Roman V. Samulyak

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Education

New Jersey Institute of Technology/Rutgers University (joint program), Applied Mathematics, Ph.D., 1999

L'viv University, Ukraine, Mathematical Physics, Candidate of Science (Ph.D.), 1995

L'viv University, Ukraine, Physics, M.S., 1992

L'viv University, Ukraine, Physics, B.S., 1989

Appointments

2013 – present Professor, Department of Applied Mathematics and Statistics, Stony Brook University
2007 – 2013 Associate Professor, Department of Applied Mathematics and Statistics, Stony Brook University
2005 – present Scientist, Computational Science Center (CSC), Brookhaven National Laboratory (BNL), Upton, NY
2003 – 2005 Associate Scientist, CSC, BNL
2001 – 2003 Assistant Scientist, CSC, BNL
1999 – 2001 Postdoctoral Research Associate, CSC, BNL
09/1996 – 05/1999 Graduate Research and Teaching Assistant, Department of Mathematical Sciences and Particle Technology Center, New Jersey Institute of Technology, Newark, NJ

Fields of Expertise:

Mathematical modeling, numerical methods and large scale computing, fluid dynamics and magnetohydrodynamics, computational electrodynamics, computational structural dynamics, mathematical physics.

Teaching Experience, Primary Instructor:

AMS501, Differential Equations and Boundary Value Problems, Fall 2012, 2013, Spring 2008, 2009, 2010, SUNYSB

AMS503, Applications of Complex Analysis, Spring 2011, 2012, 2013, SUNYSB

AMS505, Applied Liner Algebra, Fall 2007, 2008, SUNYSB

AMS528, Numerical Analysis III, Fall 2009, SUNYSB

AMS261, Multivariable Calculus, Fall 2010, SUNYSB

Calculus II, Spring 1999, NJIT

Publications

Referred Papers, Book Chapters, and Technical Reports

1. X. Wang, R. Samulyak, J. Jiao, K. Yu, Adaptive Particle-in-Cloud method for optimal solutions to Vlasov-Poisson equation, J. Comput. Phys., 316 (2016), 682 - 699.
2. R. Samulyak, H.-C. Chen, K. Yu, Second Order Upwind Lagrangian Particle Method for Euler Equations, Procedia Comp. Sci., 80 (2016), 2433 - 2437.
3. W. Li, T. Delaney, X. Jiao, R. Samulyak, C. Lu, Finite Element Model for Brittle Fracture and Fragmentation, Procedia Comp. Sci., 80 (2016), Pages 245 - 256
4. V. Litvinenko, Y. Jing, I. Pinayev, G. Wang, R. Samulyak, D. Ratner, Testing aspects of advanced coherent electron cooling technique, Technical Report BNL-108153-2015-CP.
5. K. Yu, R. Samulyak, SPACE: relativistic electromagnetic PIC code with plasma chemistry, 2015, to be submitted to Nuclear Instruments and Methods in Physics Research.
6. K. Yu, R. Samulyak, M. Chung, A. Tollestrup, K. Yonehara, B. Freemire, Simulation studies of beam-induced plasma loading of high-pressure RF cavities, 2016, Phys. Rev. Accel. and Beams, to appear.
7. E. Feinberg, M. Li, R. Samulyak, B. Fardanesh, G. Stefopoulos, Sensor Placement for Real-Time Power Flow Calculations in Transmission Networks, ENERGY 2015 : The Fifth International Conference on Smart Grids, Green Communications and IT Energy-aware Technologies, ISBN: 978-1-61208-406-0.

8. R. Samulyak, H. Wei, X. Jiao, T. Delaney, W. Li, C. Lu, Conservative models and numerical algorithms for brittle fracture, Technical report submitted to Army Research Laboratory, May 2014.
9. H. Wei, R. Samulyak, Mass-conservative network model for brittle fracture, J. Coupled Syst. Multiscale Dyn., Vol. 2 (2014), No 2, p. 2330.
10. T. Guo, S. Wang, R. Samulyak, Sharp interface algorithm for large density ratio incompressible multiphase magnetohydrodynamic flows, Procedia Comp. Science, 18 (2013), 511 - 520.
11. S. Wang, J. Glimm, R. Samulyak, X. Jiao, Embedded boundary method for two-phase incompressible flow, 2013. Submitted, available at arxiv.org
12. H. Kim, L. Zhang, R. Samulyak, P.Parks, On the structure of plasma liners for plasma jet induced magnetoinertial fusion, Phys. Plasmas 20, 022704 (2013)
13. H. Kim, R. Samulyak, L. Zhang, P. Parks, Influence of atomic processes on the implosion of plasma liners, Physics of Plasmas, 9:0827111, 2012.
14. T. Kaman, H. Lim, Y. Yu, D. Wang, Y. Hu, J.-D. Kim, L. Wu, J. Glimm, X. Jiao, X.-L. Li, and R. Samulyak, A numerical method for the simulation of turbulent mixing and its basis in mathematical theory. Book chapter in: Lecture Notes on Numerical Methods for Hyperbolic Equations: Short Course Book, CRC Press, Balkema London, 2011.
15. R. J. Abrams et. al., International design study for the Neutrino Factory, interim design report, 2011. BNL-96453-2011; CERN-ATS-2011-216
16. R. Samulyak, P. Parks, L. Wu, Spherically symmetric simulation of plasma liner driven magnetoinertial fusion, Physics of Plasmas, 17 (2010), 092702.
17. R. Samulyak, W. Bo, Xiaolin Li, H. Kirk, K. McDonald, Computational algorithms for multiphase magnetohydrodynamics and applications, Condensed Matter Physics, 13 (2010), No 4, 43402: 1 - 12.
18. S. Wang, R. Samulyak, T. Guo, An embedded boundary method for parabolic problems with interfaces and application to multi-material systems with phase transitions, Acta Mathematica Scientia, 30B (2010), No. 2, 499 - 521.
19. I. Bolotnov, F. Behafarid, D. Shaver, H. Hei, S. Anthal, K, Jansen, R. Samulyak, H. Wei, M. Podowski, Multiscale computer simulations of

