Luoding Zhu

Department of Mathematical Sciences

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EDUCATION

- PhD in Applied Mathematics (2001), Courant Institute of Mathematical Sciences, New York University, USA (Advisor: Prof. Charles S. Peskin)

- MS in Fluid Dynamics (1992), Beijing Institute of Applied Physics and Computational Mathematics (BIAPCM), China (Advisor: Prof. Jihai Wang)

- BS in Mechanics (1989), Department of Mechanics, Zhejiang University, China (Advisor: Prof. Benzhao Zhang)

ACADEMIC APPOINTMENT

- Professor (August 2022 - Present), Department of Mathematical Sciences, Indiana University - Purdue University Indianapolis

- Associate Professor (July 2010 - July 2022), Department of Mathematical Sciences, Indiana University - Purdue University Indianapolis

- Assistant Professor (August 2004 - June 2010), Department of Mathematical Sciences, Indiana University - Purdue University Indianapolis

- Postgraduate Researcher (September 2001 - July 2004), Division of Computational Science and Engineering, Department of Computer Science, University of California Santa Barbara (Mentor: Prof. Linda Petzold)

- Research Associate/Assistant Professor (September 1992 - June 1997), State Key Laboratory of Computational Physics, BIAPCM, China

RESEARCH INTERESTS

- Fluid Dynamics

- Numerical Methods for Fluid-Structure-Interaction with Applications

- Modeling and Simulation of Cells

- Modeling and Simulation of Blood Flows

- Scientific Computing

- Machine Learning with Application to Fluid Dynamics

RESEARCH FUNDING

Current Research Funding

- Luoding Zhu (PI), Jared Barber (Co-PI), "A 3D multiscale computational model for fluid flow over osteocyte in loaded bone", $200,000, NSF-DMS, August 2020 - July 2024.

- J Arciero (PI), J Barber (Co-PI), L Ruchinsky, A Kuznetsov, L Zhu (Senior Personnel), "REU Site: IUPUI REU Program in mathematics with applications to medicine, neuroscience, and fluid dynamics", my role: Senior Personnel, NSF, $259,184, September 2022 - August 2025.

- Jared Barber (PI), Jing Liu (Co-PI), Luoding Zhu (Co-PI), "Developing Poroelastic and Contractile Models for Generating Insights Into Cell Migration and Eventual Use in Novel Multicomponent Models", $44,226, Research Support Funds Grant (RSFG) IUPUI. January 2023 - December 2023.

Pending Research Funding

Jared Barber (PI), Jing Liu (PI), Luoding Zhu (Co-PI), "Collaborative Research: DMS/NIGMS 1: Simulating cell migration with a multi-scale 3D model fed by intracellular tension sensing measurements", $599,990, NSF-NIGMS, July 1 2024 to June 30 2027.

Luoding Zhu (PI), Jared Barber (Co-PI), Jiliang Li (Co-PI), "3D multiscale computational modeling of primary cilia with application" $719,521, submitted to NSF-DMS-MB, Dec 22 2023. August 1 2024 to July 31 2027.

Past Research Funding

- Luoding Zhu (PI), Jared Barber (Co-PI), "Osteocyte in flow: a 3D computational model and in-vitro experiments", $23,935, near-miss grant, School of Science, IUPUI. Oct 2019 - Oct 2023.

- Luoding Zhu (PI), Fengguang Song (Co-PI, Computer Science, IUPUI), "Collaborative research: a new three-dimensional parallel immersed boundary method with application to hemodialysis", $209,314, Division of Mathematical Sciences, National Science Foundation, Award No. DMS-NSF 1522554. September 15 2015 - August 31 2019.

- Luoding Zhu, Sungsoo Na, and Hiroki Yokota, "Modeling and simulation of fluid flows around osteocytes", May 1 2015 - Dec 31 2016. $10,000, Integrated Nanosystems Development Institute (INDI), IUPUI.

- Yongguang Cheng, Luoding Zhu, and Hui Zhang, "A 3D immersed boundary method for turbulent flow with application", 650,000 Yuan (approximately $100,000), Chinese National Science Foundation (NSFC), Division of Mathematical and Physical Sciences, January 1 2012- December 31, 2015.

- Luoding Zhu, Released Time for Research Grant (RTR), $10,000, Office of Vice Chancellor for Research, IUPUI, May 2013 – April 2014.

- Luoding Zhu, "A 3D implicit immersed boundary method with application", $193,484, National Science Foundation (NSF), DMS-0713718, July 1 2007 to June 30 2010.

PUBLICATIONS

Book Chapter

[1] HY Chen, **L Zhu**, Y Huo, Y Liu, and GS Kassab (2009). "Fluid-Structure Interaction (FSI): Modeling in the Cardiovascular System". *Modeling and Applications in Heart Failure. Guccione JM and Kassab GS (Eds.), Hardcover, 436 pages, Springer (Oct 8 2009). ISBN-10:1441907297. ISBN-13:978-1441907298.*

Editorial

[1] F Tian, Y Sui, **L Zhu**, L, C Shu, and HJ Sung (2016). "Computational Methods and Models in Circulatory and Reproductive Systems". *Computational and Mathematical Methods in Medicine*, Article ID 9028409, p.1-2.

Papers Submitted

Albert, M, Cruikshank, A, Das, K, Zhu, L, Barber, J. (2023). "Image digitization and calculation of forces for osteocyte viscoelastic networks". Submitted to the Columbia Journal of Undergraduate Mathematics, Nov 2023.

Zigon R. and Zhu, L, (2023). "Modeling 2D Unsteady Flows using a 3D Convolutional Neural Network and a Mixture of Experts" . Computer Physics Communications, revision submitted, Jan 2024.

