NEELESH A. PATANKAR

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EDUCATION

BS (B.Tech), Mechanical Engineering, 1993, Indian Institute of Technology, Bombay, India
MS, Mechanical Engineering, 1995, University of Pennsylvania, Philadelphia, PA
Ph.D., Mechanical Engineering, 1997, University of Pennsylvania, Philadelphia, PA
Thesis: "Numerical simulation of particulate two-phase flows"
Advisor: Prof. Howard H. Hu

APPOINTMENTS

- Professor, Northwestern University, 2011 – present.
- Associate Professor, Northwestern University, 2006 – 2011.
- Assistant Professor, Northwestern University, 2000 – 2006.
- Senior Visiting Fellow, Center for Turbulence Research, Stanford University, summer 2001.
- Post-doctoral Research Associate, University of Minnesota, 1997 – 2000; Advisor: Professor Daniel D. Joseph.

HONORS & AWARDS

- Charles Deering McCormick Professor of Teaching Excellence, 2014.
- Cole-Higgins Award for Teaching Excellence, 2013; Honorable Mention, 2008.
- Associated Student Government Honor Roll, Northwestern University, 2009, 2013.
- Fellow, American Physical Society, 2012.
- Int. Conf. on Multiphase Flow Junior Award, 2010 (presented once every three years).
- One of 17 scientists selected to the Defense Science Study Group (2010–2011).
- NSF CAREER Award, 2002.
- Searle Center for Teaching Excellence Junior Fellowship, Northwestern University, 2001.
- John Goff prize for highest scholarship performance, University of Pennsylvania, 1998.
- Certificate of outstanding ability in mathematics (ranked 14th in India), Indian Mathematics Olympiad Association, 1988.
- National Talent Scholarship, 1987, National Council for Education Research and Training, India.

CURRENT RESEARCH AREAS

- **Fully resolved simulation of fluid-particle flows:** Development of fast algorithms, multiscale methods.
- **Fully resolved simulation of freely swimming fish motion:** Development of novel fast computation techniques. Application to neuromechanics, underwater vehicle design, evolution of form and function, and animation.

- **Fully resolved simulation of Brownian motion:** Development of fundamental modeling schemes for the Brownian motion of micro/nanoscale particles, application to biological processes.
- **Fully resolved simulation of esophageal transport:** Development of computational physics tools for use in diagnostics and device design for clinical practice.
- **Fully resolved simulation of vehicle aerodynamics:** Development of simulation techniques for in-silico testing of the stability and dynamics of moving vehicles.
- **Phase control using textured surfaces and superhydrophobicity:** Using surface chemistry and textures to control phase transition, roughness enhanced superhydrophobicity (lotus effect), novel material design and synthesis for energy (power plants, boilers, condensers) and water (dew, fog) applications.
- **Electrohydrodynamic (EHD) flows and micromixing:** Numerical methods for EHD flows for fluid and fluid-particle systems, instabilities in EHD flows.

SUMMARY OF TECHNICAL CONTRIBUTIONS*

- A novel formulation of the Distributed Lagrange Multiplier (DLM) method for rigid and self-propelling bodies.[3,24,38]
- A fast projection scheme,[25,26,35,38,39] and Stokes flow algorithms[27,48] for rigid and self-propelling bodies.
- A new approach for the DNS of Brownian motion of particles.[20]
- Fundamental studies of aquatic locomotion with applications in engineering and biology.[34,45,53]
- Fundamental studies of esophageal transport with application in clinical practice.[65,67]
- Theoretical foundation for roughness-based non-wetting surfaces.[14,16-19,21,23,37,40,43,44,46,47,49,51,54]
- Numerical simulation of electroosmotic flows.[2]
- A theoretical model for 'electrokinetic' instabilities.[50]
- First continuum approach to reproduce molecular scale slip.[42]
- New power law models for the lift force on particles.[7,10,13,15,28]
- Rheological modeling of fluid-particle systems.[5,11]
- Drag model based simulation of dense fluid-particle systems by the Lagrangian approach.[8,9]

PUBLICATIONS

Citation Statistics

- Web of Science: Total citations: 6100+; h-index: 33
- Google Scholar: Total citations: 9200+; h-index: 39

Book

- Patankar NA, Fully resolved simulation of immersed bodies: From macro to micro-scales, under contract, Taylor-Francis.

Book chapters

- Chen Y, Sharma N, Patankar NA, Fluctuating immersed material (FIMAT) dynamics for the direct simulation of the Brownian motion of particles, in IUTAM Symposium on Computational Approaches to Multiphase Flow, Editor(s): Balachandar S; Prosperetti A,

* Reference numbers in the list are as per the numbering of Refereed Journal Articles below.

Book Series: FLUID MECHANICS AND ITS APPLICATIONS, Volume: 81, Pages: 119-129, 2004.

- Patankar NA, Hydrophobicity of Surfaces with Cavities: Making Hydrophobic Substrates from Hydrophilic Materials?, in Superhydrophobic surfaces, Editor(s): Carre A; Mittal KL, 2009, Koninklijke Brill NV, Leiden, The Netherlands.
- Patankar NA, Fundamentals of roughness induced superhydrophobicity, in Nano and cell mechanics: Fundamentals and frontiers, Editor(s): Espinosa HD; Bao G, 2013, Wiley, UK.

