

Curriculum Vitae

Xu Yang

Department of Mathematics
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Education

Ph.D. 2008, Mathematics, University of Wisconsin-Madison
M.S. 2005, Applied Mathematics, Tsinghua University, Beijing, China
B.S. 2003, Mathematics, Tsinghua University, Beijing, China

Research Interests:

Applied analysis and numerical computation of scientific problems arising from biology, seismology, materials science and geophysical fluids. Specifically, biological modeling, seismic imaging, computational methods for high-frequency wave propagation, dynamics of electrons in crystals, semiclassical approximation in quantum mechanics, atmospheric and oceanic modeling, kinetic transport in heterogeneous media.

Academic Experience

Employment:

Associate Professor, Department of Mathematics, University of California, Santa Barbara, since 2016.

Assistant Professor, Department of Mathematics, University of California, Santa Barbara, 2012–2016.

Associate Research Scientist, Courant Institute of Mathematical Sciences, New York University, 2010–2012.

Postdoctoral Research Associate, Program in Applied and Computational Mathematics, Princeton University, 2008–2010.

Visiting position:

Visiting member, Department of Mathematical Sciences, Tsinghua University, Beijing, China, August-September, 2014.

Visiting member, Institute of Natural Sciences, Shanghai Jiao Tong University, Shanghai, China, August, 2012.

Awards and Honors

Hellman Family Foundation Faculty Fellowship 2015–2016, UC Santa Barbara.

Regents Junior Faculty Fellowship 2013–2014, University of California, Santa Barbara.

Vilas Travel Grant Award, University of Wisconsin-Madison, 2008.

Excellence in Mathematical Research Award for 2006–2007, University of Wisconsin-Madison.

Research Grants

Principal Investigator, National Science Foundation grant DMS-1418936, “Kinetic Approaches for Multi-scale Problems in Quantum Chemistry and Seismology”, 2014–2018.

Advisors and Mentors

Advisors of master degree thesis: Professors Zhongyi Huang and Shi Jin.

Advisor of doctoral degree thesis: Professor Shi Jin.

Post-doctoral mentors: Professors Weinan E, Weiqing Ren and Eric Vanden-Eijnden.

Students and Postdocs

Student: James Hateley (2015 – present), Christopher Gorman (2015 – present, co-advised with Prof. Shiv Chandrasekaran), Lan Liu (2015 – present, co-advised with Prof. Hector Ceniceros), Ricardo Delgadillo (2012–2016, now a postdoc at Michigan State University).

Postdocs: Hailong Guo (Sep. 2015 – present), Lihui Chai (Jan. 2014 – present, co-supervised with Prof. Carlos Garcia-Cervera), and Jingrun Chen (July 2012 – Sep. 2015, co-supervised with Prof. Carlos Garcia-Cervera, now a tenure-track assistant professor at Soochow University, China).

Publications/Preprints

(Available at <http://www.math.ucsb.edu/~xuyang/publications.htm>)

- [1] L. Chai, P. Tong and X. Yang, Frozen Gaussian approximation for 3-D seismic tomography, *Geophys. J. Int.*, submitted.
- [2] H. Guo and X. Yang, Gradient recovery for elliptic interface problem: III. Nitsche’s method, *J. Comput. Phys.*, submitted.
- [3] R. Delgadillo, X. Yang and J. Zhang, Frozen Gaussian approximation-based artificial boundary conditions for one-dimensional nonlinear Schrödinger equation in the semiclassical regime, *J. Sci. Comput.*, submitted.
- [4] R. Delgadillo, J. Lu and X. Yang, Frozen Gaussian approximation for high frequency wave propagation in periodic media, *Asymptot. Anal.*, submitted.
- [5] L. Chai, C.J. Garcia-Cervera and X. Yang, Semiclassical limit of the Schrödinger-Poisson-Landau-Lifshitz-Gilbert system, *Arch. Rational Mech. Anal.*, to appear.
- [6] H. Guo and X. Yang, Gradient recovery for elliptic interface problem: I. body-fitted mesh, *Commun. Comput. Phys.*, to appear.
- [7] H. Guo, X. Yang and Z. Zhang, Superconvergence analysis of partially penalized immersed finite element methods, *IMA J. Numer. Anal.*, 00, 1–22, 2017.
- [8] H. Guo and X. Yang, Gradient recovery for elliptic interface problem: II. immersed finite element method, *J. Comput. Phys.*, 338, 606–619, 2017.