Papers in Preparation

Jared Barber, Maxim Eugene, Vanessa Maybruck, and Luoding Zhu. "Modeling and simulation of osteocyte process fluid interaction in a canalilculus", draft to be submitted, March 2024.

Peer-Reviewed Journal Publications and Peer-Reviewed Proceedings (*Peer-reviewed conference papers are treated as good as peer-reviewed journal papers for my collaborators in Computer Science.*)

[46] Jared Barber, Isaac Manring, Sophie Boileau, and **Luoding Zhu** (2023), "Modeling and simulation of flow-osteocyte interaction in a lacuno-canalicular network", *Physics of Fluids*, 35(9), 2023.

[45] **L Zhu**, J Barber, R Zigon, S Na, and H Yokota (2022). "Modeling and simulation of interstitial fluid flow around an osteocyte in a lacuno-canalicular network". *Physics of Fluids*, **34**(4), p.041906.

[44]Xiaoyu Zhang, Joan Gomez-Paz, Xi Chen, J. M. McDonough, Md Mahfuzul Islam1, Yiannis Andreopoulos, **Luoding Zhu**, and Huidan Yu, (2022). "Volumetric lattice Boltzmann method for wall stresses of image-based pulsatile flows", *Scientific Reports* 12(1), 1697.

[43]**L Zhu** and K Sakai (2021). "Modeling and simulation of blood flow past arteriovenous-graft anastomosis with intimal hyperplasia", *Physics of Fluids* **33**, 051905 (2021).

[42] R Chen, S Zhou, L Zhu, **L Zhu**, W Yan, and H Yu (2021). "A new criterion of coalescence-induced microbubble detachment in three dimensional microfluidic channel", *Physics of Fluids***33**, 043320 (2021).

[41] Z Bai and **L Zhu** (2019). "Simulation of blood flow past a distal arteriovenous-graft anastomosis at low Reynolds numbers", *Physics of Fluids* **31**(9),091902. (See media report on ScienceDaily.com – https://www.sciencedaily.com /releases/2019/09/190927115630.htm)

[40] **L Zhu** (2019). "An IB method for non-Newtonian-fluid flexible-structure interaction in three-dimensions ", *Computer Modeling in Engineering and Sciences* **119**, no. 1, pp. 125-143.

[39] Z Bai and **L Zhu** (2019). "3D Simulation of a Viscous Flow past a Compliant Model of Arteriovenous-Graft Anastomosis ", *Computers & Fluids* **181**, pp. 403-415.

[38] J Barber and **L Zhu** (2019). "Two-dimensional finite element model of breast cancer cell motion through a microfluidic channel", *Bulletin of Mathematical Biology*, **81** (4), pp. 1238-1259.

[37] R Chen, H Yu, Y Xu, and **L Zhu** (2019). "Scalings of inverse energy transfer and energy decay in 3-D decaying isotropic turbulence with non-rotating or rotating frame of reference". *Journal of Applied and Computational Mechanics* **5**(4), 639-646.

[36] Y Fu, F Li, F Song, **L Zhu** (2018). "Designing a parallel memory-aware lattice Boltzmann algorithm on many-core systems", In 2018 30th International Symposium on Computer Architecture and High Performance Computing (SBAC-PAD), pp. 97-106. IEEE, 2018. (Acceptance rate 27%.)

[35] **L Zhu** (2018)."A three-dimensional immersed boundary method for non-Newtonian fluids". *Theoretical & Applied Mechanics Letters*, **8**(3), 193-196 (2018).

[34] R Zigon, **L Zhu**, and F Song (2018). "Interactive 3D simulation for fluid-structure interactions using dual coupled GPUs". *The Journal of Supercomputing* **74**(1), 37-64 (2018).

[33] **L Zhu**, X Yu, N Liu, Y Cheng, and X Lu (2017). "A deformable plate interacting with a non-Newtonian fluid in three dimensions". *Physics of Fluids* **29**, 083101 (2017); doi: 10.1063/1.4996040.

[32] Y Fu, F Song, and **L Zhu** (2016). "Modeling and Implementation of an Asynchronous Approach to Integrating HPC and Big Data Analysis". *The 16th International Conference on Computational Science*, San Diego, CA, June 2016.

[31] C Zhang, Y Cheng, **L Zhu**, and J Wu (2016). "Accuracy improvement of the immersed boundary-lattice Boltzmann coupling scheme by iterative force correction". *Computers & Fluids*, **124** (1), pp.246-260.

[30] C Tang, **L Zhu**, G Akingba, and X Lu (2015). "Viscous flow past a collapsible channel as a model for self-excited oscillation of blood vessels". *Journal of Biomechanics* **48** (10), pp.1922-1929.

[29] P Nagar, F Song, **L Zhu**, L Lin (2015). "LBM-IB: A Parallel Library to Solve 3D Fluid-Structure Interaction Problems on Manycore Systems". *The 44th International Conference on Parallel Processing (ICPP)*, Beijing, China, September 2015 (acceptance rate 32%).

[28] R Hua, **L Zhu**, and X Lu (2014). "Dynamics of fluid flow past a circular plate in three dimensions". *Journal of Fluid Mechanics* **759**, pp.56-72.

[27] R Hua, **L Zhu**, X Lu (2014). "Numerical investigation of the dynamics of a flexible filament in the wake of cylinder". *Advances in Applied Mathematics and Mechanics* **6**(4), pp.478-493.

[26] Y Cheng, **L Zhu**, and C Zhang (2014). "Stability and accuracy of the coupling scheme of the immersed boundary method and the lattice Boltzmann BGK model". *Communications in Computational Physics* **16**(1), pp.136-168.

[25] R Hua, **L Zhu**, and X Lu (2013). "Locomotion of a flapping flexible plate". *Physics of Fluids* **25**(12), Article No. 121901.