Refereed Journal Articles

77. Patel, Namrata K.; Bhalla, Amneet Pal Singh; Patankar, Neelesh A.; A new constraint-based formulation for hydrodynamically resolved computational neuromechanics of swimming animals, JOURNAL OF COMPUTATIONAL PHYSICS Volume: 375 Pages: 684-716 2018

76. Kou, Wenjun; Pandolfino, John E; Kahrilas, Peter J; Patankar, Neelesh A; Studies of abnormalities of the lower esophageal sphincter during esophageal emptying based on a fully coupled bolus-esophageal-gastric model, BIOMECHANICS AND MODELING IN MECHANOBIOLOGY Volume: 17 Pages: 1069-1082 2018

75. Kou, Wenjun; Pandolfino, John E; Kahrilas, Peter J; Patankar, Neelesh A; Simulation studies of the role of esophageal mucosa in bolus transport, BIOMECHANICS AND MODELING IN MECHANOBIOLOGY Volume: 16 Pages: 1001-1009 2017

74. Kou, Walter; Pandolfino, John E; Kahrilas, Peter J; Patankar, Neelesh A; Could the peristaltic transition zone be caused by non-uniform esophageal muscle fiber architecture? A simulation study, NEUROGASTROENTEROLOGY & MOTILITY Volume: 29 Article Number: e13022 2017

73. Jones, Paul R; Kirn, Adrian T; Ma, Y David; Rich, Dennis T; Patankar, Neelesh A; The thermodynamics of restoring underwater superhydrophobicity, LANGMUIR Volume: 33 Pages: 2911-2919 2017

72. Sprinkle, Brennan; Bale, Rahul; Bhalla, Amneet Pal Singh; MacIver, Malcolm A; Patankar, Neelesh A; Hydrodynamic optimality of balistiform and gymnotiform locomotion, EUROPEAN J. COMP. MECH. Volume: 26 Pages: 31-43 2017

71. Nangia, Nishant; Bale, Rahul; Chen, Nelson; Hanna, Yohanna; Patankar, Neelesh A; Optimal specific wavelength for maximum thrust production in undulatory propulsion, PLoS ONE Volume: 12 Article Number: e0179727 2017

70. Sprinkle, Brennan; Balboa Usabiaga, Florencio; Patankar, Neelesh A; Donev, Aleksandar; Large scale Brownian dynamics of confined suspensions of rigid particles, JOURNAL OF CHEMICAL PHYSICS Volume: 147 Article Number: 244103 2017

69. Hsu, Hua-Yi; Lin, Ming-Chieh; Popovic, Bridget; Lin, Chii-Ruey; Patankar, Neelesh A; A numerical investigation of the effect of surface wettability on the boiling curve, PLoS ONE Volume: 12 Article Number: e0187175 2017

68. Patankar, Neelesh A.; Thermodynamics of Trapping Gases for Underwater Superhydrophobicity, LANGMUIR Volume: 32 Pages: 7023-7028 2016

67. Kou, Wenjun; Bhalla, Amneet Pal Singh; Griffith, Boyce E.; Pandolfino, John E.; Kahrilas, Peter J.; Patankar, Neelesh A.; A fully resolved active musculo-mechanical model foresophageal transport, JOURNAL OF COMPUTATIONAL PHYSICS Volume: 298 Pages: 446-465 2015

66. Jones, Paul R.; Hao, Xiuqing; Cruz-Chu, Eduardo R.; Rykaczewski, Konrad; Nandy, Krishanu; Schutzius, Thomas M.; Varanasi, Kripa K.; Megaridis, Constantine M.; Walther, Jens H.; Koumoutsakos, Petros; Espinosa, Horacio D.; Patankar, Neelesh A.; Sustaining dry surfaces under water, SCIENTIFIC REPORTS Volume: 5 Article Number: 12311 2015

65. Kou, Wenjun; Pandolfino, John E.; Kahrilas, Peter J.; Patankar, Neelesh A.; Simulation studies of circular muscle contraction, longitudinal muscle shortening, and their coordination in esophageal transport, AMERICAN JOURNAL OF PHYSIOLOGY-GASTROINTESTINAL AND LIVER PHYSIOLOGY Volume: 309 Pages: G238-G247 2015

64. Bale, Rahul; Neveln, Izaak D.; Bhalla, Amneet Pal Singh; MacIver Malcolm A.; Patankar, Neelesh A.; Convergent Evolution of Mechanically Optimal Locomotion in Aquatic Invertebrates and Vertebrates, PLOS BIOLOGY Volume: 13 Article Number: e1002123 2015

63. Bale, Rahul; Shirgaonkar, Anup A.; Neveln, Izaak D.; Bhalla, Amneet Pal Singh; MacIver Malcolm A.; Patankar, Neelesh A.; Separability of drag and thrust in undulatory animals and machines, SCIENTIFIC REPORTS Volume: 4 Article Number: 7329 2014

62. Bale, Rahul; Hao, Max; Bhalla, Amneet Pal Singh; Patel, Namrata; Patankar Neelesh A.; Gray's paradox: A fluid mechanical perspective, SCIENTIFIC REPORTS Volume: 4 Article Number: 5904 2014.

61. Bale, Rahul; Hao, Max; Bhalla, Amneet Pal Singh; Patankar, Neelesh A.; Energy efficiency and allometry of movement of swimming and flying animals, PROC. NAT. ACAD. SCI. Volume: 111 Pages: 7517-7521 2014.

60. Neveln, Izaak D.; Bale, Rahul; Bhalla, Amneet Pal Singh; Curet Oscar M.; Patankar, Neelesh A.; MacIver Malcolm A.; Undulating find produce off-axis thrust and flow structures, JOURNAL OF EXPERIMENTAL BIOLOGY Volume: 217 Pages: 201-213 2014.

59. Bhalla, Amneet Pal Singh; Bale, Rahul; Griffith, Boyce E.; Patankar, Neelesh A.; Fully resolved immersed electrohydrodynamics for particle motion, electrolocation, and self-propulsion, JOURNAL OF COMPUTATIONAL PHYSICS Volume: 256 Pages: 88-108 2014.

58. Bhalla, Amneet Pal Singh; Bale, Rahul; Griffith, Boyce E.; Patankar, Neelesh A.; A unified mathematical framework and an adaptive numerical method for fluid-structure interaction with rigid, deforming, and elastic bodies, JOURNAL OF COMPUTATIONAL PHYSICS Volume: 250 Pages: 446-476 OCT 1 2013.

