 3538-3548, 2007.
13. W. Bo, B. Cheng, J. Du, B. Fix, E. George, J. Glimm, J. Grove, X. Jia, H. Jin, H. Lee, Y. Li, **X. F. Liu**, D. H. Sharp, L. Wu, Y. Yu. Recent Progress in the Stochastic Analysis of Turbulent Mixing. *Contemporary Mathematics*, 429, 2007.
14. **X. F. Liu**, E. George, W. Bo, J. Glimm. Turbulent mixing with physical mass diffusion. *Physical Review E*. (Impact factor: 2.352), 73, 056301, 2006.
15. E. George, J. Glimm, X. L. Li, Y. H. Li, **X. F. Liu**. Influence of scale-breaking phenomena on turbulent mixing rates. *Physical Review E*. (Impact factor: 2.352), 73, 016304, 2006.
16. J. Glimm, B. Fix, J. Liu, **X. F. Liu**, T. Lu, R. Samulyak, Z. Xu. Front Tracking under TSTT. *Numerical Modeling of Space Plasma Flows (Astronom-2006 ASP Conference Series)*, 359, 15, 2006.
17. H. Jin, **X. F. Liu**, T. Lu, B. Cheng, J. Glimm, D. Sharp. Rayleigh-Taylor mixing rates for compressible flow. *Physics of Fluids* (Impact factor: 1.998), 17, 024104, 2005.
18. B. Fix, J. Glimm, X. Li, Y. Li, **X. F. Liu**, R. Samulyak. A TSTT integrated Frontier code and its applications in computational fluid physics. *Journal of Physics (Conference Series)*, 16, pp 471-475, 2005.
19. **X. F. Liu**, M. X. Wang. The Critical Exponent of Doubly Singular Parabolic Equations. *Journal of Mathematical Analysis and Applications* (Impact factor: 1.345), 257, pp 170-188, 2001.

Submitted Papers

1. **X. F. Liu**, D. Kanojia, P.-K. Lo, Qian Wang, Qi Wang, Q. Nie, H. X. Chen. Mathematical modeling of the dynamic interaction between cancer stem cells and non-stem cancer cells and its potential clinical implications. *Proceedings of the National Academy of Sciences* (Impact factor: 9.771), Under Revision.

2. **X. F. Liu**, L. Bardwell, R. D. Moore, Q. Nie. Spatially localized scaffold proteins may robustly simultaneously boost and suppress signaling. Submitted to FEBS Journal.

Papers in Final Preparation

1. K. Basu, L. Wang, **X. F. Liu**. Scaffold binding in a cascade can enhance bistabilities. Preprint.
2. **X. F. Liu**, K. Basu, Y. J. Liu. Stable numerical schemes for convection-reaction-diffusion equations. Preprint.

PRESENTATION

1. “Computational studies for cell signaling and cancer stem cells”, (Invited) Seminar at Department of Mathematics, Ohio State University, Columbus, OH, October 2012.
2. “Mathematical modeling and computational studies for cell signaling with scaffolds”, (Invited) Ninth Conference on Dynamical Systems, Differential Equations and Applications, Orlando, FL, July 2012.
3. “Computational studies for fluid mixing, cell signaling and cancer stem cells”, (Invited) Seminar at Beijing Computational Science Research Center, Beijing, China, June 2012.
4. “Computational studies for fluid mixing, cell signaling and cancer stem cells”, (Invited) Seminar at School of Mathematical Sciences, Nankai University, Tianjin, China, June 2012.
5. “Operator splitting methods for convection-reaction-diffusion equations”, (Invited) Eighth International Conference on Scientific Computing and Applications, University of Las Vegas, Nevada, April 2012.
6. “Operator splitting methods for convection dominated equations”, (Invited) SIAM-SEAS 2012, University of Alabama in Huntsville, Huntsville, AL, March 2012.
7. “Computational studies for cell signaling with scaffolds”, (Invited) SIAM-SEAS 2012, University of Alabama in Huntsville, Huntsville, AL, March 2012.
8. “Mathematical modeling of the dynamical interaction between cancer stem cells and non-stem cells”, (Invited) Regional conference in Georgia Health Sciences University, Augusta, GA, March 2012.
9. “Mathematical modeling of cancer stem cells”, (Invited) Seminar at Department of Mathematics, University of California at Irvine, Irvine, CA, March 2012.
10. “Operator-splitting methods for stiff convection-reaction-diffusion equations”, (Invited) Baylor Workshop on Splitting and Multiscale Methods for Computational PDEs, Waco, Texas, September 2011.
11. “Operator-splitting methods for stiff convection-reaction-diffusion equations”, (Invited) ICIAM 2011, Vancouver, Canada, July 2011.
12. “Computational studies for cell signaling in the presence of scaffold proteins”, ICIAM 2011, Vancouver, Canada, July 2011.
13. “Computational studies for spatial-temporal dynamics of cell signaling”, (Invited) Seminar at Institute of Nature Sciences, Shanghai Jiaotong University, Shanghai, China, June 2011.

