Lianxia Li, PhD

llianxia@unc.edu (307)460-1709, Department of Mathematics, University of North Carolina at Chapel Hill, Chapel Hill, NC 27514

Education

2023 **PhD, University of Wyoming**, Mechanical Engineering
Thesis: *A Hybrid ALE and Immersed Boundary Method on Unstructured Grids for Fluid-structure Interaction*

2021 **MS, University of Wyoming**, Mechanical Engineering

2007 **PhD, Sichuan University**, Hydraulics and River Engineering
Thesis: *Parallelization of Nonstationary Spectral Method in Stochastic Groundwater Modeling on Unstructured Grids*

2002 **BEng, Zhengzhou University**, Water Conservancy and Hydropower Engineering

Academic Appointments

2023.9 – present **Postdoctoral Research Associate**, Department of Mathematics, University of North Carolina at Chapel Hill

2010.5 – 2018.5 **Associate Professor**, State Key Laboratory of Hydraulics, Sichuan University

2012.8 – 2013.8 **Visiting Professor**, Department of Civil and Environmental Engineering, University of Pittsburgh

2007.7 – 2010.4 **Assistant Professor**, State Key Laboratory of Hydraulics, Sichuan University

Research Experience

2023.9 - present **Lead Researcher**, Department of Mathematics, University of North Carolina at Chapel Hill

- **Developed** computational fluid dynamics models of blood flow in experimental image-based models of arteriovenous fistulas, collaborating with UNC Kidney Center, supported by **NIH Award with PIs: Dr. Boyce Griffith, Dr. Prabir Roy-Chaudhury, and Dr. Gang Xi.**
- **Developing and applying** numerical methods in fluid-structure interaction, focusing on biomedical applications in the heart, supported by **NIH Award and NSF Award with PI: Dr. Boyce Griffith.**

2018.8 – 2023.8 **Research Assistant**, Department of Mechanical Engineering, University of Wyoming

- Developed a novel hybrid FSI (fluid-structure interaction) solver coupling the Arbitrary Lagrangian-Eulerian (ALE) and the immersed boundary method (IBM) under OpenFOAM.
- Developed an image-based CFD model for heart flow simulation, supported by INBRE
- Conducted comprehensive numerical study on hydrodynamic characteristics of semi-planing ship hulls at various cruising speeds using OpenFOAM

Research Experience (continued)

2010.5 – 2018.5 **Principal Investigator**, State Key Laboratory of Hydraulics, Sichuan University
- Conducted experimental and numerical studies in turbulence, energy dissipation, and groundwater, supported by NSF China Award and industrial funding
- Developed stochastic groundwater modeling based on wavelet transform, supported by the Department of Education, China
- Created software and tools for educational and industrial applications, supported by industrial funding
- Secured ¥3,353,300 in grant funding from NSF China and industry partners

2002.9 – 2007.7 **Research Assistant**, State Key Laboratory of Hydraulics, Sichuan University
- Developed a parallel computing framework for large-scale groundwater modeling

Teaching Experience

2007 – 2017 **Instructor**, College of Water Resource & Hydropower, Sichuan University
- Fluid Mechanics: Designed and delivered lectures for graduate students (Fall 2007, 2008, 2009, 2016)
- Computational Fluid Dynamics: Developed and taught graduate-level courses (Spring 2007, 2008, 2009, 2011, 2012, 2017)
- Hydraulics: Instructed 60 undergraduate students (Fall 2014, 2016, 2017)
- Groundwater: Designed and introduced a new course for 40 undergraduate students (Fall 2010, 2011)

2019 – 2023 **Teaching Assistant**, Department of Mechanical Engineering, University of Wyoming
- Heat Transfer: Presented lecture and graded assignments for 70 undergraduates (Spring 2019, 2020)
- Computational Fluid Dynamics I: Assisted 12 graduate students in laboratory sessions (Spring 2021)
- Fluid Mechanics: Graded assignments and held office hours for 13 graduate students (Spring 2021)
- Numerical Methods: Graded assignments for 72 undergraduate students (Fall 2019)
- Engineering Experimentation: Assisted 22 undergraduate students in laboratory work (Fall 2022)
- Thermal Fluids Laboratory: Supported 20 undergraduate students in lab sessions (Spring 2023)