57. Bhalla, Amneet Pal Singh; Griffith, Boyce E.; Patankar, Neelesh A.; A Forced Damped Oscillation Framework for Undulatory Swimming Provides New Insights into How Propulsion Arises in Active and Passive Swimming, PLOS COMPUTATIONAL BIOLOGY Volume: 9 Issue: 6 Article: e1003097 JUN 2013.

56. Green, Matthew H; Curet, Oscar M; Patankar, Neelesh A; et al., Fluid dynamics of the larval zebrafish pectoral fin and the role of fin bending in fluid transport., BIOINSPIRATION & BIOMIMETICS Volume: 8 Issue: 1 Pages: 016002 2013-Mar (Epub 2012 Dec 05).

55. Kopacz, Adrian M.; Patankar, Neelesh A.; Liu, Wing K., The immersed molecular finite element method, COMPUTER METHODS IN APPLIED MECHANICS AND ENGINEERING Volume: 233 Pages: 28-39 AUG 2012.

54. Vakarelski, Ivan U.; Patankar, Neelesh A.; Marston, Jeremy O.; et al., Stabilization of Leidenfrost vapour layer by textured superhydrophobic surfaces, NATURE Volume: 489 Issue: 7415 Pages: 274-277 SEP 13 2012.

53. Curet Oscar M.; Patankar Neelesh A.; Lauder George V.; MacIver Malcolm A., Aquatic manoeuvering with counter-propagating waves: a novel locomotive strategy, JOURNAL OF THE ROYAL SOCIETY INTERFACE Volume: 8 Issue: 60 Pages: 1041-1050 JUL 6 2011.

52. Curet Oscar M.; Patankar Neelesh A.; Lauder George V.; MacIver Malcolm A., Mechanical properties of a bio-inspired robotic knifefish with an undulatory propulsor, BIOINSPIRATION & BIOMIMETICS Volume: 6 Issue: 2 Article Number: 026004 JUN 2011.

51. Kwon Hyuk-Min; Paxson Adam T.; Varanasi Kripa K.; Patankar Neelesh A., Rapid Deceleration-Driven Wetting Transition during Pendant Drop Deposition on Superhydrophobic Surfaces, PHYSICAL REVIEW LETTERS Volume: 106 Issue: 3 Article Number: 036102 JAN 20 2011.

50. Patankar Neelesh A., Electrokinetic instability: The sharp interface limit, PHYSICS OF FLUIDS Volume: 23 Issue: 1 Article Number: 014101 JAN 2011.

49. Kwon Y.; Choi S.; Anantharaju N.; Lee J.; Panchagnula Mahesh V.; Patankar Neelesh A., Is the Cassie-Baxter Formula Relevant?, LANGMUIR Volume: 26 Issue: 22 Pages: 17528-17531 NOV 16 2010.

48. Curet OM, AlAli IK, MacIver MA, Patankar NA, A versatile implicit iterative approach for fully resolved simulation of self-propulsion, COMPUTER METHODS IN APPLIED MECHANICS AND ENGINEERING 199: 2417-2424 MAR 26 2010.

47. Patankar, NA, Vapor Stabilizing Substrates for Superhydrophobicity and Superslip, LANGMUIR 26(11): 8783-8786 JUN 1 2010.

46. Patankar, NA, Consolidation of Hydrophobic Transition Criteria by Using an Approximate Energy Minimization Approach, LANGMUIR 26(11): 8941-8945 JUN 1 2010.

45. MacIver MA, Patankar NA, Shirgaonkar AA, Energy-Information Trade-Offs between Movement and Sensing, PLOS COMPUTATIONAL BIOLOGY 6(5): Article Number: e1000769 MAY 2010.

44. Patankar, NA, Hysteresis with regard to Cassie and Wenzel states on superhydrophobic surfaces, LANGMUIR 26(10): 7498-7503 MAY 18 2010.

43. Patankar NA, Supernucleating surfaces for nucleate boiling and dropwise condensation heat transfer, SOFT MATTER, 6(8): 1613-1620 2010 (invited article).

42. Hsu HY, Patankar NA, A continuum approach to reproduce molecular-scale slip behaviour, JOURNAL OF FLUID MECHANICS, 645: 59-80 FEB 25 2010.

41. Hsu, H-Y, Sharma, N, Patankar NA, An algorithm for the simulation of electrohydrodynamic rigid particulate flows, COMMUNICATIONS IN NUMERICAL METHODS IN ENGINEERING, Published online in Wiley InterScience (www.interscience.wiley.com) DOI: 10.1002/cnm.1247, 2009.

40. Kwon Y, Patankar NA, Choi J, Lee J, Design of surface hierarchy for extreme hydrophobicity, LANGMUIR, 25 (11): 6129-6136 JUN 2 2009 (cover page article).

39. Apte, SV, Martin, M, Patankar NA, A numerical method for fully resolved simulation (FRS) of rigid particle-flow interactions in complex flows, JOURNAL OF COMPUTATIONAL PHYSICS, 228 (8): 2712-2738 MAY 1 2009.

38. Shirgaonkar, AA, MacIver MA, Patankar NA, A new mathematical formulation and fast algorithm for fully resolved simulation of self-propulsion, JOURNAL OF COMPUTATIONAL PHYSICS, 228 (7): 2366-2390 APR 20 2009.

37. Patankar NA, Hydrophobicity of Surfaces with Cavities: Making Hydrophobic Substrates from Hydrophilic Materials?, JOURNAL OF ADHESION SCIENCE AND TECHNOLOGY, 23 (3): 413-433 2009 (invited article).

36. Patankar NA, Are the hydrodynamic forces and torques zero during the electrophoresis of multiparticle systems with thin Debye layers?, MECHANICS RESEARCH COMMUNICATIONS, 36 (1): 39-45 JAN 2009 (invited article).

35. Apte, SV, Patankar, NA, A formulation for fully resolved simulation (FRS) of particle-turbulence interactions in two-phase flows, INT. J. NUM. ANALYSIS AND MODELING 5: 1-16 2008 (invited article).