14. “Computational studies for spatial-temporal dynamics of cell signaling”, (Invited) Seminar at Department of Mathematics, Fudan University, Shanghai, China, June 2011.
15. “Operator-splitting methods for stiff convection-reaction-diffusion equations”, (Invited) 2011 International Conference on Applied Mathematics and Interdisciplinary Research, Nankai, China, June 2011.
16. “Operator-splitting methods for stiff convection-reaction-diffusion equations”, (Invited) Seminar at Institute of Computational Mathematics and Scientific/Engineering Computing, Beijing, China, June 2011.
17. “Implicit integration factor methods for stiff systems”, (Invited) AMS 2011 Spring Western Section Meeting, University of Nevada, Las Vegas, NV, April 2011.
18. “Operator-splitting methods for stiff reaction-convection-diffusion equations”, SIAM-SEAS 2011, UNC at Charlotte, Charlotte, NC, March 2011.
19. “Computational studies of cell signaling and organ bio-fabrication”, (Invited) Seminar at Department of Computer Science, Arizona State University, Phoenix, AZ, March 2011.
20. “Computational analysis of cell signaling and organ bio-fabrication”, (Poster) South Carolina EPSCoR ERAB meeting, Columbia, SC, February 2011.
21. “Computational studies for spatially dynamics of cell signaling with localized scaffolds”, (Invited) Seminar at Department of Mathematics and Statistics, Wichita State University, Wichita, KS, November 2010.
22. “Computational analysis of bio-fabrication in tissue engineering”, (Poster) IMA Hot Topic Workshop: Medical Device-Biological Interactions at the Material-Tissue Interface, Minneapolis, MN, September 2010.
23. “Computational analysis of fluid instability and cell signaling”, Talk at South Carolina EPSCoR/IDeA State Office, Columbia, SC, September 2010.
24. “Compact integration factor methods for complex domains and adaptive mesh refinement”, (Invited) SIAM Annual Meeting, Pittsburg, PA, July 2010.
25. “Mathematical modeling and computational studies of cancer stem cells”, SIAM Conference on the Life Science, Pittsburg, PA, July 2010.
26. “Computational studies of cell signaling with localized scaffold proteins”, (Invited) CAM Colloquium at Department of Mathematics, University of Norte Dame, South Bend, IN, April 2010.
27. “Computational studies for spatial dynamics of cell signaling”, (Invited) Seminar at Department of Applied Mathematics and Statistics, SUNY at Stony Brook, Stony Brook, NY, March 2010.
28. “Computational studies for turbulent mixing and cell signaling”, (Invited) Seminar at Department of Mathematics, Shanghai Jiao Tong University, Shanghai, China, June 2009.
29. “Computational studies for turbulent mixing and cell signaling”, (Invited) Seminar at Department of Mathematics, Nanjing University, Nanjing, China, June 2009.
30. “Computational studies for turbulent mixing and cell signaling”, (Invited) Seminar at Department of Applied Mathematics, Southeast University, Nanjing, China, June 2009.