fission gas discharge during loss-of-flow accident in sodium fast reactor, OECD Nuclear Energy Agency & IAEA Workshop (CFD4NRS-3) on Experimental Validation and Application of CFD and CMFD Codes to Nuclear Reactor Safety Issues, Washington D.C., USA, 14-16 September 2010

20. I. Bolotnov, F. Behafarid, D. Shaver, T. Guo, S. Wang, H. Wei, S. Anthal, K, Jansen, R. Samulyak, M. Podowski, Interaction of computational tools for multiscale multiphysics simulations of generation-IV rectors, Proceedings of ICAPP 2010, San Diego, CA, June 13-17, 2010, Paper 10141
21. P. Parks, T. Lu, R. Samulyak, Charging and $E \times B$ rotation of ablation clouds surrounding refueling pellets in hot fusion plasmas, Physics of Plasmas, 16, 060705 (2009).
22. H.G. Kirk, R. Samulyak, N. Simos, T. Tsang, I. Efthymiopoulos, A. Fabich, H. Haseroth, F. Haug, J. Lettry, V.B. Graves, P.T. Spampinato, K.T. McDonald, J.R.J. Bennett and T.R. Edgecock, A proof-of-principal experiment for a high-power target system, BNL report BNL-82153-2009-CP, 2009.
23. Z. L. Xu, T. Lu, R. Samulyak, J. Glimm, X. M. Ji, Dynamic phase boundaries for compressible fluids, SIAM J. Sci. Computing, 30 (2008), No. 2, 895 - 915.
24. J. Du, T. Lu, R. Samulyak, Algorithms for magnetohydrodynamics of ablated materials, Journal of Nanoscience and Nanotechnology, 8 (2008), 3674 – 3685.
25. R. Samulyak, T. Lu, P. Parks, J. Glimm, X. Li, Simulation of pellet ablation for tokamak fuelling with ITAPS front tracking, Journal of Physics: Conf. Series, 125 (2008) 012081.
26. R. Samulyak, T. Lu, P. Parks, A magnetohydrodynamic simulation of pellet ablation in the electrostatic approximation, Nuclear Fusion, 47 (2007), 103-118.
27. R. Samulyak, J. Du, J. Glimm, Z. Xu, A numerical algorithm for MHD of free surface flows at low magnetic Reynolds numbers, J. Comp. Phys., 226 (2007), 1532 - 1549.
28. T. Lu, R. Samulyak, J. Glimm, Direct numerical simulation of bubbly flows and its application, J. Fluid Eng., 129 (2007), 595 - 604.
29. W. Bo, B. Fix, J. Glimm, X. Li, , X. Liu, R. Samulyak, L. Wu FronTier and Applications to Scientific and Engineering Problems, Proc. in Appl. Math. and Mech., 7 (2007), 1024507.