34. Shirgaonkar, AA, Curet OM, Patankar NA, MacIver MA, Hydrodynamics of ribbon-fin propulsion during impulsive motion, JOURNAL OF EXPERIMENTAL BIOLOGY, 211: 3490-3503, NOV 1 2008.

33. Loh, OY, Ho, AM, Rim, JE, Kohli, P, Patankar, NA, Espinosa, HD, Electric-field Induced Direct Delivery of Proteins by a Nanofountain Probe, PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES 105 (43): 16438-16443 OCT 28 2008.
32. Martini A, Hsu HY, Patankar NA, Lichter S, Slip at high shear rates, PHYSICAL REVIEW LETTERS 100 (20): 206001 MAY 23 2008.
31. Liu Y, Liu WK, Belytschko T, Patankar NA, To AC, Kopacz A, Chung JH, Immersed electrokinetic finite element method, INTERNATIONAL JOURNAL FOR NUMERICAL METHODS IN ENGINEERING 71 (4): 379-405 JUL 23 2007
30. Datta S, Ghosal S, Patankar NA, Electroosmotic flow in a rectangular channel with variable wall zeta-potential: comparison of numerical simulation with asymptotic theory, ELECTROPHORESIS 27 (3): 611-619 Sp. Iss. SI FEB 2006 (invited article).
29. Liu WK, Liu Y, Farrell D, Zhang L, Wang XS, Fukui Y, Patankar NA, Zhang Y, Bajaj C, Lee J, Hong J, Chen X, Hsu HY, Immersed Finite Element Method and Its Applications to Biological Systems, COMPUTER METHODS IN APPLIED MECHANICS AND ENGINEERING 195 (13-16): 1722-1749 2006.
28. Ko T, Patankar NA, Joseph DD, Lift and multiple equilibrium positions of a single particle in Newtonian and Oldroyd-B fluids, COMPUTERS AND FLUIDS 35: 121-146 FEB 2006.
27. Sharma N, Chen Y, Patankar NA, A distributed Lagrange multiplier based computational method for the simulation of particulate-Stokes flow, COMPUTER METHODS IN APPLIED MECHANICS AND ENGINEERING 194: 4716-4730 NOV 2005.
26. Patankar NA, Sharma N, A fast projection scheme for the direct numerical simulation of rigid particulate flows, COMMUNICATIONS IN NUMERICAL METHODS IN ENGINEERING 21 (8): 419-432 AUG 2005.
25. Sharma N, Patankar NA, A fast computation technique for the direct numerical simulation of rigid particulate flows, JOURNAL OF COMPUTATIONAL PHYSICS 205 (2): 439-457 MAY 20 2005.
24. Patankar NA, Physical interpretation and mathematical properties of the stress-DLM formulation for rigid particulate flows, INTERNATIONAL JOURNAL FOR COMPUTATIONAL METHODS IN ENGINEERING SCIENCE AND MECHANICS 6 (2):137-143 APR 2005.
23. Lee J, He B, Patankar NA, A roughness-based wettability switching membrane device for hydrophobic surfaces, JOURNAL OF MICROMECHANICS AND MICROENGINEERING 15 (3): 591-600 MAR 2005.
22. Hsu HY, Sharma N, Ruoff RS, Patankar NA, Electro-orientation in particle light valves , NANOTECHNOLOGY 16 (2): 312-319 FEB 2005.
21. Chen Y, He B, Lee JH, Patankar NA, Anisotropy in the wetting of rough surfaces, JOURNAL OF COLLOID AND INTERFACE SCIENCE 281 (2): 458-464 JAN 15 2005.
20. Sharma N, Patankar NA, Direct numerical simulation of the Brownian motion of particles by using fluctuating hydrodynamic equations, JOURNAL OF COMPUTATIONAL PHYSICS 201 (2): 466-486 DEC 10 2004.
19. He B, Lee J, Patankar NA, Contact angle hysteresis on rough hydrophobic surfaces, COLLOIDS AND SURFACES A-PHYSICOCHEMICAL AND ENGINEERING ASPECTS 248 (1-3): 101-104 NOV 9 2004.
18. Patankar NA, Mimicking the lotus effect: Influence of double roughness structures and slender pillars, LANGMUIR 20 (19): 8209-8213 SEP 14 2004.
17. Patankar NA, Transition between superhydrophobic states on rough surfaces, LANGMUIR 20 (17): 7097-7102 AUG 17 2004.
16. He B, Patankar NA, Lee J, Multiple equilibrium droplet shapes and design criterion for rough hydrophobic surfaces, LANGMUIR 19 (12): 4999-5003 JUN 10 2003.

15. Wang J, Joseph DD, Patankar NA, Conway M, Barree RD, Bi-power law correlations for sediment transport in pressure driven channel flows, INTERNATIONAL JOURNAL OF MULTIPHASE FLOW 29 (3): 475-494 MAR 2003.

14. Patankar NA, On the modeling of hydrophobic contact angles on rough surfaces, LANGMUIR 19 (4): 1249-1253 FEB 18 2003.

13. Patankar NA, Joseph DD, Wang J, Barree RD, Conway M, Asadi M, Power law correlations for sediment transport in pressure driven channel flows, INTERNATIONAL JOURNAL OF MULTIPHASE FLOW 28 (8): 1269-1292 AUG 2002.

12. Patankar NA, Huang PY, Joseph DD, Normal stresses on the surface of a rigid body in an Oldroyd-B fluid, JOURNAL OF FLUIDS ENGINEERING-TRANSACTIONS OF THE ASME 124 (1): 279-280 MAR 2002.

11. Patankar NA, Hu HH, Finite Reynolds number effect on the rheology of a dilute suspension of neutrally buoyant circular particles in a Newtonian fluid, INTERNATIONAL JOURNAL OF MULTIPHASE FLOW 28 (3): 409-425 MAR 2002.