[24] H Yu, R Chen, H Wang, Z Yuan, Y Zhao, Y An, Y Xu, and **L Zhu** (2013). "GPU accelerated lattice Boltzmann simulation for rotational turbulence". *Computers & Mathematics with Applications* **67** (2), pp.445-451.

[23] F Tian, **L Zhu**, P Fok, and X Lu (2013). "Simulation of a pulsatile non-Newtonian flow past a stenosed 2D artery with atherosclerosis". *Computers in Biology and Medicine* **43**, pp.1098-1113.

[22] L Miller, A Santhanakrishnan, S Jones, C Hamlet, K Mertens, and **L Zhu** (2012). "Reconfiguration and reduction of vortex induced vibrations in broad leave". *Journal of Experimental Biology* **215**(15), pp.2716-2727.

[21] G Li, **L Zhu**, and X Lu (2012). "Numerical studies on locomotion performance of fishlike tail fins". *Journal of Hydrodynamics* **24** (4), pp.488-495.

[20] F Tian, H Luo, **L Zhu**, X Lu (2011). "Coupling modes of three filaments in side-by-side arrangement". *Physics of Fluids* **23** (11), 111903.

[19] J Hao and **L Zhu** (2011). "A 3D implicit immersed boundary method with application". *Theoretical and Applied Mechanics Letter* **1** (6), 062002.

[18] S Wang, **L Zhu**, X Zhang, and G He (2011). "Flow past two freely rotatable triangular cylinders in tandem arrangement". *Journal of Fluids Engineering* **133** (8), 081202.

[17] F Tian, H Luo, **L Zhu**, X Lu, and JC Liao (2011). "An efficient immersed boundary- lattice Boltzmann method for the hydrodynamic interaction of elastic filaments". *Journal of Computational Physics* **230** (19), pp.7266-7283.

[16] **L Zhu**, G He, S Wang, L Miller, X Zhang, Q You, and S Fang (2011). "An immersed boundary method by the lattice Boltzmann approach in three dimensions with application". *Computers & Mathematics with Applications* **61**, pp.3506-3518.

[15] F Tian, H Luo, **L Zhu**, and X Lu (2010). "Interaction between a flexible filament and a downstream rigid body". *Physical Review E*, **82** (2), Article Number: 026301.

[14] J Hao and **L Zhu** (2010). "A lattice Boltzmann based implicit immersed boundary method for fluid-structure-interaction". *Computers & Mathematics with Applications* **59** (1), pp.185-193.

[13] **L Zhu** (2009). "Interaction of two tandem deformable bodies in a flowing viscous fluid". *Journal of Fluid Mechanics* **635**, pp.455-475.

[12] Q You, S Fang, and **L Zhu** (2009). "Visualizing vortex shedding of an elastic plate interacting with a 3D viscous flow". *Proceedings of the IEEE 9th International Conference on Computer and Information Technology (CIT 2009)*, Xiamen, China, October 11 - 14, 2009.

[11] HY Chen, J Hermiller, A Sinha, M Sturek, **L Zhu**, and GS Kassab (2009). "Effects of Intravascular Stent

Sizing on Endothelial and Vessel Wall Stress: Potential Mechanisms of In-stent Restenosis". *Journal of Applied Physiology* **106**(5), pp.1686-91.

[10] **L Zhu** and R Chin (2008). "Simulation of elastic filaments interacting with a 2D viscous pulsatile flow". *Computational Methods in Applied Mechanics & Engineering* **197**(25-28), pp.2265-2274.

[9] **L Zhu** (2008). "Scaling laws for drag of a compliant body moving in an incompressible viscous fluid". *Journal of Fluid Mechanics* **607**, pp.387-400.

[8] **L Zhu** (2007). "Viscous flow past an elastic fibre tethered at its center point: vortex shedding". *Journal of Fluid Mechanics*, **587**, pp.217-234.

[7] **L Zhu** (2007). "Simulation of a non-homogeneous elastic filament falling in a flowing soap film". *Physics of Fluids* **19**(1), Art. No. 017113.

[6] **L Zhu** and CS Peskin (2007). "Drag of a flexible fibre in a 2D moving viscous fluid". *Computers & Fluids* **36**(2), pp.398-406.

[5] **L Zhu**, D Tretheway, L Petzold, and C Meinhart (2005). "Simulation of fluid slip at hydrophobic microchannel walls by the lattice Boltzmann method". *Journal of Computational Physics* **202**(1), pp.181-195.

[4] J Zhou, **L Zhu**, L Petzold, and T Yang (2004). "Parallel simulation of fluid slip in a microchannel". *18th International Parallel and Distributed Processing Symposium*, Santa Fe, New Mexico, April 26-30, 2004 (acceptance rate approximately 30%).

[3] **L Zhu** and CS Peskin (2003). "Interaction of two parallel flexible filaments in a flowing soap film". *Physics of Fluids*, **15**(7), pp.1954-1960.

[2] **L Zhu** and CS Peskin (2002). "Simulation of a flexible flapping filament in a flowing soap film by the immersed boundary method". *Journal of Computational Physics* **179**(2), pp.452-468.

[1] **L Zhu** and J Wang (1994). "The formation and propagation of a shock wave formed during the gravitational collapse of a gaseous polytrope". *Acta Astrophysica Sinica*, **14**(4), pp.358-366.

Conference Proceedings and Other Publications

[**10**] I Manring, **L Zhu**, J Barber (2022). "Simulation of flow-osteocyte-interaction in a lacuno-canilicular network." Proceedings of the 7th International Conference on Computational and Mathematical Biomedical Engineering (peer-reviewed) – CMBE2022 27-29 June 2022, Italy P. Nithiarasu and C.Vergara (Eds.)