Advising and Mentoring

Graduates

2014-2017 **Dewei Liu** Hydraulics and River Dynamics, Sichuan University
Thesis: *Study of stochastic groundwater model based on the wavelet method*

2015-2018 **Qiulin Li** Hydraulics and River Dynamics, Sichuan University
Thesis: *Study on Non-Saturated Groundwater Contaminant Transport Model Based on Finite Volume Method*

2015-2019 **Jingjing Wei** Hydraulics and River Dynamics, Sichuan University, Co-advised with Prof. Jianmin Zhang
Thesis: *Study on the flow of the twisted and beveled flip bucket of a tunnel*

Advising and Mentoring (continued)

- **Yuchuan Tang** Hydraulics and River Dynamics, Sichuan University, Co-advised with Prof. Jianmin Zhang
  Thesis: *Application of machine learning in stochastic analysis of groundwater flow and solute transport model*

Undergraduates

2015
- **Yuhao Hu** Hydraulic and Hydroelectric Engineering, Sichuan University
  Thesis: *Simulation and Control of Pollution of Groundwater by Landfill*
- **Wenyong Wang** Hydraulics and Hydroelectric Engineering, Sichuan University
  Thesis: *Interactive Software Development for Natural River Water Depth Calculation*
- **Junjiang Xia** Hydraulics and Hydroelectric Engineering, Sichuan University
  Thesis: *Velocity Field Simulation of Regular Desilting System in Shanshuping Power Station*

2014
- **Chao Ye** Thermal Energy and Power Engineering, Sichuan University
  Thesis: *Numerical simulation optimizations of Stilling Basin with Shallow-water Cushion*

2012
- **Xian Zheng** Hydraulics and Hydroelectric Engineering, Sichuan University
  Thesis: *Calculation on the normal depth of different cross sections in open channel*

2011
- **Weiji Wan** Hydraulics and Hydroelectric Engineering, Sichuan University
  Thesis: *Comparative analysis of pressure test and calculation of Wollo Bridge floodway*

2010
- **Jinde Feng** Hydraulics and Hydroelectric Engineering, Sichuan University
  Thesis: *Application of suspended seepage control wall in water conservancy project*

2009
- **Shukun Luo** Hydrology, Sichuan University
  Thesis: *Application of Adaptive Mesh Method to Unconfined Seepage Calculations with Multiple Segment Line Outflow Boundaries*

2008
- **Huan Ma** Hydraulics and Hydroelectric Engineering, Sichuan University
  Thesis: *Optimization analysis of dissipative pool body shape of the spillway on the left bank of Luding Hydropower Station*
- **Yan Zhou** Hydraulics and Hydroelectric Engineering, Sichuan University
  Thesis: *Application of Equivalent Permeability Coefficient to Seepage Calculation in Non-Homogeneous Aquifers*

Publications

In preparation

1. **L. Li**, *A hybrid fluid-structure interaction model coupling arbitrary lagrangian-eulerian technique and immersed boundary method.*
2. **L. Li**, *An imaged-based computational fluid dynamics model for the study of the hemodynamics of murine arteriovenous fistula.*
3. **L. Li**, M. Stoellinger, and M. Maysam, *Study on hydrodynamic characteristics during semi-planing ship hull maneuvering.*

Journal Articles

1. **L. Li**, M. Stoellinger, and M. Mousaviraad, "Rigorous benchmarking of an iterative IBM solver by comparison to body-fitted mesh results," *Computers & Fluids*, vol. 277, p. 106 281, 2024.
2. Y. Weng, **L. Li**, S. Jiang, L. Qin, and Y. Zhu, "Nanobubble-assisted liquid phase exfoliation of graphene in deionized water," *Materials Letters*, vol. 364, p. 136 372, 2024.
3. L. Yu, Y. Lin, **L. Li**, *et al.*, "Understanding interfacial dynamics: Hydrostatic pressure-induced sono-dispersion of carbon nanotubes," *Surfaces and Interfaces*, vol. 51, p. 104 740, 2024.

4 Q. Li, **L. Li**, and H. Liao, "Study on the best depth of stilling basin with shallow-water cushion," *Water*, vol. 10, no. 12, p. 1801, 2018.

5 L. Zhang, Z. Nan, X. Liang, Y. Xu, F. Hernández, and **L. Li**, "Application of the MacCormack scheme to overland flow routing for high-spatial resolution distributed hydrological model," *Journal of hydrology*, vol. 558, pp. 421–431, 2018.