31. “Computational studies for turbulent mixing and cell signaling”, (Invited) Seminar at Department of Aerodynamics, Nanjing University of Aeronautics and Astronautics, Nanjing, China, June 2009.
32. “Computational studies for turbulent mixing and cell signaling”, (Invited) Special Colloquium at Department of Mathematics, Florida International University, Miami, FL, March 2009.
33. “Computational studies for turbulent mixing and cell signaling”, (Invited) Special Colloquium at Computer Science and Mathematics Division, Oak Ridge National Laboratory, Oak Ridge, TN, February 2009.
34. “Computational studies for turbulent mixing and cell signaling”, (Invited) Special Colloquium at Department of Mathematics, University of Tennessee, Knoxville, TN, February 2009.
35. “Computational studies for turbulent mixing and cell signaling”, (Invited) Special Colloquium at Department of Mathematics, National University of Singapore, Singapore, February 2009.
36. “Computational studies for turbulent mixing and cell signaling”, (Invited) Special Colloquium at Department of Mathematics, City University of Hong Kong, Hong Kong, February 2009.
37. “Mathematical modeling and numerical simulations of cell signaling pathways”, Joint Mathematics Meetings, Washington DC, January 2009.
38. “Computational studies for turbulent mixing and cell signaling”, (Invited) Special Colloquium at Department of Mathematics, University of South Carolina, Columbia, SC, December 2008.
39. “Spatially localized scaffold may simultaneously boost and suppress signaling”, Society for Mathematical Biology Annual Meeting, Toronto, Canada, July 30-August 2, 2008.
40. “Front Tracking Method and its Application”, (Invited) Seminar at Department of Mathematics, Peking University, Beijing, China, July 2008.
41. “Implicit Integration Factor Method and its Application in Cell Signaling”, (Invited) Seminar at Institute of Applied Physics and Computational Mathematics, Beijing, China, July 2008.
42. “Implicit Integration Factor Method and its Application in Cell Signaling”, (Invited) Seminar at Institute of Computational Mathematics, Chinese Academy of Science, Beijing, China, July 2008.
43. “Turbulent Mixing with Physical Surface Tension and Mass Diffusion”, International Conference in Modeling and Simulation, Xi’an, China, July 2008.
44. “Turbulent mixing with scale breaking phenomena”, (Invited) Special Colloquium at Computer Science and Mathematics Division, Oak Ridge National Laboratory, Oak Ridge, TN, March 2006.
45. “Turbulent mixing with scale breaking phenomena”, (Invited) Special Colloquium at Department of Mathematics, University of Central Florida, Orlando, FL, February 2006.
46. “Turbulent mixing with physical surface tension and mass diffusion”, (Invited) Seminar at Department of Mathematics, New Jersey’s Science and Technology University, Newark, NJ, January 2006.

47. “The influence of transport phenomena on turbulent mixing rates”, American Physical Society 58th Annual Meeting of the Division of Fluid Dynamics, Chicago, IL, November 2005.
48. “A robust front tracking algorithm in three dimensions”, (Poster) Harvey Mudd College Mathematics Conference on Scientific Computing, Claremont, CA, November 2005.
49. “The influence of scale breaking phenomena on turbulent mixing rates”, Society for Industrial and Applied Mathematics Annual Meeting, New Orleans, LA, July 2005.
50. “Turbulent mixing with surface tension and mass diffusion”, Midwest Numerical Analysis Conference, Iowa City, Iowa, May 2005.
51. “Turbulent mixing with surface tension”, (Poster) Frontiers in Applied and Computational Mathematics, Newark, NJ, May 2005.

CONFERENCES
ATTENDED

1. MBI workshop, “Modeling and computation of biomolecular structure and dynamics”, Columbus, OH, April 2011.
2. IMA workshop, “High order numerical methods for PDEs: novel discretization”, Minneapolis, MN, November 2010.
3. “Systems Biology of Stem Cells”, Irvine, CA, May 2010.
4. “Frontiers in Mathematical Biology”, College Park, MD, April 2010.