[9] M Sanden, R Zigon, **L Zhu**, S Na, and H Yokota (2016). "Fluid flow over an osteocyte: modeling and simulation". *Proceedings of the 5th international conference on computational and mathematical biomedical engineering*, 10-12 April 2017, United States, P. Nithiarasu, A.M. Robertson (Eds.)

[8] Y Kim, **L Zhu**, X Wang and CS Peskin (2003). "On various techniques for computer simulation of boundaries with mass". *Proceedings of the Second MIT Conference on Computational Fluid and Solid Mechanics*, (Editor K.J. Bathe), pp.1746-1750.

[7] DC Tretheway, **L Zhu**, L Petzold, and CD Meinhart (2002). "Examination of the slip boundary condition by micro-PIV and lattice Boltzmann simulation". *2002 ASME International Mechanical Engineering Congress & Exposition*, New Orleans, Louisiana.

[6] DM McQueen, CS Peskin, and **L Zhu** (2001). "The immersed boundary method for incompressible fluid-structure interaction". *Proceedings: First MIT Conference on Computational Fluid and Solid Mechanics*, pp.26-29, Editor K.J. Bathe.

[5] J Wang, **L Zhu**, and Z Zhang (1996). "The nonlinear stage of Richtmyer-Meshkov instability". *Symposium of the Commemoration Meeting for the 40th Anniversary of the Chinese Mechanical Society*, Beijing, China.

[4] **L Zhu**, X Li, and J Wang (1996). "3-D simulations of Richtmyer-Meshkov instability". *Annual Report of the National Key Laboratory of Computational Physics*, BIAPCM, pp.182-186.

[3] **L Zhu** and J Wang (1995). "Simulations with k-epsilon model on turbulent mixings occurred on the late stage of interface instability". *Symposium of the 7th National Conference on Shock Tubes and Shock Waves*, pp.159-165, Luoyang, China.

[2] **L Zhu** and J Wang (1994). "Analysis on gravitational collapse and shock formation during the contraction of a gaseous polytrope". *Symposium of the 6th National Conference on Shock Tubes and Shock Waves*, pp.60-65, Sichuan, China.

[1] **L Zhu** and B Zhang (1989). "The simulative analysis of the motions of particles in viscous flows in curved pipes with annular cross-section". *Symposium of the first national academic conference on industrial hydrodynam-*

ics, pp.42, Hangzhou, China.

INVITED RESEARCH TALKS [1]

[**58**] Invited talk, "Computational modeling of stress/strain amplification of an osteocyte process interacting with a viscous flow in a 3D canaliculus." Minisymposium on Recent Studies on the Biomechanics and Fluid Dynamics of Living Systems: Cellular Biomechanics and Microfluidics. Society for Mathematical Biology Annual Meeting 2023, the Ohio State University, Columbus, Ohio, USA, July 17-21 2023.

[**57**] Invietd talk, "Computational studies of stress and strain amplification of an osteocyte process in a 3D viscous flow within a canaliculus." American Mathematical Society (AMS) Central Sectional Meeting, UC Cincinnati, OH, USA, April 15-16, 2023.

[**56**] Invited talk, "Computational studies of osteocyte fluid interaction", Workshop on Scientific Computing, Purdue University, West Lafayette, Indiana, Oct 8, 2022.

[**55**] Invited talk, "Flow over an osteocyte: modeling and simulation", Applied Math Seminar, Purdue University WL, Feburary 28, 2022.

[**54**] Invited talk, "Flow over an osteocyte: modeling and simulation", Minisymposium on modeling and simulation of hydrodynamics of cell biology, the 2021 SMB Annual Meeting, June 13-17, 2021 (virtual), the University of California-Riverside.

[**53**] Invited talk, "Modeling and simulation of blood flow past the vein-graft anastomosis with intimal hyperplasia", Minisymposium on "immersed boundary methods for fluid-structure interactions and their applications", WCCM XIV – ECCOMAS, Paris, France, January 11 to 15, 2021 (Virtual).

[**52**] Invited talk, "Modeling and simulation of blood flow past the vein-graft anastomosis with intimal hyperplasia", Special session on advances in the modeling and computation of fluid flows and Fluid-Structure Interactions, AMS Sectional Meeting, University of Tennessee at Chattanooga, Oct 10-11, 2020.

[**51**] Invited talk, "A 3D immersed boundary method for non-Newtonian fluid-structure-interaction", minisymposium on "Advanced numerical methods for PDEs and applications", the 5th international conference on Applied Mathematics, Modeling and Computational Science (AMMCS), Waterloo, Ontario, Canada, August 18-23, 2019.

[**50**] Invited talk, "A 3D immersed boundary method for non-Newtonian fluid-structure-interaction", minisympo-

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[1]Quite a few invitations for giving talks in minisymposiums at national and international conferences were declined because of temporary lack of travel funding.

sium on "Advances in computation and analysis of PDE's for multiphase system", the 9th International Congress on Industrial and Applied Mathematics (SIAM Meeting), Valencia, Spain, July 15-19, 2019.

[49] "A brief introduction to the lattice Boltzmann methods", the first part of a talk on their new parallel implementation of the LB method given by collaborator Dr. F Song at Computer Science Department of IUPUI, June 10, 2019. (20+ ANSYS engineers from USA, Germany, and India attended the talk.)

[48] "The IB method for fluid-structure-interaction with applications", end-of-semester talk, graduate course Computational Fluid Dynamics (ME 61400), Department of Mechanical Engineering, IUPUI, April 15, 2019.

[47] Invited talk, "Modeling and simulation of blood flow past the distal anastomosis of the arteriovenous graft for hemodialysis", special session on "Bio-inspired Mechanics and Propulsion" at the AMS Sectional Meeting, University of Michigan, Ann Arbot, Ann Arbor, MI, USA, October 20-21, 2018.

[46] "A 3D IB method for non-Newtonian fluid-structure-interaction", Taida Institute for Mathematical Sciences, National Taipei University, July 9 2018.