10. Patankar NA, Ko T, Choi HG, Joseph DD, A correlation for the lift-off of many particles in plane Poiseuille flows of Newtonian fluids, JOURNAL OF FLUID MECHANICS 445: 55-76 OCT 25 2001.

9. Patankar NA, Joseph DD, Lagrangian numerical simulation of particulate flows, INTERNATIONAL JOURNAL OF MULTIPHASE FLOW 27 (10): 1685-1706 OCT 2001.

8. Patankar NA, Joseph DD, Modeling and numerical simulation of particulate flows by the Eulerian-Lagrangian approach, INTERNATIONAL JOURNAL OF MULTIPHASE FLOW 27 (10): 1659-1684 OCT 2001.

7. Patankar NA, Huang PY, Ko T, Joseph DD, Lift-off of a single particle in Newtonian and viscoelastic fluids by direct numerical simulation, JOURNAL OF FLUID MECHANICS 438: 67-100 JUL 10 2001.

6. Hu HH, Patankar NA, Zhu MY, Direct numerical simulations of fluid-solid systems using the arbitrary Lagrangian-Eulerian technique, JOURNAL OF COMPUTATIONAL PHYSICS 169 (2): 427-462 MAY 20 2001.

5. Patankar NA, Hu HH, Rheology of a suspension of particles in viscoelastic fluids, JOURNAL OF NON-NEWTONIAN FLUID MECHANICS 96 (3): 427-443 JAN 30 2001.

4. Patankar NA, Hu HH, A numerical investigation of the detachment of the trailing particle from a chain sedimenting in Newtonian and viscoelastic fluids, JOURNAL OF FLUIDS ENGINEERING-TRANSACTIONS OF THE ASME 122 (3): 517-521 SEP 2000.

3. Patankar NA, Singh P, Joseph DD, Glowinski R, Pan TW, A new formulation of the distributed Lagrange multiplier/fictitious domain method for particulate flows, INTERNATIONAL JOURNAL OF MULTIPHASE FLOW 26 (9): 1509-1524 SEP 2000.

2. Patankar NA, Hu HH, Numerical simulation of electroosmotic flow, ANALYTICAL CHEMISTRY 70 (9): 1870-1881 MAY 1 1998.

1. Hu HH, Patankar NA, Non-axisymmetrical instability of core-annular flow, JOURNAL OF FLUID MECHANICS 290: 213-224 MAY 10 1995.

TALKS

Invited Talks

64. University of Illinois at Chicago, Department of Mechanical and Industrial Engineering, OCT 2018 Surface engineering the "food-energy-water" nexus.

63. 19th International Conference on Finite Elements in Flow Problems - FEF 2017, Rome, Italy, Semi-plenary talk, APR. 2017 A unifying constraint-based formulation for freely moving immersed bodies in fluids.

62. Northwestern University, Institute for Sustainability and Energy at Northwestern, OCT. 2016 Surface Engineering.
61. Northwestern University, Department of Physics and Astronomy, OCT. 2016 Computational biophysics of organisms and organs.
60. Northwestern University, Northwestern-Tel-Aviv University Workshop on Water Resources, SEP. 2016 Surface Engineering.
59. University of Illinois, Urbana-Champaign, Department of Mechanical Science and Engineering, OCT. 2015 A constraint-based formulation for freely moving immersed bodies in fluids and applications.
58. University of Minnesota, Department of Aerospace Engineering, APR. 2015 Staying dry under water.
57. University of California, Berkeley and Lawrence Berkeley Laboratory, NOV. 2014 A constraint-based formulation for freely moving immersed bodies in fluids.
56. International Conference on Nanochannels, Microchannels, and Minichannels (ICNMM), Chicago, Plenary talk, AUG. 2014 Staying dry under water.
55. Argonne National Laboratory, APR. 2014 A constraint-based formulation for freely moving immersed bodies in fluids.
54. University of California, Berkeley, Mechanical Engineering and Earth and Planetary Sciences, NOV. 2012 Staying dry under water.
53. Stanford University, Mechanical Engineering, NOV. 2012 Staying dry under water.
52. 65th Annual Meeting of the Division of Fluid Dynamics, NOV. 2012 A universal constraint-based formulation for freely moving immersed bodies in fluids.
51. Duke University, Mechanical Engineering and Materials Science, OCT. 2012 Staying dry under water.
50. Purdue University, Mechanical Engineering, OCT. 2012 Staying dry under water.
49. University of Michigan, Ann Arbor, Materials Science and Engineering, SEP. 2012 Staying dry under water.
48. Courant Institute of Mathematical Sciences, APR. 2012 A universal constraint-based formulation for freely moving immersed bodies in fluids.
47. 64th Annual Meeting of the Division of Fluid Dynamics, NOV. 2011 Roughness-based Superhydrophobic Surfaces: Fundamentals and Future Directions.
46. 48th Annual Technical Conference of Society of Engineering Sciences, OCT. 2011 The Role Of Hydrodynamics On The Evolution Of Fish Form And Its Applications In Engineering.
45. ASME Applied Mechanics and Material Conference, MAY 2011, Phase manipulation and vapor stabilization using textured surfaces.
44. Massachusetts Institute of Technology, Department of Mechanical Engineeing, NOV. 2010, The hydrodynamics of aquatic locomotion and its potential impact on the evolution of fish form and function.
43. Massachusetts Institute of Technology, Department of Mechanical Engineeing, NOV. 2010, Fundamentals of roughness–induced superhydrophobicity.
42. Northwestern University, Department of Mechanical Engineeing, NOV. 2010, Fundamentals of roughness–induced superhydrophobicity.
41. Argonne National Laboratory, JUL. 2010, Vapor stabilizing surfaces for energy efficient systems.
40. International Conference on Multiphase Flow, Keynote Junior Award Lecture, JUN. 2010, The Influence of Hydrodynamics on the Evolution of Fish Form and the Neuromechanics of Aquatic Locomotion.
39. Northwestern University, Engineeing Science and Applied Mathematics, FEB. 2010, The hydrodynamics of aquatic locomotion and its potential impact on the evolution of fish form and function.