6 **L.-x. Li**, H.-s. Liao, D. Liu, and S.-y. Jiang, "Experimental investigation of the optimization of stilling basin with shallow-water cushion used for low Froude number energy dissipation," *Journal of Hydrodynamics*, vol. 27, no. 4, pp. 522–529, 2015.

7 L. Da, L. Lian-xia, L. Hua-sheng, and H. Ben-sheng, "Study on the Accuracy of Numerical Simulation of Slope Approximation Method in Open-Channel with Vertical Wall," *Procedia Engineering*, vol. 28, pp. 630–634, 2012.

8 L. Da, L. Yanting, L. Lianxia, *et al.*, "Numerical simulation of skm in open-channel with vertical wall," *Engineering Journal of Wuhan University*, vol. 45, no. 2, pp. 148–151, 2012.

9 **L. Li**, H. Liao, and D. Liu, "A nonstationary method for stochastic groundwater," *China Sciencepaper/Zhongguo Keji Lunwen*, vol. 7, no. 5, 2012.

10 M. Li, **L. Li**, H. Liao, Z. Huang, and W. Huang, "The influence of drainage on wetland degradation in Zoige plateau," *Disaster Advances*, vol. 5, no. 4, pp. 659–666, 2012.

11 D. Liu, L.-X. Li, B.-S. Huang, H.-S. Liao, and Y.-Z. Zhang, "Experimental investigation on operation scheme optimization of complex sand-flushing system of intake," *Journal of Sichuan University: Engineering Science Edition*, vol. 44, no. 2, pp. 16–20, 2012.

12 D. Liu, Y. Lu, **L. Li**, and C. Tan, "Numerical simulation of skm in open-channel with vertical wall," *Engineering Journal of Wuhan University/ Wuhan Daxue Xuebao*, vol. 45, no. 2, 2012.

13 S. Wang, L.-X. Li, J. Sun, X. Liu, and H.-S. Liao, "An experimental study on characteristics of hydraulic jumps in multiple continuous stilling basins," *Advances in Science and Technology of Water Resources*, vol. 32, no. 4, pp. 23–28, 2012.

14 L. Yanting, L. Da, L. Lianxia, *et al.*, "Comparison and analysis of analytic solution of skm model and numerical solution in different compound channels," *Guangdong Water Resources and Hydropower*, vol. 7, pp. 3–6, 2012.

15 S.-y. JIANG, L.-x. LI, H.-s. LIAO, H. YANG, and J. ZOU, "Comparison of numerical approaches of simulating seepage flow with free surface," *Journal of Yangtze River Scientific Research Institute*, vol. 28, no. 7, p. 37, 2011.

16 S. Jiangfeng, H. Zhiyong, **L. Lianxia**, C. Chang'an, and L. Deli, "One-dimensional simulation of hydrogen isotopes diffusion in composite materials by FVM," *International journal of hydrogen energy*, vol. 36, no. 9, pp. 5702–5706, 2011.

17 W.-W. Q. H. Liu, L.-P. Hu, H.-R. S. Lian-Xia Li, and W.-M. Yi, "Optimization of energy dissipation and antiscour arrangement for angu hydropower station," *Xinan Minzu Daxue Xuebao(Ziran Kexue Ban)*, vol. 37, no. 2, pp. 666–671, 2011.

18 H. Yang, H.-S. Liao, L.-X. Li, S.-Y. Jiang, and Y.-T. Lu, "Applicability of skm model in natural channels," *Advances in Science and Technology of Water Resources*, vol. 31, no. 3, pp. 53–56, 2011.

19 M. Jiang and L.-X. Li, "An improved two-point velocity method for estimating the roughness coefficient of natural channels," *Physics and Chemistry of the Earth, Parts A/B/C*, vol. 35, no. 3-5, pp. 182–186, 2010.

20 S. Peilan, L. Huasheng, L. Lianxia, *et al.*, "Application of aerator with a trapezoidal-shaped slot on a steep slope to the spillway tunnel of pubugou hydropower project," *Journal of Hydroelectric Engineering*, vol. 29, no. 2, pp. 168–176, 2010.