- [9] H. Guo and X. Yang, Polynomial preserving recovery for high frequency wave propagation, *J. Sci. Comput.*, 71, 594–614, 2017.
- [10] L. Chai, P. Tong and X. Yang, Frozen Gaussian approximation for 3-D seismic wave propagation, *Geophys. J. Int.*, 208, 59–74, 2017.
- [11] E. Lorin and X. Yang, Frozen Gaussian approximation-based two-level methods for multi-frequency Schrödinger equation, *Comput. Phys. Comm.*, 207, 145–159, 2016.
- [12] R. Delgadillo, J. Lu and X. Yang, Gauge-invariant frozen Gaussian approximation method for the Schrödinger equation with periodic potentials, *SIAM J. Sci. Comput.*, 38, A2440–A2463, 2016.
- [13] E. Lorin, X. Yang and X. Antoine, Frozen Gaussian approximation based domain decomposition methods for the linear Schrödinger equation beyond the semi-classical regime, *J. Comput. Phys.*, 315, 221–237, 2016.
- [14] P. Tong, D. Yang, Q. Liu, X. Yang and J. Harris, Acoustic wave-equation-based earthquake location, *Geophys. J. Int.*, 205, 464–478, 2016.
- [15] T. Li, M. Tang and X. Yang, An augmented Keller-Segel model for *E. coli* chemotaxis in fast-varying environments, *Commun. Math. Sci.*, 14, 883–891, 2016.
- [16] J. Li, G. Lin and X. Yang, A frozen Gaussian approximation-based multi-level particle swarm optimization for seismic inversion, *J. Comput. Phys.*, 296, 58–71, 2015.
- [17] J. Chen, C.J. Garcia-Cervera and X. Yang, Mean-field dynamics of spin magnetization coupling in ferromagnetic materials: Application to current-driven domain wall motion, *IEEE Transactions on Magnetism*, 51, 1400906, 2015.
- [18] J. Chen, C.J. Garcia-Cervera and X. Yang, A mean-field model for spin dynamics in multi-layered ferromagnetic media, *(SIAM) Multiscale Model. Simul.*, 13, 551–570, 2015.
- [19] P. Tong, D. Zhao, D. Yang, X. Yang, J. Chen and Q. Liu, Wave-equation based traveltime seismic tomography: II. Application to the 1992 Landers earthquake, *Solid Earth*, 5, 1169–1188, 2014.
- [20] P. Tong, D. Zhao, D. Yang, X. Yang, J. Chen and Q. Liu, Wave-equation based traveltime seismic tomography: I. Method, *Solid Earth*, 5, 1151–1168, 2014.
- [21] G. Si, M. Tang and X. Yang, A pathway-based mean-field model for *E. coli* chemotaxis: Mathematical derivation and its hyperbolic and parabolic limits, *(SIAM) Multiscale Model. Simul.*, 12, 907–926, 2014.
- [22] X. Yang and J. Zhang, Computation of the Schrödinger equation in the semiclassical regime on unbounded domain, *SIAM J. Numer. Anal.*, 52, 808–831, 2014.
- [23] Q. Li and X. Yang, Exponential Runge-Kutta methods for the multispecies Boltzmann equation, *Commun. Comput. Phys.*, 15, 996–1011, 2014.
- [24] X. Yang, J. Lu and S. Fomel, Seismic modeling using the frozen Gaussian approximation, SEG Technical Program Expanded Abstracts 2013, 4677–4682.