38. University of Minnesota, Symposium celebrating the 80th birthday of Professor D. D. Joseph, MAY 2009, Fully resolved simulation of self-propulsion.

37. Northwestern University, Department of Mechanical Engineering, APR 2009, The Influence of Hydrodynamics on the Evolution of Fish Form and the Neuromechanics of Aquatic Locomotion.

36. University of Pennsylvania, Department of Mechanical Engineering, FEB 2009, Fully resolved simulation of particulate flows: From macro- to micro-scales.

35. Northwestern University, Northwestern Institute on Complex Systems, JAN 2009, The Influence of Hydrodynamics on the Evolution of Fish Form and the Neuromechanics of Aquatic Locomotion.

34. IMECE 2007, Seattle, WA, NOV 2007, Fully resolved simulation of freely swimming fish.

33. University of California, San Diego, Department of Chemistry and Biochemistry, NOV 2007, A fluctuating hydrodynamics based approach for Brownian dynamics.

32. Harvard University, School of Engineering and Applied Science, OCT 2007, Fully resolved simulation of particulate flows: From macro- to micro-scales.

31. Stanford University, SIMBIOS Center, OCT 2007, A fluctuating hydrodynamics based approach for Brownian dynamics.

30. International Conference on Multiphase Flow, JUL 2007, Fully resolved simulation of particulate flows: From macro- to micro-scales, Keynote.

29. American Geological Union, Winter meeting, San Francisco, CA, DEC 2006, Fully Resolved Simulation (FRS) of sediment transport with applications in geomorphology.

28. Illinois Institute of Technology, Department of Mechanical, Materials and Aerospace Engineering, Chicago, IL, OCT 2006, Fully resolved simulation of particulate flows: From macro to sub-micron scale.

27. University of South Florida, Department of Geoscience, Tampa, FL, AUGUST 2006, Fully Resolved Simulation (FRS) of sediment transport with applications in geomorphology.

26. SC Johnson, Racine, WI, JULY 2006, Understanding the Lotus effect and beyond.

25. Brown University, Applied Mathematics, Providence, Rhode Island, MARCH 2006, Fluctuating Immersed MATerial (FIMAT) Dynamics for the DNS of Brownian Motion.

24. Indian Institute of Technology, Bombay, India, DEC 2005, Modeling and simulation of micro/nanoscale fluid dynamics.

23. Indian Institute of Science, Bangalore, India, DEC 2005, Modeling and simulation of micro/nanoscale fluid dynamics.

22. General Electric Research Center, Albany, NY, MAY 2005, Mimicking the Lotus effect.

21. IUTAM Symposium on Computational Approaches to Disperse Multiphase Flow, Argonne National Labs, OCT 2004, DNS of the Brownian motion of particles using fluctuating hydrodynamic equations.

20. University of Illinois at Urbana-Champaign, Theoretical and Applied Mechanics Department, Urbana, IL, APR 2004, CFD based on fluctuating hydrodynamics and the Lotus effect.

19. University of Iowa, Department of Mechanical Engineering, Iowa City, Iowa, APR 2004, Problems in micron/sub-micron scale fluid dynamics.

18. IMECE03, ASME Winter meeting, Washington DC, NOV 2003, The Lotus effect.

17. 7th USNCCM, Albuquerque, NM, JUL 2003, DNS of the Brownian motion of particles using fluctuating hydrodynamic equations.

16. 7th USNCCM, Albuquerque, NM , JUL 2003, The Lotus effect.

15. Michigan Technological University, Department of Mechanical Engineering, Houghton, Michigan, DEC 2002, Modeling and simulation of micron/sub-micron scale fluid dynamics.

14. IMECE02*,* ASME winter meeting, New Orleans, LA, NOV 2002, Modeling and simulation of micron/sub-micron scale fluid dynamics.

13. 14th US National Congress of Applied Mechanics, Super Symposium on All Kinds of Fluid Mechanics in Honor of Prof. D. D. Joseph & Prof. Andreas Acrivos, Blacksburg, VA, JUN 2002, A projection scheme for DNS of rigid particulate flows.

12. 14th US National Congress of Applied Mechanics, Symposium on Nanotechnology and MEMS: Experiments and Modeling, Blacksburg, VA, JUN 2002, Computational techniques for sub-micron/nanoscale fluid dynamics.

11. Stanford University*,* Center for Turbulence Research, Stanford, CA, AUG 2001, Numerical simulation of rigid particulate flows.

10. 6th USNCCM, Dearborn, MI, AUG 2001, A numerical investigation of electrophoresis and electroosmosis.

9. XIIth International Workshop on Numerical Method for Viscoelastic Fluids, Monterey Bay, CA, JUL 2001, Direct numerical simulation of rigid particulate flows in viscoelastic fluids.

8. Hydraulic Fracturing Workshop, Washington D.C., Keynote Lecture, JUL 2001, Engineering correlations and computational techniques for proppant transport in hydraulic fractures.

7. University of Illinois at Urbana-Champaign, Theoretical and Applied Mechanics Department, Urbana, IL, MAR 2001, Numerical simulation of particulate flows.

6. Northwestern University, Department of Engineering Science & Applied Mathematics, Evanston, IL, FEB 2001, Numerical simulation of particulate flows.

5. STIM-LAB Inc., Rheology consortium meeting, Mesa, Arizona, FEB 2001, Towards a model and a simulation tool for fluid-proppant transport.

4. University of Massachusetts, Department of Mechanical Engineering, Amherst, MA, MAY 2000, Numerical simulation of particulate flows.

3. Microcosm Technologies, Boston, MA, APR 2000, Numerical simulation of electrokinetic flows.

2. CFD Research Corporation, Huntsville, Alabama, APR 2000, Numerical simulation of electrokinetic flows.

1. New Mexico State University, Department of Mechanical Engineering, Las Cruces, NM, FEB 2000, Numerical simulation of particulate flows.