30. R. Samulyak, T. Lu, Y. Prykarpatskyy, J. Glimm, Z. Xu, M.N. Kim, Comparison of heterogeneous and homogenized numerical models of cavitation, Int. J. Multiscale Comp. Eng., 4 (2006), No 3, 377 - 389.
31. Z. Xu, M.N. Kim, W. Oh, J. Glimm, R. Samulyak, X.L. Li, and C. Tzanos, Discrete bubble modeling of unsteady cavitating flow, Int. J. Multiscale Comp. Eng., 4 (2006), 601 - 616.
32. J. Glimm, B. Fix, X. Li, J. Liu, X. Liu, T. Lu, R. Samulyak, Z. Xu, Front Tracking under TSTT, Astronomical Society of the Pacific, 359 (2006), 15 - 24.
33. R. Ryne at. el., Recent progress on the MaryLie/IMPACT beam dynamics code, LBNL Technical Report, 12-06-2006.
34. N.V. Mokhov , P.C. Czarapata, A.I. Drozhdin, D.A. Still, R.V. Samulyak, Beam-induced damage to the Tevatron Components and what has been done about it. Fermilab Preprint: FERMILAB-Conf-06/415-AD, November 2006.
35. B. Fix, J, Glimm, X. Li, Y. Li, X. Liu, R. Samulyak, Z. Xu, A TSTT integrated FronTier code and its applications in computational fluid physics, Journal of Physics: Conf. Series, 16 (2005), 471 - 475.
36. R. Ryne et. al., SciDAC advances and applications in computational beam dynamics, Journal of Physics: Conf. Series, 16 (2005), 210 - 214.
37. R. Samulyak, Y. Prykarpatskyy, Richtmyer-Meshkov instability in liquid metal flows: influence of cavitation and magnetic fields, Mathematics and Computers in Simulations, 65 (2004), 431 - 446.
38. R. Samulyak, T. Lu, Y. Prykarpatskyy, Direct and homogeneous numerical approaches to multiphase flows, Lecture Notes in Comp. Sci., 3039 (2004), 653 - 660.
39. A.I. Drozhdin, N.V. Mokhov, D.A. Still, R. Samulyak Beam-induced damage to the tevatron collimators: analysis and dynamic modeling of beam loss, energy deposition and ablation, Fermilab report No. FERMILAB-FN-751, 2004.
40. J. Glimm, M.N. Kim, X. Li, R. Samulyak, Z. Xu, Jet simulation on a diesel engine, Proc. of 3rd MIT conf. on Comp. Fluid and Solid Dynamics, 2004.
41. M. Alsharoá, et al., Recent progress in neutrino factory and muon collider research within the Muon Collaboration, Phys. Rev. Special Topics - Accelerators and Beams, 6 (2003), Issue 8, 081001-1 – 52.

42. A. Hassanein, et al., An R&D program for targetry and capture at a neutrino factory and muon collider source, Nuclear Instruments and Methods in Physics Research, A 503 (2003) 70 – 77.
43. R. Samulyak, J. Glimm,W. Oh, H Kirk, K. McDonald, Numerical simulation of free surface MHD flows: Richtmyer - Meshkov instability and applications, Lecture Notes in Comp. Sci., 2667 (2003), 558 - 567.
44. J. Glimm, X. L. Li, W. Oh, M.-N. Kim, A. Marchese, R. Samulyak, C. Tzanos, Jet breakup and spray formation in a diesel engine. Second MIT Conf. on Comp. Fluid and Solid Mechanics, June 27-30, 2003.
45. J. R. J. Bennett, et. al, Studies of a Target System for a 4-MW, 24-GeV Proton Beam, CERN Tech. Report CERN-INTC-2003-033 INTC-I-049, 2003.
46. R. Ryne, A. Adelmann, P. Colella, V. Decyk, A. Dragt, S. Habib, T. Mottershead, F. Neri,J. Qiang, R. Samulyak, D. Serafini, P. Walstrom, MaryLie/IMPACT: a parallel beam dynamics code with space charge. In Particles and Accelerators, 2003, May 12-16, Portland, OR.
47. R. Samulyak, Numerical simulation of hydro- and magnetohydrodynamic processes in the Muon Collider target, Lecture Notes in Comp. Sci., 2331 (2002), 391 - 400.
48. Feasibility Study-II of a Muon-Based Neutrino Source", editors S. Ozaki, R. Palmer, M. Zisman, J. Gallardo, BNL Tech. Report BNL-52623, 2001.
49. J. Glimm, H. Kirk, X. L. Li, J. Pinezich, R. Samulyak, N. Simos, Simulation of 3D fluid jets with application to the Muon Collider target design, in Advances of Fluid Mechanics III (Editors: M. Rahman, C. Brebbia), WIT Press, 2000, 191 - 200.
50. D. Blackmore, R. Samulyak, R. Dave, A. Rosato, Dynamics of a two species oscillating particle system, In: IUTAM Symposium on Segregation in Granular Flows, Kluwer Academic Publishers, Netherlands, 2000, 255 - 268.
51. D. Blackmore, R. Samulyak, M.C. Leu, Singularity theory approach to swept volumes, International Journal of Shape Modeling, 6 (2000), No.1, 105 - 129.
52. D. Blackmore, R. Samulyak, A. Rosato, New mathematical models for granular flow dynamics, Nonlinear Mathematical Physics, 6 (1999), No. 2, 198- 221.
53. D. Blackmore, R. Samulyak, M.C. Leu, Trimming swept volumes, Computer Aided Design, 31 (1999), 215 - 223.

54. D. Blackmore, Y. Prykarpatsky, R. Samulyak, The integrability of Lie- invariant geometric objects generated by ideals in the Grassmann algebra. Nonlinear Mathematical Physics, 5 (1998), N1, 1-14.
55. M. Kopych, Y. Prykarpatsky, R. Samulyak, Adiabatic invariants of a generalized Henon-Heiles Hamiltonian system and the structure of chaotic motion. Proc. of Ukr. Acad. of Sci., 1997, No 2, p.32-36.
56. A. Prykarpatsky, W. Strampp, D. Blackmore, Yu. Sidorenko, R. Samulyak, Some remarks on Lagrangian and Hamiltonian formalism related to infinite dimensional dynamical systems with symmetries, Condensed Matter Phys., 6 (1995), 79 - 104.
57. A. Prykarpatsky, O. Hentosh, M. Kopych, R. Samulyak, Neumann-Bogoliubov-Rosochatius oscillatory dynamical systems and their integrability via dual moment maps. Part I. Nonlinear Mathematical Physics, 2 (1995), No 2, p.98-113.
58. A. Prykarpatsky, R. Samulyak, Higgs model as an exactly integrable bi- Hamiltonian dynamical system of the classical field theory. Proc. of Ukr. Acad. of Sci., 1995, No 1, p.34-37.
59. R. Samulyak, Generalized Dicke type dynamical system as the inverse nonlinear Schrodinger equation. Ukr. Math. J., 47 (1995), No 1, 149-151.
60. R. Samulyak, Hamiltonian analysis of exact integrability of the quantum 3-level superradiance Dicke model, Ukr. Math. J., 44 (1992), No 9, 1149-1155.

