

# Lei Li

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## Research Interests

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I am broadly interested in applied mathematics, including

- Analysis of differential equations (PDE models, optimal transport, time fractional differential equations etc)
- Numerical SDEs, numerical PDEs and their applications
- Fluid-structure interactions

## Education

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Ph.D., Mathematics, University of Wisconsin-Madison (Thesis advisor: Saverio Spagnolie)	2010-2015
M.A., Mathematics, University of Wisconsin-Madison.	2013
M.S., Computer Science, University of Wisconsin-Madison.	2012
B.S., Mathematics and Physics, Tsinghua University, Beijing.	2006-2010

## Positions

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Tenure-Track Associate Professor, Shanghai Jiao Tong University	2018-present
William W. Elliott Assistant Research Professor, Duke University (Research is mainly mentored by Jian-Guo Liu)	2015-2018

## Teaching

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<b>Duke University</b>	Mathematical Fluid Dynamics. Spring, 2017 Introduction to Numerical PDEs. Spring, 2016; Spring 2018 Multivariable Calculus. Fall 2015, Spring 2016, Fall 2016, Fall 2017.
<b>University of Wisconsin-Madison</b>	Teaching Assistant for undergraduate courses like calculus, linear algebra and applied analysis etc

## Preprints and Publications

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**L. Li**, J.-G. Liu, *Large time behaviors of upwind schemes by jump processes*, arXiv.  
**L. Li**, J.-G. Liu, Z. Liu, Y. Yang, and Z. Zhou, *On Runge-Kutta methods for the water wave equation and its simplified nonlocal hyperbolic model*, arXiv:1712.04881  
Y. Gao, **L. Li** and J.-G. Liu *Patched peakon weak solutions of the modified Camassa-Holm equation*, arXiv:1703.07466  
Z. Zhu, J.-G. Liu and **L. Li**, *A modified Lévy jump-diffusion model based on market sentiment memory for online jump prediction*, arXiv:1709.03611  
W. Hu, C. J. Li, **L. Li**, and J.-G. Liu *On the diffusion approximation of nonconvex stochastic gradient descent*, Annals of Mathematical Sciences and Applications; To appear  
Y. Feng, **L. Li** and J.-G. Liu *Semi-groups of stochastic gradient descent and online principal component analysis: properties and diffusion approximations*, Comm. Math. Sci. Vol. 16, No. 3, 2018  
Y. Feng, **L. Li**, J.-G. Liu and X. Xu *Continuous and discrete one dimensional autonomous fractional ODEs*, Discrete Contin. Dyn. Syst. Ser. B, Vol. 23, No. 8, 2018

- L. Li** and J.-G. Liu *Some compactness criteria for weak solutions of time fractional PDEs*, SIAM Math. Anal. Vol. 50, Issue 4, 2018
- L. Li** and J.-G. Liu *A generalized definition of Caputo derivatives and its application to fractional ODEs*, SIAM Math. Anal. Vol. 50, Issue 3, 2018
- Y. Gao, **L. Li** and J.-G. Liu *A dispersive regularization for the modified Camassa-Holm equation*, SIAM Math. Anal. Vol. 50, Issue 3, 2018
- L. Li**, J.-G. Liu and L. Wang *Cauchy problems for Keller-Segel type time-space fractional diffusion equation*, J. Differ. Equations. Vol. 265, Issue 3, 2018
- F. Feng, **L. Li**, J.-G. Liu and X. Xu, *A note on one-dimensional time fractional ODEs*, Appl. Math. Lett. Vol. 83, 2018
- L. Li** and J.-G. Liu *p-Euler equations and p-Navier-Stokes equations*, J. Differ. Equations., Vol. 264, Issue 7, 2018
- L. Li** and J.-G. Liu *A note on deconvolution with completely monotone sequences and discrete fractional calculus*, Quart. Appl. Math., Volume 76, Issue 1, 2018.
- L. Li**, J.-G. Liu and J. Lu *Fractional stochastic differential equations satisfying fluctuation-dissipation theorem*, J. Stat. Phys., Volume 169, Issue 2, 2017
- L. Li**, X. Xu and S. E. Spagnolie *A locally gradient preserving reinitialization for level set functions*, J. Sci. Comput., Volume 71, Issue 1, 2017
- L. Li** and S. E. Spagnolie *Swimming and pumping by helical waves in viscous and viscoelastic fluids*, Phys. Fluids, Volume 27, Issue 2, 2015
- F. Liang, Y. Li, **L. Li** and J. Wang *Analytical solution for laterally loaded long piles based on Fourier-Laplace integral*, Appl. Math. Model., Vol. 38, Issue 21, 2014
- H. Manikantan, **L. Li**, S. E. Spagnolie and D. Saintillan *The instability of a sedimenting suspension of weakly flexible fibres*, J. Fluid Mech., Vol. 756, 2014
- L. Li** and S. E. Spagnolie *Swimming and pumping of rigid helical bodies in viscous fluids*, Phys. Fluids, Volume 26, Issue 4, 2014
- L. Li**, H. Manikantan, D. Saintillan and S. E. Spagnolie *The sedimentation of flexible filaments*, J. Fluid Mech., Vol. 735, 2013