- [25] W. E, J. Lu and X. Yang, Asymptotic analysis of the quantum dynamics in crystals: The Bloch-Wigner transform, Bloch dynamics and Berry phase, *Acta Math. Appl. Sin. Engl. Ser.*, 29, 465–476, 2013.
- [26] H. Wu and X. Yang, Eulerian Gaussian beam method for high frequency wave propagation in the reduced momentum space, *Wave Motion*, 50, 1036–1049, 2013.
- [27] D. Wei and X. Yang, Eulerian Gaussian beam method for high frequency wave propagation in heterogeneous media with discontinuities in one direction, *Commun. Math. Sci.*, 10, 1287–1299, 2012.
- [28] Z.Y. Huang and X. Yang, Tailored finite cell method for computing Helmholtz equation in layered heterogeneous medium, *J. Comput. Math.*, 30, 381–391, 2012.
- [29] J. Lu and X. Yang, Frozen Gaussian approximation for general linear strictly hyperbolic systems: Formulation and Eulerian methods, *(SIAM) Multiscale Model. Simul.*, 10, 451–472, 2012.
- [30] J. Lu and X. Yang, Convergence of frozen Gaussian approximation for high frequency wave propagation, *Comm. Pure Appl. Math.*, 65, 759–789, 2012.
- [31] Z.Y. Huang and X. Yang, Tailored finite point method for first order wave equation, *J. Sci. Comput.*, 49, 351–366, 2011.
- [32] H. Wu and X. Yang, A hybrid phase-flow method for solving the Liouville equation in bounded domain, *SIAM J. Numer. Anal.*, 49, 733–754, 2011.
- [33] J. Lu and X. Yang, Frozen Gaussian approximation for high frequency wave propagation, *Commun. Math. Sci.*, 9, 663–683, 2011.
- [34] W. E, J. Lu and X. Yang, Effective Maxwell equations from time-dependent density functional theory, *Acta Math. Sin.*, 27, 339–368, 2011.
- [35] S. Jin, H. Wu and X. Yang, Semi-Eulerian and high order Gaussian beam methods for the Schrödinger equation in the semiclassical regime, *Commun. Comput. Phys.*, 9, 668–687, 2011.
- [36] D. Wei, S. Jin, R. Tsai and X. Yang, Level set method for the semiclassical limit of the Schrödinger equation with discontinuous potential, *J. Comput. Phys.*, 229, 7440–7455, 2010.
- [37] S. Jin, H. Wu, X. Yang and Z.Y. Huang, Bloch decomposition-based Gaussian beam method for the Schrödinger equation with periodic potentials, *J. Comput. Phys.*, 229, 4869–4883, 2010.
- [38] S. Jin, H. Wu and X. Yang, A numerical study of the Gaussian beam methods for one-dimensional Schrödinger-Poisson equations, *J. Comput. Math.*, 28, 261–272, 2010.
- [39] S. Jin, H. Wu and X. Yang, Gaussian beam methods for the Schrödinger equation in the semiclassical regime: Lagrangian and Eulerian formulations, *Commun. Math. Sci.*, 6, 995–1020, 2008.
- [40] S. Jin, X. Liao and X. Yang, The Vlasov-Poisson equations as the semiclassical limit of the Schrödinger-Poisson Equations: A numerical study, *J. Hyperbolic Differ. Equ.*, 5, 569–587, 2008.
- [41] S. Jin and X. Yang, Computation of the semiclassical limit of the Schrödinger equation with phase shift by a level set method, *J. Sci. Comput.*, 35, 144–169, 2008.