Non-referred Conference Papers

61. J. Ma, G. Wang, X. Wang, R. Samulyak, V. N. Litvinenko, K. Yu, Modulator simulations for coherent electron cooling, Proceedings of NA-PAC 2016, paper WEPOA55.
62. K. Yu, R. Samulyak, SPACE Code for Beam-Plasma Interaction, IPAC-2015, 6th International Particle Accelerator Conference, May 3-8, 2015, Richmond, VA. Paper MOPMN016.
63. X. Wang, R. Samulyak, X. Jiao, K. Yu, Optimal Generalized Finite Difference Solution to Particle-in-Cell Problem, IPAC-2015, 6th International Particle Accelerator Conference, May 3-8, 2015, Richmond, VA. Paper MOPMN040.
64. K. Yu, R. Samulyak, M. Chung, A. Tollestrup, K. Yonehara, B. Freemire, Simulation of Beam-Induced Plasma in Gas Filled Cavities, IPAC-

2015, 6th International Particle Accelerator Conference, May 3-8, 2015, Richmond, VA. Paper MOPMN017.

65. J. Ma, R. Samulyak, V. Litvinenko, K. Yu, Simulation of Beam-Induced Plasma for the Mitigation of Beam-Beam Effects, IPAC-2015, 6th International Particle Accelerator Conference, May 3-8, 2015, Richmond, VA. Paper MOPMN019
66. K. Yu, R. Samulyak, M. Chung, A. Tollestrup, K. Yonehara, Modeling and simulation of beam-induced plasma in muon cooling devices, IPAC-2014, 5th International Particle Accelerator Conference, June 15 - 20, 2014, Dresden, Germany. Paper MOPME043
67. R. Samulyak, H.C. Chen, H. Kirk., K. McDonald, Simulation of high-power mercury jet targets for neutrino factory and muon collider, Proc. NA-PAC 2013, North American Particle Accelerator Conference, Sep. 29 - Oct. 3, 2013, Pacadena, CA, paper TUPBA09.
68. R. Samulyak, K. Yu, M. Chung, A. Tollestrup, K. Yonehara, R. D. Ryne, Algorithms for self-consistent simulations of beam-induced plasma in muon cooling devices, Proc. NA-PAC 2013, North American Particle Accelerator Conference, Sep. 29 - Oct. 3, 2013, Pacadena, CA, paper MOPBA06.
69. K. Yonehara, M. Chung, A. Tollestrup, R.P. Johnson, T.J. Roberts, R.D. Ryne, B. Freemire, R. Samulyak, K. Yu, Simulation of beam-induced gas plasma in high gradient RF field for muon colliders, Proceedings of IPAC2013, Shanghai, China, Paper TUPFI058.
70. H.G. Kirk et. al, A Solenoid Capture System for a Muon Collider In Proc. Particles and Accelerators, 2011, PAC-2011-TUP265.
71. H. Kirk et. al., A High-power Target Experiment at the CERN PS, Particles and Accelerators, 2005, 3745 - 3747.
72. Studies of a Target System for a 4-MW, 24-GeV Proton Beam, Proc. of INTC, INTC-2004-016, p. 186, 2004.
73. Davenport, J.W., Deng, Y., Glimm, J., and Samulyak, R. Computational science at Brookhaven National Laboratory: Three selected topics. In: Proc. 6th International Seminar on Science and Computing, Moscow, September 15-17, 2003.
74. A. Hassanein, et al., The primary target facility for a neutrino factory based on muon beams, In Particles and Accelerators 2001, v. 2, p. 1583 - 1585.
75. K. T. McDonald, et al., The R&D program for targetry at neutrino factory, Particles and Accelerators 2001, June 18 - 22, Chicago, IL.