## Skills

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### Language

Chinese (Mandarin), English

### Computer Languages

C/C++, Java, Matlab, HTML, L<sup>A</sup>T<sub>E</sub>X

## Service and instruction

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- Project adviser of undergraduates: Zibu Liu (Summer 2017, co-advised with Jian-Guo Liu and Zhennan Zhou)
- Helped to run applied and analysis seminar at Duke University in Fall 2016 and Spring 2017 with Tingran Gao and Zhennan Zhou.

## Conferences and talks

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### Numerical Analysis Seminar, University of Maryland

Feb. 2018

Talk Title: A conformal mapping formulation for inviscid incompressible fluid drops and its numerical analysis.

### Seminar, City University of Hong Kong

Dec. 2017

### Seminar, Hong Kong University of Science and Technology

Dec. 2017

### Young Researchers' Workshop, Shanghai Jiao Tong University

Dec. 2017

Talk title: Some new progress of time fractional differential equations with Caputo derivatives.

### Young Researchers' Workshop, Peking University

Dec. 2017

Talk title: Some new progress of time fractional differential equations with Caputo derivatives.  
**KI-Net Young Researchers' Workshop, University of Maryland** *Oct. 2017*  
Talk title: Compactness and weak solutions to fractional PDEs  
**SIAM Annual Meeting, Pitts, PA** *July 2017*  
Talk title: A fractional SDE model satisfying fluctuation-dissipation theorem  
**KI-Net Young Researchers' Workshop, Duke University** *Nov. 28-Dec. 2nd 2016*  
Talk title: Fractional calculus based on a convolution group and basic properties of fractional ODEs  
**AMS Southern Sectional Meeting, North Carolina State University** *Nov. 2016*  
Contributed talk: A conformal mapping formulation for fluid drops and filtered Fourier method  
**CNA seminar, Carnegie Mellon University** *Oct. 2016*  
Talk title: Fractional calculus based on a convolution group and basic properties of fractional ODEs  
**Applied/Analysis Math Seminar, Duke University** *Nov. 2015*  
Talk title: An Eulerian formulation of immersed interface method for moving interfaces with tangential stretching  
**APS-DFD meeting, San Francisco, CA** *2014*  
Contributed talk: Swimming and pumping by helical waves in viscous and viscoelastic flows.  
**SIAM Annual meeting, Chicago, IL** *2014*  
Contributed talk: Swimming and pumping by helical structure in viscous flow  
**APS-DFD meeting, Pitts, PA** *2013*

### **Awards and Honors**

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**John Nohel Prize in Applied Mathematics** (UW-Madison Math Dept.) *2014/2015*  
**Excellent Student** (Tsinghua University) *2010*