[45] Invited talk, "Modeling and simulation of blood flow past the distal anastomosis of the arteriovenous graft for hemodialysis", at the minisymposium on "Fluid-structure interactions in medicine and biology: modeling, analysis, and experiments" at the AIMS conference on Dynamical Systems, Differential Equations and Applications, Taipei, Taiwan, July 5-9, 2018.

[44] "Modeling and simulation of blood flow past the distal anastomosis of the arteriovenous graft for hemodialysis", Department of Computer Science, Sun Yat-sen University, Guangzhou, Guangdong, China, June 11, 2018.

[43] Invited speaker, "A 3D IB method for non-Newtonian fluid-structure-interaction", Workshop on Modeling, Analysis, Simulations and Applications of Interfacial Dynamics and FSI Problems (IMA-FSI), Sanya, Hainan, China, June 4-8, 2018.

[42] "Modeling and simulation of blood flow past the distal anastomosis of the arteriovenous graft for hemodialysis", National Key Laboratory of Science and Technology on Computational Physics, Beijing Institute of Applied Physics and Computational Mathematics, Beijing, China, June 3, 2018.

[41] "A 3D IB method for non-Newtonian fluid-structure-interaction", minisymposium on Free and Moving Boundary Problems: Methods and Applications at the Fourteenth US National Congress on Computational Mechanics, Montreal, Canada, July 17-20 2017.

[40] "Fluid flow over an osteocyte: modeling and simulation", minisymposium on Recent Advances in Modeling, Computational PDEs and their Applications, the 5th International Conference on Computational and Mathematical Biomedical Engineering, Pittsburgh, PA, USA, April 10 - 12, 2017.

[39] "A deformable plate interacting with a non-Newtonian fluid in three dimensions", minisymposium on Nonlinear Systems and applications, 2017 Joint Mathematics Meetings, Atlanta, GA, USA, January 4 - 7, 2017.

[38] "A new 3D immersed boundary method with application", National Key Laboratory of Science and Technology on Computational Physics, Beijing Institute of Applied Physics and Computational Mathematics, Beijing, China, November 11 2016.

[37] "A new 3D immersed boundary method with application", Tsinghua University, Beijing, China, November 10 2016.

[36] "Simulation of a non-Newtonian fluid interacting with a deformable sheet in 3D", Institute of Mechanics, Chinese Academy of Sciences, Beijing, China, November 8 2016.

[35] "The immersed boundary formulation", Institute of Mechanics, Chinese Academy of Sciences, Beijing, China, November 6 2016.

[34] "The immersed boundary method with applications", School of Mathematical Sciences, University of Electronic Science and Technology of China, Chengdu, Sichuan, China, November 3 2016.

[33] "Simulation of a non-Newtonian fluid interacting with a deformable sheet in 3D", Dept of Modern Mechanics, University of Science and Technology of China, Hefei, Anhui, China, October 12 2016.

[32] "Simulation of a non-Newtonian fluid interacting with a deformable sheet in 3D", National Key Laboratory of Science and Technology on Computational Physics, Beijing Institute of Applied Physics and Computational Mathematics, Beijing, China, September 30 2016.

[31] "Simulation of a non-Newtonian fluid interacting with a deformable sheet in 3D", minisymposium on the immersed boundary method and its extensions at the SIAM Conference on the Life Sciences, Boston, MA, USA, July 11 - 14, 2016.

[30] "A new 3D immersed boundary method with application", International Workshop on Fluid-Structure-Interaction

Problems, Institute of Mathematical Sciences, National University of Singapore, May 30 - June 3, 2016.

[29] "A new 3D immersed boundary method with application", Computational & Applied Mathematics Seminar, Dept of Mathematics, Purdue University, West Lafayette, April 18 2016.

[28] Invited to give a talk at the the minisymposium on "Free and Moving Boundary Problems: Methods and Applications" at the Thirteenth US National Congress on Computational Mechanics, San Diego, California, USA, July 26-30, 2015. (Declined because of time confliction with another conference in China.)

[27] "The immersed boundary method", State Key Laboratory of Computational Physics, Beijing Institute of Applied Physics and Computational Mathematics, July 21, 2015.

[26] "The immersed boundary method with recent applications", Dept of Mechanical Engineering, Zhejiang University, Hangzhou, Zhejiang, China, July 18, 2015.

[25] "A 3D immersed boundary method for fluid thin-walled-structure interaction", Scientific Computing Seminars, University of Houston, Houston, Texas, USA, April 2, 2015.

[24] "The immersed boundary method for fluid-structure-interaction with applications" and "Modeling and simulation of atherosclerosis", Institute of Fluid Physics, Chinese Academy of Engineering Physics, Mianyang, Sichuan, China, March 18, 2015.

[23] "Simulation of a 3D viscous flow past a deformable thin-walled circular disk tethered at its center by a new IB method", minisymposium on modeling of fluid-structure interaction inspired by organism motion, 2014 SIAM Annual Meeting, Chicago, IL, USA, July 7 - 11, 2014.

[22] "Coupling the blood flow to the oxidation of Low-Density Lipoprotein: a simple model for a key process in atherosclerosis", Biomath Seminar, IUPUI, Sept 25, 2012.

[21] "A 3D implicit boundary method with application", the 2nd International Conference on Scientific Computing, Nanjing, China, May 22-25, 2012.

[20] "The immersed boundary method with applications", State Key Laboratory of Water Resources and Hydropower Engineering Science, Wuhan University, Wuhan, China, May 17 2012.

[19] "A lattice-Boltzmann based immersed boundary method in 3D with applications", Dept of Mechanical Engi-

neering, IUPUI, Sept 15 2011.

[**18**] "A 3D immersed boundary method with applications", Dept of Mathematical Sciences, University of Delaware, Newark, Delaware, USA, May 10 2011.