76. H. Kirk, et al., Target studies with BNL E951 at the AGS, Particles and Accelerators, 2001, vol. 2, p. 1535 - 1537.
77. A. Luccio, N. D'Imperio, R. Samulyak, Solving by parallel computing the Poisson problem for high intensity beams in circular accelerators, In Particles and Accelerators 2001, June 18 - 22, Chicago, IL

Seminars, Invited Conference Talks and Other Selected Presentations

1. Second Order Upwind Lagrangian Particle Method for Euler Equations, ICCS-16, June 6 - 8, 2016, San Diego, CA
2. Particle-based Methods for Multiphase Systems and Applications to High Power Targets, A&T Seminar, CERN, Geneva, Switzerland, June 26, 2016
3. Novel Numerical Methods for Vlasov-Poisson and Vlasov-Maxwell PDE?s and Applications, AMS Lecture, Stony Brook University, April 20, 2016.
4. Simulation of Plasma Jet Merger and Liner Formation within PLX-Alpha, Annual APS-DPP meeting, November 18, 2016, Savannah, GA.
5. Computational Methods for Complex Systems and Applications to Laser Ablation and Exploding Wire Experiments, Army Research Laboratory Seminar, Aberdeen, MD, November 12, 2015
6. Novel Particle and Particle-Mesh methods for Electromagnetic Systems involving Plasma and Relativistic Beams, Computational Science Center Seminar, BNL, September 1, 2015
7. Lagrangian Particle Method for Compressible Fluid Dynamics, Particles-2015, September 28-30, 2015, Barcelona, Spain
8. Novel Particle-based and Hybrid Methods for Complex Systems, Physics Department Seminar, September 24, 2015, Kyiv University, Ukraine. Department of Applied MAthematics Seminar, September 18, 2015, Lviv University, Ukraine.
9. New Lagrangian Particle and Particle-Mesh Methods for Complex Systems, AMS Lecture, Stony Brook University, 2015
10. SIAM Conference on Computational Science and Engineering, March 14-18, 2015, Salt Lake City, Utah, USA
11. Simulation of high power liquid mercury jet targets, Annual collaboration of Muon Accelerator Project, December 3 - 5, 2014, SLAC, Stanford University.

12. Numerical studies of beam loading of high-pressure hydrogen filled RF cavity, Annual collaboration of Muon Accelerator Project, December 3 - 5, 2014, SLAC, Stanford University.
13. Modeling and simulation of beam-induced plasma in muon cooling devices, IPAC-2014, 5th International Particle Accelerator Conference, June 15 - 20, 2014, Dresden, Germany. Paper MOPME043
14. New Conservative Models and Numerical Algorithms for Brittle Fracture, Seminar at Army Research Laboratory, June 10, 2014.
15. Error Analysis of Lagrangian Particle Methods, Minisymposium presentation at the SIAM Conference on Uncertainty Quantification, March 31 - April 3, 2014, Savannah, Georgia.
16. Average ionization EOS model for high-Z plasma and applications, 55th Annual Meeting of the APS Division of Plasma Physics November 11-15, 2013, Denver, Colorado. (Presented by my grad. student H. Kim).
17. Simulation of high-power mercury jet targets for neutrino factory and muon collider, North American Particle Accelerator Conference, Sep. 29 - Oct. 3, 2013, Pacadena, CA.
18. Algorithms for self-consistent simulations of beam-induced plasma in muon cooling devices, North American Particle Accelerator Conference, Sep. 29 - Oct. 3, 2013, Pacadena, CA.
19. GPU Implementation of Lagrangian Particle Methods for Compressible Euler Equations Invited talk at GPGPU Workshop, Stony Brook University, August 23, 2013
20. Particle-based Methods for Elliptic Boundary and Elliptic Interface Problems, 12th U.S. National Congress on Computational Mechanics, Raleigh, North Carolina, July 22-25, 2013. (Presented by my grad. student G. Telang).
21. Lagrangian Particle Method for Compressible Euler Equations based on Generalized Finite Differences, 12th U.S. National Congress on Computational Mechanics, Raleigh, North Carolina, July 22-25, 2013. (Presented by my grad. student M. Chen).
22. Self-consistent simulation of beam-plasma interaction in muon cooling devices, MAP Collaboration Meeting, Fermilab, June 19-22, 2013.
23. Sharp Interface Algorithm for Large Density Ratio Incompressible Multiphase MHD and Applications, ISSC-2013, Barcelona, Spain, June 5-7, 2013.

24. Fast Alorithms for Power Grid Optimization in Real Time. Invited talk at the Workshop on Utility Probabilisti Risk Assessment in Real Time, March 7 - 8, BNL, 2013.
25. Conservative Particle-Mesh Algorithms and Parallel Software for Electromagnetism and Applications, Seminar at the Collider Accelerator Department, BNL, February 14, 2013.
26. Lagrangian Mesh and Particle Algorithms for Multiphase Flows. Seminar at Kyiv Polytechnical Institute, Ukraine, November 19, 2012.
27. Supercomputers and Mathematical Models for Multiphysics Simulations in Energy and Accelerator Sciences, 477th Brookhaven Lecture, April 25, 2012.
28. Progress in modeling and simulations fo high power liquid mercury targets, Muon Accelerator Program Collaboration Meeting, March 4 - 8, 2012 SLAC National Accelerator Laboratory, Menlo Park, California.
29. Mathematical modeling and simulations of multiphase weakly ionized plasmas. Seminar at Naval Research Laboratory, August 11, 2011.
30. Advancing energy research applications with ITAPS front tracking, Annual SciDAC meeting, July 11 - 14, 2011, Denver, Colorado. Invited plenary talk
31. Computational algorithms for multiphase magnetohydrodynamics and applications, ICIAM-2011: International Congress on Industrial and Applied Mathematics, July 18-22, 2011, Vancouver, Canada. (Invited minisymposium talk)
32. ITAPS tools in computational evaluation of alternative methods of nuclear fusion, SIAM Conference on Computational Science and Engineering, February 28 - March 4, 2011, Reno, Nevada.(Invited minisymposium talk)
33. On the Structure of Plasma Liners for Plasma Jet Induced Megnetoinertial Fusion, 52st Annual Meeting of the Division of Plasma Physics, November 8 - 12, 2010, Chicago, Il.
34. Simulation of Formation and Implosion of Plasma Liners for Magnetized Target Fusion, 51st Annual Meeting of the Division of Plasma Physics, November 2 - 6, 2009, Atlanta, Georgia.
35. Intrinsic rotation of pellet ablation clouds, 51st Annual Meeting of the Division of Plasma Physics, November 2 - 6, 2009, Atlanta, Georgia.
36. Simulations of Multiphase Flows in Nuclear Fusion Applications, Physics Department Colloquium, Stony Brook University, October 16, 2009, Stony Brook, NY.