Contributed Talks More than 80 contributed talks.

PATENTS

5. John E. Pandolfino; Walter Kou; Neelesh A. Patankar; Dustin Carlson; Four-dimensional esophageal impedence manometry U.S. provisional patent filed November, 2018.

4. Neelesh A. Patankar; Kyoo Chul Park; Youhua Jiang; Brine management system for achieving zero liquid discharge U.S. provisional patent serial number 62/746,652 filed October 17, 2018.

3. Neelesh A. Patankar; Kyoo Chul Park; Katherine A. Cai; Enhanced vaporization of liquid on a surface U.S. provisional patent serial number 62/626,855 filed February 6, 2018.

2. Neelesh A. Patankar; Kyoo Chul Park; Natalie Alvarez; Superomniphilic surfaces with a high surface area for enhanced condensation and mist-fog elimination U.S. provisional patent serial number 62/621,849 filed January 25, 2018.

1. Neelesh A. Patankar; Nishant Nangia; Systems and methods for computational simulation of self-propelling vehicles for aerodynamic design USPTO International application number PCT/US17/67649 filed December 20, 2017.

STUDENT SUPERVISION

Graduate Students and Post-doc

Ph.D. students

- Nitin Sharma, *Direct numerical simulation of particulate flows for three different length scales: Macro, Micro and Meso*, Ph.D., JUN 2005.
- Yong Chen, *Fluctuating immersed material (FIMAT) dynamics for the Brownian motion of particles*, Ph.D., NOV 2005.
- Hua-Yi Hsu, *Three problems in microfluidics: Electrokinetic instability, electrohydrodynamic self-assembly, and slip*, Ph.D., AUG 2008.
- Bo He (joint with J. Lee and J. Wang), *Micro/nanoscale friction and application of surface wettability in MEMS,* Ph.D., JUL 2008.
- Oscar M. Curet (joint with M. A. MacIver), *Direct numerical simulation of fish swimming*. Ph.D. AUG 2009.
- Christine Darve, *Direct numerical simulation of particle motion in superfluid Helium*, Ph.D. AUG 2011.
- Amneet Pal Singh Bhalla, *Constraint-based adaptive immersed body technique for multiphysics problems*, Ph.D. JUN 2013.
- Rahul Bale, Ph.D. *Hydrodynamics and energetics of undulatory propulsion* AUG 2013.
- Xiuqing Hao, Ph.D. exchange student, FEB 2012 – MAY 2013.
- Ling Bai, Ph.D. exchange student, SEP 2012 – JAN 2014.
- Paul Jones, Ph.D. *Sustaining metastable water within nanostructured surfaces* JUN 2016.
- Wenjun (Walter) Kou, Ph.D. *Studies of esophageal transport and emptying based on fully-resolved computational models* AUG 2016.
- Namu Patel, Ph.D. *Computational investigation of the neuromechanical problem for swimming* AUG 2017.
- Brennan Sprinkle, Ph.D. *Development and use of high performance numerical methods to study fluid structure interaction phenomena at two different scales* AUG 2018.
- Nishant Nangia, Ph.D. expected MAR 2019.
- Shashank Acharya, Ph.D. expected JUN 2020.
- Tom Zhao, Ph.D. expected JUN 2020.
- Sourav Halder, Ph.D. expected JUN 2022.
- Thomas Jenssen, Ph.D. expected JUN 2022.

M.S. students

- Oscar M. Curet, *Estimation of force in gymnotiform swimming using three-dimensional fluid computational model*, M.S., MAR 2006.
- Max Hao, *Analysis of the swimming ability of zebrafish using numerical simulation,* M. S., JUN 2010.
- David Ma, M.S., *Drying up under water: Conical pores,* JUN. 2012.
- Adrian Kirn, M.S., *Drying up under water: An application of superhydrophobicity,* DEC. 2013.
- Zachary Rachlin, M.S., *Mileage efficiency of automotive vehicles,* JUN. 2014.
- Angela Yang, M.S., *Aerodynamic design of solar car*s, JUN. 2016.
- Jiahui Liu, M.S., *Aerodynamic Design and Optimization of Solar Powered Race Car*, DEC. 2016.
- Nichakarn Laprungsirat, M.S., *A numerical investigation of imposing saturation temperature at the liquid-vapor interface during pool boiling*, DEC. 2016.

- Bridget Popovic, M.S., *A numerical investigation of pool boiling*, JUN. 2017.
- Spencer Gellman, M.S., *Aquatic locomotion*, JUN. 2017.
- Yanqi Liu, M.S., *Aquatic locomotion*, JUN. 2017.

Post-doc

- Silviu Podariu, *Fluctuating hydrodynamics*, 2002 – 2003.
- Yong Chen, *Simulation of fish swimming*, 2005 – 2006.
- Anup Shirgaonkar, *Simulation of fish swimming*, 2007 – 2008.
- Srinivas Ramakrishnan, *Simulation of fish swimming*, 2009 – 2010.
- Walter Kou, *Esophageal transport*, 2016 – present.

Undergraduate

- Ryan Sochol, *Directional control of cellular motility*, Independent study units, Spring/Summer/Fall 2005.
- Fabian Wittmer (exchange student from ETH, Zurich), *An introduction to numerical heat transfer and fluid flow with applications*, undergraduate thesis, AUG 2005.
- Skander Spies, *Simulation of baseball motion using FLUENT*, Independent study unit, Fall 2006.
- Ibrahim AlAli, *Normal mode analysis of proteins*, and *Artificial evolution simulation for aquatic locomotion*, Independent study units, Summer 2007 – Spring 2008.
- Scott Aikin, *Simulation of baseball motion using FLUENT*, Fall 2007.
- Noah Mosberg, Summer 2011 – present.
- David Ma, *Superhydrophobic surfaces*, 2012.
- Mark Fischer, *Wildcat Balloon*, 2012-2013.
- Yohanna Hanna, *Swimming,* 2012-2013.
- Nelson Chen, *Swimming*, 2012-2014.
- Kashyap Saxena, *Soccer dynamics,* 2014-2015.
- Juan Takase, *Superhydrophobicity,* 2014-present.
- Austin Han, *Odor source localization*, 2015-2016.
- Yousef Maynie, *Fluid mechanics of ocean waves,* 2015.
- Elaine Lokken, *FlugTag*, 2016.
- Vyas Alwar, *Aquatic locomotion*, 2016.
- Elizabeth McTighe, *Aquatic locomotion*, 2016.
- Avery Dempsey, *Metasurfaces for phase change*, 2016.
- Shaan Savarirayan, *Metasurface for CO_2 capture*, 2016.