21 Y. Ru, H. Liao, **L. Li**, S. Chen, and T. Li, "Numerical simulation and experimental investigation on stilling basin with shallow-water cushion," *Shuili Fadian Xuebao(Journal of Hydroelectric Engineering)*, vol. 29, no. 2, 2010.

22 L. Shukun, **L. Lianxia**, R. Yongshen, *et al.*, "Numerical simulation on stepped spillway in discharge tunnel of buxi power station," *Journal of Hydroelectric Engineering*, vol. 29, no. 1, pp. 50–56, 2010.

23 P. Su, H. Liao, **L. Li**, Y. Qiu, and C. Li, "Application of aerator with a trapezoidal-shaped slot on a steep slope to the spillway tunnel of pubugou hydropower project," *Shuili Fadian Xuebao(Journal of Hydroelectric Engineering)*, vol. 29, no. 2, pp. 168–176, 2010.

24 R. Yongshen, L. Huasheng, L. Lianxia, *et al.*, "Numerical simulation and experimental investigation on stilling basin with shallow-water cushion," *Journal of Hydroelectric Engineering*, vol. 29, no. 2, pp. 36–41, 2010.

25 L.-X. LI, D. LIU, H.-S. LIAO, and M. YUAN, "Seepage simulation on water seal failure behind cut off wall in jinping 2nd stage hydropower station," *Journal of Yangtze River Scientific Research Institute*, vol. 26, no. 10, p. 44, 2009.

26 **L.-x. Li**, H.-s. Liao, and L.-j. Qi, "An improved r-factor algorithm for TVD schemes," *International Journal of Heat and Mass Transfer*, vol. 51, no. 3-4, pp. 610–617, 2008.

27 **L.-x. Li**, H.-s. Liao, and T.-x. Li, "A hybrid model for simulating velocity field of a river with complex geometry plunged by multiple jets," *Journal of Hydrodynamics*, vol. 18, no. 6, pp. 752–759, 2006.

28 **L. Li**, H. Liao, and D. Liu, "A method of water free surface adapting grid system to simulate phreatie surface in seepage flow," *JOURNAL-SICHUAN UNIVERSITY ENGINEERING SCIENCE EDITION*, vol. 38, no. 5, p. 76, 2006.

29 H.-S. Liao, M. Gao, and L.-X. Li, "Optimal simulation and analyzing to" lower window" type seepage control scheme in left abutment of shawan hydropower station," *Journal of Sichuan University: Engineering Science Edition*, vol. 37, no. 4, pp. 1–6, 2005.

Conference Proceedings

1 **L. Li**, M. Fenn, M. Mousaviraad, and C. Gilbert, "Fluid-structure interaction (fsi) of wedge drop slamming," in *72nd Annual Meeting of the APS Division of Fluid Dynamcis*, APS, vol. 64, Seattle, WA: ACM Press, Nov. 2019.

2 **L. Li**, H. Liao, D. Liu, Y. Ru, and T. Li, "Numerical simulation and experimental investigation on hydraulic performance of stilling basin with shallow-water cusion," in *Proceedings of 35th IAHR World Congress*, IAHR, Chengdu, China, Aug. 2013.

3 **L. Li**, H. Liao, and L. Qi, "Application of an improved r-factor algorithm for tvd schemes on structured and unstructured grids," in *Proceedings of 32th IAHR World Congress*, IAHR, Venice, Italy, Jul. 2007.

4 L. Qi, H. Liao, and **L. Li**, "Numerical simulation of bottom aeration devices in a mildly sloping spillway tunnel with large unit discharge and low froude number," in *Proceedings of 32th IAHR World Congress*, IAHR, Venice, Italy, Jul. 2007.

5 Y. Yang and **L. Li**, "Development of eco-friendly hydro-power engineering," in *The UN International Symposium on Hydropower and Sustainable Development*, National Development, Reform Commission, China United Nations Department of Economic, and Social Affairs World Bank, Beijing, China, Nov. 2004.

Books and Chapters

1 *Hydraulics, Chapter 19, Calculation of Hydraulic Engineering Application*. China Higher Education Press, 2006.

Grants and Funding [¥3,353,300 ≈ $480,000]

Sole PI

[1] China Dianjian Group Chengdu Survey Design Research Institute Co., Ltd, ¥140,000, Experimental Study of the Discharging Tunnel of Lianghekou Hydropower Project, Phase II. 2016-2017

[2] China Dianjian Group Chengdu Survey Design Research Institute Co., Ltd, ¥140,000, Experimental Study of the Discharging Tunnel of Lianghekou Hydropower Project – Phase I. 2014-2015.