37. Multi-Physics Simulations of the Failure of Fuel Rods During Accidents in Sodium-Cooled Fast Reactors, Workshop on Characterization of Advanced Materials Under Extreme Environments for the Next Generation Energy Systems, September 25-26, 2009, Brookhaven National Laboratory, Upton, NY.
38. Simulations of High-Intensity Pulsed Beam Targeting, Workshop on Applications of High Intensity Proton Accelerators, October 19-21, 2009, Fermi National Accelerator Laboratory, Batavia, IL.
39. Simulation of mercury targets for Neutrino Factory / Muon Collider, MUTAC, April 6 8 2009, Fermi National Accelerator Laboratory, Batavia, IL.
40. ITAPS Based Software for Multiphase Flows in Nuclear Fusion Applications, SIAM Conference on Computational Science and Engineering, March 2-6, 2009, Miami, Florida.
41. Computational models for the fracture of inhomogeneous brittle materials, Plasticity 2009, St. Thomas, US Virgin Islands, January 3-8, 2009
42. Simulation of Plasma Jet Driven MTF, 50th Annual Meeting of the Division of Plasma Physics, November 17-21, 2008, Dallas, Texas
43. Simulation of mercury targets for Neutrino Factory / Muon Collider, 2nd Princeton/Oxford Meeting on High Power Targets, November 67, 2008, Princeton, NJ.
44. Simulations of Multiphase Magnetohydrodynamic Flows for Nuclear Fusion Applications, Invited talk at the Workshop on the Role of High Performance Computation in Economic Development, Rensselaer Polytechnic Institute, Troy, New York, October 22 - 24, 2008.
45. Front tracking simulation of pellet ablation for tokamak fuelling, Invited presentation at SciDAC annual meeting, July 13 - 17, 2008, Seattle.
46. Visualization on New York Blue, New York Center for Computational Sciences Seminar Series, Stony Brook University, July 12, 2008.
47. MHD simulation of liquid mercury jet targets, Annual Meeting of the Neutrino Factory / Muon Collider Collaboration, March 1720, 2008, Fermilab, IL.
48. Charging and Rotation of Pellet Ablation Cloud, 49th Annual Meeting of the Division of Plasma Physics November 12 - 16, 2007, Orlando, Florida

49. Models and Computational Algorithms for Multiphase Magnetohydrodynamics, Applied Mathematics Research Program Annual PI Meeting, DOE Office of Advanced Scientific Computing Research, May 22 - 24, 2007, Lawrence Livermore National Laboratory.
50. Numerical Algorithms for MHD of Free Surface Flows of Ablated Materials, minisymposium talk at the SIAM Conference on Computational Science and Engineering, February 19 - 23, 2007, Costa Mesa, CA.
51. Axisymmetric MHD Simulations of Pellet Ablation, presentation at the Annual APS Meeting of the Division of Plasma Physics, October 30 - November 3, 2006, Philadelphia, PA.
52. MHD Simulation of Pellet Ablation in Tokamaks, Computational Plasma Physics Seminar, Princeton Plasma Physics Laboratory, Princeton University, July 26, 2006.
53. MHD Control of Laser Ablation Plumes: Models, Algorithms, and Simulation, minisymposium talk at 7th World Congress on Computational Mechanics, July 16-22, 2006, Los Angeles, CA.
54. Numerical Algorithms for MHD of Multiphase Systems and Applications to Fusion Science, Computational Science Center Seminar, Brookhaven National Laboratory, March 9, 2006
55. New Algorithm for Riemann Problem at the Phase Transition Boundary, presentation at the Annual SIAM Conference, July 11 - 15, 2005, New Orleans, LA.
56. Direct Numerical Simulation of Bubbly/Cavitating Flows and Applications to Cavitation Mitigation, invited talk at the Workshop on Mitigation of Cavitation Damage Erosion in Liquid Metal Spallation Targets, November 30 - December 1, 2005 ORNL/SNS.
57. Low Magnetic Reynolds Number Flows with Phase Transitions, presentation at the Second Conference on Frontiers in Applied and Computational Mathematics (FACM-05), May 13-15, 2005, New Jersey Institute of Technology, Newark, NJ.
58. Magnetohydrodynamics Simulations of Free Surface Flows. invited talk at the 2nd High-Power Targetry Workshop, October 10 - 14, 2005, Oak Ridge, TN.
59. Modeling and Simulation of Multiphase Flows and Applications to Accelerator Targets, invited talk at the Conference on Analysis, Modeling and Computation of PDE and Multiphase flow dedicated to the 70th birthday of James Glimm, August 3-5, 2004, Stony Brook University, Stony Brook, New York.