High school

- Martina Pillay, *Sound rendering from fluid-structure interaction simulations*, Fall 2007-Spring 2008.
- Dennis Rich, *Energy landscape of phase change metasurfaces*, 2014-2015.
- James Wei, *Molecular dynamics of heat transfer*, 2016-present.

Other project supervision

- IDEA 298/398 projects: 2009-2010, 2008-2009.
- MMM capstone project: 2008-2009.
- ME 398 projects: 2014-current.

Exam Committees More than 50 exam committees.

TEACHING

Courses Taught:

- Heat Transfer (ME 377-0).
- Engineering Fluid Mechanics (ME 373-0).
- Engineering Analysis III (GE 205-3).
- Fundamentals of Fluid Dynamics I (ME 425).
- Introduction to Computational Fluid Dynamics (ME 424-1/ME 423).
- Advanced topics in Computational Fluid Dynamics (ME 424-2/ME 424).
- Design and Analysis of Microfluidic Systems (ME 421).

Courses Developed: Introduction to Computational Fluid Dynamics (ME 424-1, now ME 423), Advanced topics in Computational Fluid Dynamics (ME 424-2, now ME 424), Design and Analysis of Microfluidic Systems (ME 421).

UNIVERSITY SERVICE

Present

- Associate Chair, Department of Mechanical Engineering.
- ME ABET co-coordinator.
- Segal Design Institute faculty member.

Past

- ME faculty search committee – 2016.
- ME-BME faculty search committee – 2012/2013.
- Ad-hoc committee for promotion, McCormick School of Engineering.
- TAM program steering committee.
- Ad-hoc committee, Segal Design Center.
- University Library Committee.
- Coordinator for EA3 and member of the Engineering First study group.
- Chair, ME undergraduate curriculum committee.
- Northwestern University Mechanical Engineering representative at the Big 10 ABET committee.
- Chair, honors program in Mechanical Engineering.
- Member, graduate curriculum committee in Mechanical Engineering.
- Editor, Mechanical Engineering Newsletter.
- Host, Midwest Mechanics Seminar Series.

PROFESSIONAL ACTIVITIES

Editorships:

- Associate Editor of Scientific Reports (2015 – present)
- Editorial Advisory Board, International Journal of Multiphase Flow (2010 – 2017).
- Associate Editor of Journal of Computational Physics (2010 – 2016).
- Associate Editor of ASME Journal of Fluids Engineering (2008 – 2011).

Memberships: American Physical Society (APS), American Society of Mechanical Engineers (ASME).

Reviewer

- Funding agencies: National Science Foundation, Petroleum Research Fund.
- Journal referee: Many journals including – Analytical Chemistry, Electrophoresis, Europhysics Letters, IEEE/ASME Journal of MEMS, Journal of Non-Newtonian Fluid Mechanics, International Journal for Numerical Methods in Engineering, International Journal of Multiphase Flow, International Journal of Heat and Mass Transfer, Journal of Computational Physics, Journal of Fluid Mechanics, Journal of Micromechanics and Microengineering, Langmuir, Nanotechnology, Physics of Fluids.

Committees, advisory boards, study groups

- Fluid Dynamics Prize Committee, American Physical Society, 2011-2013.
- Advisory Board: EUROMECH/ERCOFTAC colloquium on Immersed Boundary Methods (IBMs), June 2013.
- Future Directions for Selected Topics in Mechanical and Civil Engineering, Office of the Assistant Secretary of Defense for Research and Engineering, Basic Science Office, 2012.
- Publications and Media Committee of the APS DFD unit, 2010-2011.
- Defense Science Study Group, 2010–2011.
- Advisory Board: Royal Netherlands Academy of Arts and Sciences Colloquium on Immersed Boundary Methods, June 2009.
- Academic-Industrial Workshop on Complex and Evolving Multiphase Flows, November 2008.
- Member, Scientific Advisory Board of the Seventh World Congress on Computational Mechanics (WCCM-VII), Los Angeles, CA, July 2006.
- Organizing committee of the 58th Annual Meeting of the Division of Fluid Dynamics, American Physical Society, Chicago, IL, 2005.

Conferences

- Chair of fluids, thermal, and energy track at the 2011 Annual Meeting of the Society of Engineering Science (SES).
- Co-organizer of a mini symposium on “Fish-like sensing and locomotion” at the International Mechanical Engineering Congress and Exposition at Seattle, November, 2007.
- Organizer of a mini symposium on “Modeling and simulation of micro-/nanoscale fluid dynamics” at the International Mechanical Engineering Congress and Exposition at Washington DC, November 16 – 21, 2003.
- Organizer of two mini symposia – “Immersed boundary methods and fictitious domain methods” and “Computational micro- and nano- fluidics” – at the 7th U. S. National Congress on Computational Mechanics at Albuquerque, New Mexico, July 27 – 31, 2003.
- Organizer of two sessions on Nanofluidics at the International Mechanical Engineering Congress and Exposition at New Orleans, Louisiana, November 17 – 22, 2002.
- Organizer of a symposium on “Modeling and Computational Techniques for Microfluidic Applications” at the Sixth U. S. National Congress on Computational Mechanics at Dearborn, Michigan, August 1 – 4, 2001.