- [42] P.A. Milewski and X. Yang, A simple model for biological aggregation with asymmetric sensing, *Commun. Math. Sci.*, 6, 397–416, 2008.
- [43] S. Jin, X. Liao and X. Yang, Computation of interface reflection and regular or diffuse transmission of the planar symmetric radiative transfer equation with isotropic scattering and its diffusion limit, *SIAM J. Sci. Comput.*, 30, 1992–2017, 2008.
- [44] S. Jin, X. Yang and G. Yuan, A domain decomposition method for a two-scale transport equation with energy flux conserved at the interface, *Kinet. Relat. Models*, 1, 65–84, 2008.
- [45] X. Yang, F. Golse, Z.Y. Huang and S. Jin, Numerical study of a domain decomposition method for a two-scale linear transport equation, *Netw. Heterog. Media*, 1, 143–166, 2006.
- [46] J.S. Zhao, X. Yang, L. Zhu, Z.J. Feng and K. Zhou, On the forward and inverse displacement of spatial parallel manipulators, *Int. J. Adv. Manuf. Technol.*, 29, 1284–1294, 2006.
- [47] X. Yang, Z.Y. Huang and L. Zhu, Wavelet-Galerkin method for reaction-diffusion equation, *J. Tsinghua Univ.*, 46, 392–395, 2006, (in Chinese).

Teaching Experience

University of California, Santa Barbara

2017 Spring: Advanced Numerical Analysis (Undergrad level).

2017 Winter: Numerical Analysis (Undergrad level).

Multidimensional Analysis I. (course for College of Creative Study).

2016 Fall: Introduction to Numerical Analysis (Undergrad level).

2016 Spring: Fourier Series and Numerical Methods (Undergrad level).

Seminar in Mathematics.

2016 Winter: Partial Differential Equations (Undergrad level).

Freshmen Seminars.

2015 Fall: Differential Equations (Undergrad level).

2015 Spring: Seminar in Mathematics.

2015 Winter: Partial Differential Equations (Grad level).

Partial Differential Equations (Undergrad level).

2014 Fall: Differential Equations (Undergrad level).

2014 Spring: PDE's Finite Difference.

2014 Winter: Seminar in Mathematics.

2013 Fall: Differential Equations (Undergrad level).

2013 Spring: Fourier Series and Numerical Methods (Undergrad level).

Methods of Analysis.

2013 Winter: Partial Differential Equations (Undergrad level).

2012 Fall: PDE's Finite Element Method.

New York University

2010 Fall: Introduction to Mathematical Analysis I (recitation).

University of Wisconsin-Madison

2007 Fall: Calculus and Analytical Geometry (discussion section).

2006 Fall: Calculus and Analytical Geometry (discussion section).

Tsinghua University, Beijing, China

2005 Spring: Introduction to Complex Analysis (discussion section).

2003 Fall: Calculus (discussion section).

Academic Services

Organizer of the conferences:

Workshop: Mean-field modeling and multiscale methods for complex physical and biological systems. Department of Mathematics, University of California, Santa Barbara, October 31–November 3, 2016. (Co-organized with Lihui Chai and Carlos Garcia-Cervela)

Summer School on Quantum and Kinetic Theory for Complex Systems. Department of Mathematics, University of California, Santa Barbara, June 13–17, 2016. (Co-organized with Carlos Garcia-Cervela)

Minisymposium: Analysis, Modeling, and Numerical Methods for High Frequency Waves. International Council for Industrial and Applied Mathematics (ICIAM), Beijing, China, August 10–14, 2015. (Co-organized with Zhongyi Huang, Olof Runborg and Lexing Ying)

Member of scientific program committee: The Ninth IMACS Conference on Nonlinear Waves. Athens, Georgia, April 01–04, 2015.