60. Direct and Homogeneous Numerical Approach to Multiphase Flows and Applications, minisymposium talk at the 4th International Conference on Computational Sciences, June 2004, Krakow, Poland.
61. Computational Models for Multiphase MHD Flows, Seminar at the Department of Mechanical Engineering, NJIT, March 25, 2004.
62. Liquid Targets for Advanced Accelerators: Modeling and Simulations, Seminar at National Superconducting Cyclotron Laboratory, Michigan State University, February 5, 2004.
63. Progress in Numerical Studies of Liquid Mercury Targets, invited talk at the Neutrino Factory/Muon Collider Collaboration Meeting, January 27-31, 2004, Mission Inn, Riverside, CA.
64. Algorithms for Multiphase MHD and Applications, minisymposium presentation at 7th US Congress on Computational Mechanics, July 28 - 30, 2003, Albuquerque, NM.
65. Numerical Simulation of Richtmyer-Meshkov Instability in Free surface MHD Flow, minisymposium talk at the 3rd International Conference on Computational Sciences, May 2003, Montreal, Canada.
66. Numerical Simulation of the Hg-Jet Target, invited talk at the Neutrino Factory/Muon Collider Collaboration Meeting, May 9 - 15, 2002, Shelter Island, NY.
67. Numerical Simulation of Hydro- and MHD Processes in Liquid Metal Targets, minisymposium talk at the 2nd International Conference on Computational Sciences, April 2002, Amsterdam, the Netherlands.
68. Computational Methods in Accelerator Physics, Center for Data Intensive Computing Seminar, Brookhaven National Laboratory, October 9, 2001, Upton, NY.
69. Computational Hydro- and Magnetohydrodynamics of 3D free surface flows of real materials. NJIT Applied Mathematics Colloquium, September 7, 2001.
70. Computational Free Surface Hydrodynamics and Magnetohydrodynamics and Applications to the Muon Collider Target Design. Seminar at Princeton Plasma Physics Laboratory, October 12, 2000, Princeton.
71. Simulation of 3D Fluid Jets with Applications to the Muon Collider Target Design, presentation at the 3rd International Conference on Advances in Fluid Mechanics, May, 2000, Montreal, Canada.
72. Front Tracking Simulations of 3D Jets and Accelerator Target Applications, Center for Data Intensive Computing Seminar, Brookhaven National Laboratory, March 24, 2000, Upton, NY.

73. Exact Finite Dimensional Reductions of Nonlinear Dynamical Systems on Functional Manifolds and Applications to Laser Physics Models. Arizona Center for Mathematical Sciences Seminar, University of Arizona, April 1999, Tucson, AZ.
74. Mathematical Models for Particle Flow Dynamics. Department of Mathematics Seminar. Duke University, April 1999, Durham, NC.
75. Dynamical Systems Associated with Particle Flow Models: Theory and Numerical Methods. Department of Applied Mathematics and Statistics Seminar, SUNY at Stony Brook, March 3, 1999, Stony Brook, NY.

Current Research

Project 1: Development of Scalable Lagrangian Mesh and Particle Methods for Multiphase Flows

The goal of the project is to develop new and enhanced Lagrangian particle and moving mesh mathematical models and scalable algorithms extending and improving ideas generalized finite differences and front tracking. The developed methods will improve the mathematical rigor and accuracy of the current particle-based PDE methods and extend them to new systems. The software, that implements modern programming paradigms for multicore supercomputers and GPU clusters, will be used for a variety of fundamental science and applied problems.
For more information, visit
http://www.ams.sunysb.edu/ rosamu/Projects/Lparticles/lparticles.html

Project 2: High Power Targets for Neutrino Factory / Muon Collider

Development of mathematical models and software for free surface / multiphase megnetohydrodynamics in the low magnetic Reynolds number approximation and their application to the simulation of high power liquid mercury targets interacting with proton pulses in strong magnetic fields. Simulations made predictions for the targetry experiment at CERN called MERIT and influenced its design. Future designs will increasingly rely on simulations. Two codes are being developed: front tracking code FronTier-MHD and MHD code based on Lagrangian particles.
For more information, visit
http://www.ams.sunysb.edu/ rosamu/Projects/Target/target.html

Project 3: New Smart Grid: Algorithms for Real Time Optimization of Power Systems

The main goal of this collaborative project with NYPA is the development and deployment of numerical algorithms and software to be used by the Smart Grid control equipment. New software will dramatically improve the real-time control of the electric power grid by solving power control problems on orders of magnitude faster than what is currently available. Emerging Smart Grid technologies, including the deployment of telecommunication networks and new generation of sensors, such as Phase Measurement Units (PMUs), will provide large amounts of useful data for such control decisions. This project develops mathematical algorithms and software to provide robust state solution for dynamic visibility of the power system behavior for the systems with more than ten thousand nodes.