[**17**] "A lattice-Boltzmann based 3D immersed boundary method with applications", Dept of Mathematics and Statistics, Old Dominion University, Norfolk, Virginia, USA, March 18 2011.

[**16**] "The immersed boundary method with applications", Dept of Mathematics, Indiana University, Bloomington, Indiana, USA, December 6 2010.

[**15**] "The immersed boundary method with recent applications", Institute of Process Engineering, Chinese Academy of Sciences, Beijing, China, March 19 2010.

[**14**] "A 3D lattice Boltzmann based immersed boundary method", Dept of Modern Mechanics, University of Science and Technology of China, Hefei, Anhui, China, March 15 2010.

[**13**] "The immersed boundary method and its applications", the 20th Annual Meeting of the State Key Laboratory of Nonlinear Mechanics, Institute of Mechanics, Chinese Academy of Sciences, Beijing, China, December 21 - 22, 2008.

[**12**] "The immersed boundary method with applications", School of Mathematical Sciences, Rochester Institute of Technology, Rochester, New York, USA, May 2008.

[**11**] "A viscous flow past a flexible fiber tethered at its middle point: drag reduction and vortex shedding", Dept of Mathematics, Kent State University, Kent, Ohio, USA, April 3 2008.

[**10**] "A viscous flow past a flexible fiber tethered at its middle point: drag reduction and vortex shedding", Dept of Applied Mathematics and Statistics, University of California Santa Cruz, California, USA, February 22 2008.

[**9**] "The immersed boundary method and its applications", Dept of Mathematics and Statistics, University of New Mexico, Albuquerque, New Mexico, USA, February 7 2008.

[**8**] "A viscous flow past a flexible fiber tethered at its middle point: drag reduction and vortex shedding", Dept of Mathematics, State University of New York at Buffalo, New York, USA, January 11 2008.

[**7**] "The immersed boundary method", Applied Math Seminar, Dept of Mathematics, Purdue University, West Lafayette, Indiana, USA, April 18 2016.

[**6**] "The applications of the immersed boundary method", Graduate Special Topic Lecture, Dept of Applied Math and Statistics, New York State University Stony Brook, New York, USA, April 24 2006.

[**5**] "Simulation of elastic filaments interacting with a viscous pulsatile flow", Dept of Math, University of Michigan Ann Arbor, Michigan, USA, Nov 10 2006.

[**4**] "The immersed boundary method with applications", Dept of Mechanical Engineering, IUPUI, Sept 22 2005.

[**3**] Invited talk at the 14th International Conference on Discrete Simulation of Fluid Dynamics in Complex Systems, Kyoto University, Kyoto, Japan, August 22 - 26, 2005. (Declined over Green Card concern)

[**2**] Invited to give a talk at the Dept of Mechatronics, Gwangju Institute of Science and Technology, South Korea, October 2005. (Declined over Green Card concern)

[**1**] Invited to give a talk at the Annual Meeting of the Laboratory of Nonlinear Mechanics, the Institute of Mechanics, Chinese Academy of Science, Beijing, China, December 16-17, 2006. (Declined over Green Card concern)

Other Professional Visits

[9] The 13th User Training Workshop on Developing Multi-Scale, Virtual Tissue Simulations with CompuCell3D, Indiana University, Bloomington, IN, USA, August 5-11, 2018.

[8] Invited visit to State Key Laboratory of Science and Technology on Computational Physics, Beijing Institute of Applied Physics and Computational Mathematics, Beijing, China, September 16 - October 2, October 17 - November 17, 2016.

[7] Invited visit to Dept of Modern Mechanics, University of Science and Technology of China, Hefei, Anhui, China, October 9 - 16, 2016.

[6] Invited visit to North Carolina State University, Raleigh, August 5 - 8 2014.

[5] Invited visit to Wuhan University, Wuhan, China, May 8 - 21, 2012.

[4] Invited visit to University of Wisconsin Milwaukee, May 2008.

[3] Invited participant for the opening workshop on the random media, the Statistical and Applied Mathematical Sciences Institute (SAMSI), September 23 - 26, 2007.

[2] The workshop on Blood Flows in the microcirculation, Mathematical Bioscience Institute (MBI), Ohio State University, January 22 - 26, 2007.

[1] The New Direction Short Course on Biophysical Fluid Dynamics, Institute for Mathematics and its Applications (IMA), University of Minnesota Twin Cities, June 19 - 30, 2006.

Presentations at Conferences and Meetings (not invited)

21) J Barber, M Mukhin, V Maybruck, and L Zhu (Presenter). "Modeling and simulation of an osteocyte cellular process interacting with fluid flow in a canaliculus" (poster with pitch video). The 28th Congress of the European Society of Biomechanics, Maastricht, The Netherlands, 9 -12 July 2023.

20) N Karimli (Speaker), J Barber, L Zhu, "A three-dimensional mathematical model of a viscoelastic osteocyte and its interaction with the surrounding flow", the 75th Annual Meeting of the American Physical Society (APS) Division of Fluid Dynamics (DFD), Indianapolis, Indiana, USA, November 20 - November 22, 2022.

19) J Barber, L Zhu (Speaker), Maxim Mukhin, and Vanessa Maybruck, "Modeling and simulation of an osteocyte cellular process interacting with fluid flow in three dimensions", the 75th Annual Meeting of the American Physical Society (APS) Division of Fluid Dynamics (DFD), Indianapolis, Indiana, USA, November 20 - November 22, 2022.

18) L Zhu (Speaker), J Barber, R Zigon, S Na, H Yokota, "Modeling and simulation of interstitial fluid flow around an osteocyte in a lacuno-canalicular network", minisymposium on modeling and simulation of biological cells, the joint 15th World Congress on Computational Mechanics (WCCM XV) and the 8th Asian Pacific Congress on Computational Mechanics (APCOM VIII), July 31-August 5, 2022. Yokohama, Japan (format was changed to virtual in March 2022).