SYNERGISTIC
ACTIVITIES

- NSF Panelist and Proposal Reviewer (Joint Math-Bio/Computational Math Program, March 2012), Army Research Office (ARO) Proposal Reviewer.
- Committee of Ph.D. Thesis Defense (Xiao Xiao, Chen Chen, Treena Sircar); Committee of Ph.D. Oral Qualifying Exam (Che Wang); Committee of Ph.D. Qualifying Exam (Mehdi Famouri, Department of Mechanical Engineering); Committee of Master Thesis (Xiao Xiao, Jing Liu, Liwei Wang).
- Member of University Graduate Council (Fall 2011), Faculty Hiring Committee (2010-2013), Graduate Advisory Council (2010-2013), High School Math Contest Committee (2009-2013), Undergraduate Advisory Council (2009-2010), Applied and Computational Math Committee (2009-2013), and Events Committee at the University of South Carolina (2009-2013); Member of South Carolina EPSCoR Scientific Working Group.
- Minisymposium Organizer at SIAM Conference on the Life Sciences (2010, 2012), SIAM-SEAS (2011, 2012) and ICIAM (2011).
- Referee for Proceedings of the National Academy of Sciences (PNAS), FEBS Letters, Journal of Computational Physics, SIAM Journal on Numerical Analysis, Mathematical Biosciences and Engineering (MBE), Journal of Scientific Computing, International Journal of Computer Mathematics, ASME Journal of Manufacturing Science and Engineering, British Journal of Math. and Stat. Psych., Zeitschrift für Angewandte Mathematik und Mechanik (ZAMM), Bulletin of Mathematical Biology, Mathematical Methods in the Applied Sciences, and Frontiers of Mathematics in China.

GRADUATE
STUDENTS

Kanadpriya Basu (Ph.D.), 2006-2012
Thesis Title: “Mathematical Modeling and Computational Studies for Cell Signaling”.
Current Position: Lecturer at Department of Mathematics, University of North Texas.

TEACHING
EXPERIENCE

University of South Carolina

- Instructor for Math 241: Vector Calculus (Evaluations: 4.21 out of 5); Math 550: Vector Analysis (Evaluations: 4.5 out of 5), Fall 2009.
- Instructor for Math 242: Elementary Differential Equations (Evaluations: 4.41 out of 5); Math 520: Ordinary Differential Equations (Evaluations: 4.63 out of 5), Spring 2010.
- Instructor for Math 141: Calculus I (Evaluations: 3.72 and 3.79 out of 5); Math 723: Partial Differential Equations (Evaluations: 4.86 out of 5), Fall 2010.
- Instructor for Math 141: Calculus I (Evaluations: 4.07 and 4.32 out of 5); Math 724: Partial Differential Equations (Evaluations: 4.8 out of 5), Spring 2011.
- Instructor for Math 142: Calculus II (Evaluations: 4.22 out of 5); Math 526: Numerical Linear Algebra (Evaluations: 4.45 and 4.5 out of 5), Fall 2011.
- Instructor for Math 554: Analysis I (Evaluations: 4.75 out of 5), Spring 2012.
- Instructor for Math 142: Calculus II; Math 526: Numerical Linear Algebra, Fall 2012.

University of California at Irvine

- Instructor for Math 105LA: Numerical Analysis, Fall 2006.
- Instructor for Math 107LB: Numerical Analysis; Math 2B: Calculus, Winter 2007.
- Instructor for Math 107L: Numerical Analysis; Math 6C: Linear Algebra, Spring 2007.
- Instructor for Math 2E: Multivariable Calculus, Fall 2007.
- Instructor for Math 3D: Elementary Differential Equations, Winter 2008.
- Instructor for Math 2E: Multivariable Calculus, Spring 2008.
- Instructor for Math 1B: Pre-Calculus, Summer 2008.
- Instructor for Math 2E: Multivariable Calculus, Fall 2008.
- Instructor for Math 2B: Calculus, Winter 2009.

State University of New York at Stony Brook

- Instructor for AMS410: Actuarial Mathematics, Fall 2005.

TECHNICAL SKILLS Programming: C, C++, FORTRAN, PASCAL, MATLAB, MATHEMATICA, PERL, UNIX shell scripting, SQL

Applications: $\text{T}_{\text{E}}\text{X}$, $\text{L}^{\text{A}}\text{T}_{\text{E}}\text{X}$, $\text{BIB}\text{T}_{\text{E}}\text{X}$, Microsoft Office, and other common productivity packages for Windows, OS X, and Linux platforms

Operating Systems: Microsoft Windows XP/Vista, Apple OS X, Linux, Solaris, and other UNIX variants