Special Session: Recent progress in spintronics: Experiment, theory and simulation. The 10th AIMS Conference on Dynamical Systems, Differential Equations and Applications, Madrid, Spain, July 7–11, 2014. (Co-organized with Jingrun Chen, Carlos Garcia-Cervela and Sookyung Joo)

Minisymposium: Charge Transport with Applications to Solar Cells. SIAM Conference on Analysis of Partial Differential Equations, Lake Buena Vista, Florida, December 7–10, 2013. (Co-organized with Jingrun Chen and Carlos Garcia-Cervela)

Session: Recent progress in spintronics: Experiment, theory and simulation. International Conference: Applied Mathematics, Modeling and Computational Science – 2013, Waterloo, Ontario, Canada, August 26–30, 2013. (Co-organized with Jingrun Chen)

Session: Waves and Their Applications in Climate Science. The Eight IMACS International Conference on Nonlinear Evolution Equations and Wave Phenomena: Computation and Theory, University of Georgia, Athens, Georgia, March 25–28, 2013. (Co-organized with Benjamin Akers)

Minisymposium: Computational Problems in Geophysics: Modeling, Imaging and Simulation. SIAM Conference on Computational Science and Engineering, Boston, Massachusetts, February 25–March 1, 2013. (Co-organized with Jinglai Li)

Minisymposium: Computational High Frequency Waves. The Eighth International Conference on Computational Physics, Hong Kong, January 7–11, 2013. (Co-organized with Hao Wu)

Minisymposium: Multiscale Computational Methods in Quantum Mechanics and High Frequency Waves. The 12th Annual Conference of China Society for Industrial and Applied Mathematics, Hefei, China, August 19–24, 2012. (Co-organized with Zhongyi Huang and Hao Wu)

Referee for the (selected) journals:

Multiscale Model. Simul., SIAM J. Applied Math., J. Comput. Phys., Commun. Math. Sci., Commun. Comput. Phys., Comput. Math. Appl., J. Comput. Appl. Math., Appl. Math. Model., J. Braz. Soc. Mech. Sci. & Eng., Front. Math. China, Wave Motion, J. Comput. Math., Computational Geosciences, J. Sci. Comput..

Invited Conference Talks

The 90th Anniversary Celebration of the Establishment of Mathematical Disciplines at Tsinghua University, Beijing China, April 21 – April 24, 2017.

SIAM Conference on Computational Science and Engineering (Minisymposium), Atlanta, Georgia, February 27 – March 3, 2017.

Conference on Quantum and Kinetic Transport, Shanghai Jiao Tong University, Shanghai, China, July 12–15, 2016.

Workshop on Partial Order: Mathematics, Simulations and Applications, IPAM, University of California, Los Angeles, January 25–29, 2016.

Workshop on Collective Dynamics in Biological and Social Systems, Department of Mathematics, Duke University, November 19–22, 2015.

International Council for Industrial and Applied Mathematics (ICIAM), Beijing, China, August 10–14, 2015.

The First International Workshop on Mathematical Geophysics, Harbin Institute of Technology, Harbin, China, January 8–11, 2015.

The Seventh International Conference on Multiscale Materials Modeling, Berkeley, California, October 6–10, 2014.

Plenary speaker, 2014 Annual Meeting of Beijing Computational Mathematics Society, Tsinghua University, Beijing, China, August 28, 2014.

Mathematical and Numerical Methods for Complex Quantum Systems, University of Illinois at Chicago, March 26–30, 2014.

Workshop on Modeling Rare Events in Complex Physical Systems, Institute for Mathematical Sciences, National University of Singapore, Singapore, November 5–9, 2013.

International Conference: Applied Mathematics, Modeling and Computational Science – 2013, Waterloo, Ontario, Canada, August 26–30, 2013.

Receptor Fest, University of California, Santa Barbara, August 7–8, 2013.

The Second Pacific Rim Mathematical Association (PRIMA) Congress, Shanghai Jiao Tong University, China, June 24–28, 2013.

Quantum Systems: A Mathematical Journey from Few to Many Particles, University of Maryland, College Park, May 13–16, 2013.

The Eight IMACS International Conference on Nonlinear Evolution Equations and Wave Phenomena: Computation and Theory, University of Georgia, Athens, Georgia, March 25–28, 2013.

SIAM Conference on Computational Science and Engineering, Boston, Massachusetts, February 25–March 1, 2013.

The Eighth International Conference on Computational Physics, Hong Kong, January 7–11, 2013.