17) I Manring, L Zhu (Speaker), J Barber. "Simulation of flow-osteocyte-interaction in a lacuno-canalicular network." the 7th International Conference on Computational and Mathematical Biomedical Engineering – CMBE2022 27-29 June 2022, Milan Italy.

16) J Barber (Speaker), L Zhu, S Na, and H Yokota, "Osteocyte in Flow: a Mathematical Model with Experimental Validation", Minisymposium on Math Models and Lab Experiments for Bone Development and Remodeling, 2020

SIAM Conference on the Life Sciences (Virtual), June 11 - July 2, 2020.

15) J Barber, L Zhu, S Na, and H Yokota, "A mathematical and computational model of an osteocyte immersed in shear flow with experimental validation" (poster), ASBMR (the American Society for Bone and Mineral Research) 2020 Annual Meeting (Virtual), September 11 – 15, 2020.

14) Z Bai (Speaker) and L Zhu, "Modeling and simulation of blood flow past distal anastomosis of arteriovenous graft for hemodialysis", the 30th International Conference on Parallel Computational Fluid Dynamics, Indianapolis, Indiana, USA, May 14 - 17, 2018.

13) "A new 3D IB method for non-Newtonian fluid structure interaction", the 70th Annual Meeting of the American Physical Society (APS) Division of Fluid Dynamics (DFD), Denver, Colorado, USA, November 19 - November 21, 2017.

12) "A new 3D IB method for non-Newtonian fluids", the International Workshop on Computational Mathematics and Scientific Computing, Qingdao, Shandong, China, June 28 - July 2, 2017.

11) "A 3D immersed boundary method for thin-walled structures", the 12th International Conference for Mesoscopic Methods in Engineering and Science, Beijing, China, July 20 - 24, 2015.

10) "A 3D lattice-Boltzmann based implicit immersed boundary method" (poster), the Workshop on Fluid Motion Driven by Immersed Structures, Fields Institute, University of Toronto, Canada, August 9 - 13, 2010.

9) "A lattice Boltzmann based implicit immersed boundary method for fluid-structure-interaction" (poster), the 62nd Annual Meeting of the American Physical Society (APS) Division of Fluid Dynamics (DFD), Minneapolis, Minnesota, USA, November 22 - 24, 2009.

8) "A 3D immersed boundary method by the lattice Boltzmann approach with application", the 6th International Conference for Mesoscopic Methods in Engineering and Science, Guangzhou, China, July 13 - 17 2009.

7) "Scaling laws for drag of a compliant body in an incompressible viscous fluid", the 60nd Annual Meeting of the American Physical Society (APS) Division of Fluid Dynamics (DFD), Salt Lake City, Utah, USA, November 19 - 22, 2007.

6) "Simulation of elastic filaments interacting with a 2D viscous pulsatile flow by the IB method", the 7th World Congress on Computational Mechanics, Los Angeles, California, USA, July 16 - 22, 2006.

5) "Simulation of a 2D flow past a flexible fiber tethered at its center point: vortex shedding", the 58nd Annual Meeting of the American Physical Society (APS) Division of Fluid Dynamics (DFD), Chicago, Illinois, USA, November 20 - 22, 2005.

4) "Simulation of a non-homogeneous elastic filament falling in a flowing soap film", the Third M.I.T. Conference on Computational Fluid and Solid Mechanics, Massachusetts Institute of Technology, Boston, USA, June 14 - 17, 2005.

3) "Drag of a flexible fiber in a 2D moving viscous fluid", the SIAM Conference on Computational Science and Engineering, Orlando, Florida, USA, February 12 - 15, 2005.

2) "Parallel simulation of fluid slip at 3D microchannel walls", the SIAM Conference on Parallel Processing for Scientific Computing, San Francisco, California, USA, February 25 - 27, 2004.

1) "Simulation of a flexible flapping filament in a flowing viscous fluid by the immersed boundary method", RPI Applied Math Days, Troy, New York, November 2000.

AWARDS AND HONORS

- Favorite Professor, selected by students of the Athletics Department of the IUPUI, 2006, 2011

- Outstanding Dissertation in the Natural Sciences Award, New York University, April, 2002

- William Magnus Prize (for significant contribution to mathematical sciences), Courant Institute of Mathematical Sciences, New York University, February 2002

- Harold Grad Prize, Courant Institute of Mathematical Sciences, New York University, April 2001

- The First Prize at the 12th Academic Conference at the BIAPCM, Oct. 1996 (paper presented: 3D Simulations of Richtmyer-Meshkov Instability)

- Admission to the graduate school of the BIAPCM with exemption from national entrance examinations, 1989

OTHER PROFESSIONAL ACTIVITIES

Session Chair: Session T05: Biological Fluid Dynamics: Cells, 75th Annual Meeting of the Division of Fluid Dynamics Sunday–Tuesday, November 20–22, 2022; Indiana Convention Center, Indianapolis, Indiana

NSF panelist: Joint Panel (Virtual) of the Division of Molecular and Cellular Biosciences and the Division of Mathematical Sciences, 2020.

ad hoc reviewer, 2021.

Minisymposium Organizer: **L Zhu** and J Barber: minisymposium on modeling and simulation of biological cells for the joint 15th World Congress on Computational Mechanics (WCCM XV) and the 8th Asian Pacific Congress on Computational Mechanics (APCOM VIII), July 31-August 5 2022, Yokohama, Japan (Virtual).