[3] National Natural Science Foundation of China, Non-stationary Spectrum Method of Random Groundwater Modeling Based on Wavelet Transform (No. 51209154), ¥250,000. 2013-2015.

[4] Doctoral Program of the Ministry of Education, China. Research on Large Area of Random Groundwater Based on Parallel Non-stationary Spectrum Theory. ¥36,000. 2009-2011.

[5] Young Researcher Program of Sichuan University, ¥15,000. 2009-2010.

[6] China Guodian Daduhe Valley Hydropower Development Co., Ltd, Measurement and Analysis of Dadu River Luding Hydropower Station Dam Seepage. ¥137,300. 2011.

[7] Wanyuan City Water Bureau. Safety analysis of Hongxing Reservoir Dam of Wanyuan, ¥80,000. 2011.

[8] Sole PI. PowerChina Hydropower Development Group Co. Ltd., Experimental Study of Angu Hydropower Project Energy Dissipation, ¥580,000. 2010.

[9] Sole PI. PowerChina Hydropower Development Group Co. Ltd. Local hydraulic model test of flood discharge sand flushing gate of Sichuan Dadu River Angu Hydropower Station, ¥350,000. 2011.

[10] Sole PI. Yangyuan County Woluo River Power Co. Hydraulic model test of Woluoqiao Hydropower Station discharging structures, ¥200,000. 2011.

[11] Sole PI. Yilong County Water Bureau. Consultation and evaluation for small farmland water conservancy projects of Yilong. ¥20,000. 2011.

[12] Sole PI. Sichuan Province Water Conservancy Planning Research Institute, Seepage Simulation of Dam of Chuntangba Hydropower Project. ¥10,000. 2008.

Co-PI

[1] National Natural Science Foundation of China. Hydraulic Performances of Stilling Basin with Shallow-water Cushion (No. 51079091), ¥320,000. 2011-2013.

Professional Development and Outreach

2024 **Judge**, NCSSM Science and Engineering Fair
North Carolina School of Science and Mathematics, Durham, NC

- Evaluated student projects at the high school level science and engineering fair

Professional Development and Outreach (continued)

2023 **Instructor**, Engineering Summer Program (ESP)
Department of Mechanical Engineering, University of Wyoming, Laramie, WY
- Taught Solidworks to 6 high school students
- Led students through Engineering workshop and 3D printing workshop

Honors and Awards

2016 First Prize in Scientific and Technological ProgressSichuan, China4th out of 8 recipients

2012 Excellence in Teaching Award, Sichuan University

2002 – 2006 Department Prize for Outstanding Student Performance, Sichuan University, Awarded annually

1998 – 2001 Department Prize for Outstanding Student Performance,Zhengzhou University, Awarded annually

Patents and Certification

Patents

2015 CN105239540B, An inclined floor formula stilling basin

CN105239541B, Local cushion pool formula stilling basin

2009 CN101538841B, Differential trajectory jet energy dissipater in absorption basin

CN101538840B, Trajectory jet type energy dissipater in absorption basin

Certification

2022 NVIDIA DLI Certificate, Fundamentals of Accelerated Computing with CUDA C/C++

2012 Associate Constructor, Awarded by Sichuan Province Construction Department, China

Skills

Programming and Tools	C/C++, Fortran, C#, Matlab, Python, Bash; Github, Spack, Visual Studio, VS Code, LaTeX
Computing and Modeling	OpenFOAM, Ansys Fluent/Mechanical, Abacus, IBAMR, deal.II, HPC (MPI, Linux, Slurm), Paraview, Tecplot, ViSit, Gmsh, Gambit, Solidworks, FreeCAD, 3d Slicer, meshmixer

Skills (continued)

Software Developed

- iPisoIbmFoam: A fully implicit iterative PISO solver with IBM in OpenFOAM.
- WaterH: 1D channel flow solver based on Visual C++.
- Atomization: A GUI program predicting the atomization caused by flood discharging, C++, Fortran + OpenGL.
- FLOOD: A lumped flood model for mountain area flood prediction. C#.
- HYROGEN: A 2D GUI model for hydrogen diffusion simulation. C#.