Second Biannual TCCS Research Meeting, Austin, TX, November 12–13, 2012.

International Workshop on Recent Advances in Scientific and Engineering Computing, Shanghai Jiao Tong University, Shanghai, China, October 20–22, 2012.

2012 Young Researchers Workshop: Kinetic Description of Model Scale phenomena, University of Wisconsin-Madison, October 10–13, 2012.

Random Media II, WPI-AIMR, Tohoku University, Sendai, Japan, September 3–7, 2012.

The 12th Annual Conference of China Society for Industrial and Applied Mathematics, Hefei, China, August 19–24, 2012.

The Sixth Workshop for Young Chinese Computational Mathematicians, ICMSEC, CAS, Beijing, China, August 8–9, 2012.

SIAM Conference on Nonlinear Waves and Coherent Structures (Minisymposium), the University of Washington, Seattle, Washington, June 13–16, 2012.

Summer Program on Electronic Structure Analysis and Computation, Shanghai Jiao Tong University, Shanghai, China, June 5–26, 2011.

SIAM Conference on Mathematical and Computational Issues in the Geosciences (Minisymposium), Long Beach, California, March 21–24, 2011.

International Conference on Computational and Mathematical Methods in Science and Engineering, University of Wisconsin-Madison, Madison, May 24–26, 2010.

Kinetic Description of Multiscale Phenomena: The 2010 Annual Kinetic FRG Meeting, Brown University, Providence, May 10–14, 2010.

Quantum-Classical Modeling of Chemical Phenomena, University of Maryland, College Park, March 8–11, 2010.

Kinetic FRG Young Researchers Workshop, University of Maryland, College Park, March 2–5, 2009.

12th International Conference on Hyperbolic Problems: Theory, Numerics, Applications, University of Maryland, College Park, June 9–13, 2008.

SIAM Conference on Analysis of Partial Differential Equations (Minisymposium), Mesa, Arizona, December 10–12, 2007.

Invited Colloquia and Seminar Talks

Colorado State University, April 2017.

University of South Carolina, February 2017.

University of California, Riverside, February 2017.

Beijing Computational Science Research Center, Beijing, August 2016.

Penn State University, April 2016.

Michigan State University, February 2015.

Purdue University, November 2014.

Beijing Computational Science Research Center, Beijing, September 2014.

Zhou Pei-Yuan Center For Applied Mathematics, Tsinghua University, September 2014.

University of California, Santa Barbara, (Grad Student Colloquium), February 2014.

University of California, San Diego, October 2013.

Peking University, July 2013.

Shanghai Jiao Tong University, July 2013.
Lawrence Berkeley National Laboratory, May 2013.
University of California, Santa Barbara, (Grad Student Colloquium on the π Day), 2013.
University of California, Riverside, February 2013.
University of California, Santa Barbara, October 2012.
Tsinghua University, Beijing, August 2012.
Shanghai Fudan University, August 2012.
Shanghai Jiao Tong University, August 2012.
University of California, Santa Barbara, May 2012.
McGill University, February 2012.
Florida State University, January 2012.
University of California, Santa Barbara, January 2012.
Carnegie Mellon University, December 2011.
Northeastern University, December 2011.
Shanghai Jiao Tong University, June 2011.
University of Wisconsin-Madison, December 2009.
PACM, Princeton University, February 2009.
Chinese Academy of Science, Beijing, China, November 2008.
University of Texas-Austin, October 2008.
University of Wisconsin-Madison, September 2008.

Conference Posters

AGU Fall Meeting, San Francisco, December 12–16, 2016.
Challenges in Geometry, Analysis, and Computation: High-Dimensional Synthesis, Yale University, New Haven, Connecticut, June 4–6, 2012.
Workshop on Multiscale Modeling, Analysis, and Simulations, Michigan State University, East Lansing, Michigan, March 27–28, 2008.
Workshop on Computational Methods in Transport, Lake Tahoe, California, September 9–14, 2006.