Minisymposium Organizer: J Barber and L Zhu, minisymposium on Math Models and Lab Experiments for Bone Development and Remodeling, 2020 SIAM Conference on the Life Sciences (Virtual), June 11 - July 2,2020

Advisory Board: Physics of Fluids (August 2019 - December 2022)

Editorial Board: Theoretical and Applied Mechanics Letters (January 2011 - Present)

Guest Editor of the Special Issue of Computational and Mathematical Methods in Medicine (2016)

Reviewer of research proposal for German-Israeli Foundation (GIF) for Scientific Research and Development (GIF Young Scientists Program (2015, 2019)

Reviewer of the following journals:
    Journal of Computational Physics
    Physics of Fluids
    SIAM Journal for Scientific Computing
    Computer Methods in Applied Mechanics and Engineering
    The Bulletin of Math Biology
    Journal of Applied Numerical Mathematics
    Journal of Thermophysics and Heat Transfer
    Journal of Zhejiang University Science A
    Journal of Fluid Mechanics
    Computers and Mathematics with Applications
    Mathematical Physics, Analysis and Geometry
    Physica D
    Journal of Fluids and Structures
    Theoretical and Applied Mechanics Letters
    International Journal of Biomathematics
    International Journal for Numerical Methods in Fluids
    Communication in Computational Physics

Mathematical Methods in Applied Sciences

Discrete and Continuous Dynamical System B

International Journal of Numerical Methods for Heat and Fluid Flow

Computer Methods in Biomechanics and Biomedical Engineering

International Journal for Numerical Methods in Biomedical Engineering

Computers and Fluids

PLOS Computational Biology

Ocean Engineering

Open Physics

Acta Mechanica Sinica

Journal of Biological Systems B

Cogent Engineering

AWM proceedings for NIMBioS Workshop for Women in Mathematical Biology

Applied Mathematical Modeling

Proceedings of the Royal Society of London, Series A

Experimental Thermal and Fluid Science

International Journal of Modern Physics B

IWEMSE 2018: Proceedings of 2018 International Workshop on Environmental Management, Science and Engineering

Advances in Applied Mathematics and Mechanics

Computer Modeling in Engineering and Science

Applied Sciences

Computers in Biology and Medicine

TEACHING EXPERIENCE

Calculus for Technology I and II

Calculus for Life Sciences I and II

Calculus & Analytical Geometry I

Vector Calculus

Complex Variables

Ordinary Differential Equations

Discrete Modeling and Game Theory

Numerical Methods

Numerical Analysis

Frontiers in Physics

Applied Computational Methods I and II

STUDENTS/POSTDOCS MENTORED (on IUPUI campus)

Yuehui Xu, PhD Research Co-Advisor, Math, IUPUI, Sept 2023 - Present

Robert Zigon, PhD Research Co-Advisor, Computer Science, IUPUI, Oct 2022 - Present

Nigar Karimli, PhD Research Co-Advisor, Math, IUPUI, January 2022 - Present

Luke Hanson, Mentor for REU at IUPUI, Biola University, June - July 2023

Leah Bandy, Mentor for REU at IUPUI, Colorado School of Mines, June - July 2023

Maxim Muhkin, Mentor for REU at IUPUI, Vanderbilt University, June - Nov 2022

Vanessa Maybruk, Mentor for REU at IUPUI, Kutztown University, June - Dec 2021

Isaac Manring, Mentor for REU at IUPUI and Capstone Experience, IUPUI, June - Dec 2021

Kaoru Sakai, MS student, Research Advisor, Math (part-time), IUPUI, August 2018 - May 2021

Zengding Bai, PhD Research Advisor, Math, IUPUI, August 2013 - August 2018

Yuankun Fu, PhD Research Co-Advisor (unofficial), Computer Science, IUPUI, September 2015 - December 2019

Jose Celaya-Alcala, Co-Mentor for REU at IUPUI, Univ of Arizona, June 13 -August 5 2017

Alexa Kovacs, Co-Mentor for REU at IUPUI, Rose-Hulman, June 13 -August 5 2017

Robert Zigon, MS Research Advisor, Math, IUPUI, August 2015 - September 2016

Madison Sanden, Mentor for REU at IUPUI, Univ of Kentucky, June 13 - August 5 2016

Prateek Nagar, MS Research Co-Advisor, Computer Science, IUPUI, September 2013 - May 2015

Jake Zatecky, Undergraduate Capstone Experience Advisor, Math, IUPUI, Fall 2012, Spring 2013

Everton Lima, Co-Mentor for MURI at IUPUI, Computer Science, IUPUI, June - July 2012

Sam Kukadia, Co-Mentor for MURI at IUPUI, Computer Science, IUPUI, June - July 2012

Henry Chen, PhD Research Co-Advisor (unofficial), Biomedical Engineering, IUPUI, Sept 2008 - Sept 2011

Philip Oliver, Undergraduate Research Advisor, Biomedical Engineering, IUPUI, Fall 2010

Jian Hao, Postdoc Research Advisor, Math, IUPUI, November 2008 - July 2010

Brian Denton, Undergraduate Capstone Experience Advisor, Math, IUPUI, Spring 2010

Derek Black, Undergraduate Capstone Experience Advisor, Math, IUPUI, Spring 2009

Sarah Simon Undergraduate Capstone Experience Advisor, Math, IUPUI, Summer II 2005

STUDENTS MENTORED (outside IUPUI)

Chao Tang, PhD Research Co-Advisor (unofficial), U of Sci & Tech of China, August 2013 - September 2015

Runan Hua, PhD Research Co-Advisor, U of Sci & Tech of China, August 2010- September 2014

Willie Zhu, the Siemens Competition in Math, Sci & Tech, Carmel High School, August - October 2014

Fangbao Tian, PhD Research Co-Advisor (unofficial), U of Sci & Tech of China, August 2009 - September 2012

Gaojin Li, MS Research Co-Advisor (unofficial), U of Sci & Tech of China, September 2010 - July 2012