For more information, visit

http://www.ams.sunysb.edu/ rosamu/Projects/PowerGrid/power_grid.html

Project 4: Evaluation of Plasma Liner Driven Magneto-Inertial Fusion via Advanced Computing

In the plasma jet driven magneto-inertial fusion concept, a plasma liner, formed by merging of a large number of radial, highly supersonic plasma jets, implodes on a plasma target, and compresses it to conditions of the fusion ignition. Our goal is to evaluate this method via high fidelity numerical simulations and to provide guidance for the Plasma Liner Experiment at Los Alamos. Recent results include verification of theoretical scaling laws, development of new physics models, and investigation of factors affecting the liner quality and fusion energy gain. Work is supported by the DOE Program in High Energy Density Laboratory Plasmas.

For more information, visit

http://www.ams.sunysb.edu/ rosamu/Projects/PJMIF/pjmif.html

Project 5: Highly Scalable Electromagnetic Solvers Coupled to Particles

The goal of the project is the development of highly scalable code for the simulation of electromagnetic fields coupled to particles. Using a hybrid parallelization method based on MPI with multithreads for multicore supercomputers such as BlueGene-Q, the software will be applicable for a variety of fundamental science and applied problems. In particular, it will be used by BNL scientists working on advanced laser wakefield acceleration methods and noise reduction in electron beams.

For more information, visit
http://www.ams.sunysb.edu/ rosamu/Projects/EM/em.html

Project 6: Mesoscale Models for Brittle Failure of Solids
Development of new mass-conserving brittle fracture algorithms based on the energy minimization of elasto-plastic networks. The main research goals are to improve the method of Extended Finite Elements, in particular its ability to simulate complex fracture regimes and flows of disintegrated materials, develop highly scalable software, and apply it to problems relevant to Army Research Lab and DOE Nuclear Energy research.
For more information, visit
http://www.ams.sunysb.edu/ rosamu/Projects/BrittleFracture/fracture.html

Synergistic Activities

American Physical Society

Society for Industrial and Applied Mathematics

Reviewer for applied and computational mathematics and physics journals, DOE Office of Science proposals and proposals submitted to European funding agencies

University, Departmental, and Brookhaven Laboratory Services

University Senate

Member of the Executive Committee of the AMS Department

Chair, Department of the Applied Mathematics and Statistics Hiring Committee in the area of computational applied mathematics

Member of the BNL committee "Brookhaven Lecture Series"

Graduate and Post Doctoral Advisors

J. Glimm, Department of Applied Mathematics and Statistics, SUNY at Stony Brook, and CDIC/BNL

D. Blackmore, Department of Math. Sciences, New Jersey Institute of Technology

A. Prykarpatsky, Institute for Applied Problems of Mechanics and Mathematics, L'viv, Ukraine

Graduate dissertations completed or being written under my direction

Completed Ph.D. dissertations:
Tianshi Lu, currently Associate Professor at Whichita University
Jian Du, Assistant Professor at Florida Institute of Technology
Lingling Wu, software engineer in industry
Hongren Wei, Samsung Corporation
Tongfei Guo, Bloomberg Corporation
Lina Zhang, software engineer in industry
Hyoungkeun Kim, postdoc at DOE National Energy Technology Laboratory
Morris Chen, software engineer in industry
Kwangmin Yu, Advanced Technology Engineer, Brookhaven National Laboratory

Postdocs supervised:
Yarema Prykarpatskyy (BNL), 2002 - 2004
Tianshi Lu (BNL), 2005 - 2008
Shuqiang Wang (SBU), 2008 - 2009
Wurigen Bo (SBU), 2009 - 2010
Viktor Kilchyk (BNL), 2009 - 2011

Current Ph.D. students:
1. Wei Li, AMS Department, Works on modeling and simulation of brittle fracture within ARO-funded project, expected to graduate in February 2017
2. Jun Ma, AMS Department, works on coherent electron cooling, supported by the LDRD project located at CA-D, expected to graduate in the summer of 2017.
3. Wen Shih, AMS Department, works on simulations of plasma liners within the PLX-Alpha project, expected to graduate in the summer of 2018.
4. Xingyu Wang, AMS Department, works on numerical aspects related to the PLX-Alpha project and the AP-Cloud method, expected to graduate in the summer of 2018.
5 Nicolas Bosviel, AMS Department, works on new physics models for FronTier-MHD. Currently supported by a TA line.
6. Sijia Huang, AMS Department, Co-advised by Prof. Carlos Colosqui of ME Department and supported on his project on simulations of complex biofluids.
7. Prabhat Kumar, AMS Department, a new student starting to work on electromagnetic simulations relevant to BNL Accelerator test facility. Beginning student, currently supported by a TA line.