Ming-Chih Lai

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Education:

Ph.D. Mathematics, Courant Institute of Mathematical Sciences, New York University, 1998/09

Research Interests:

Immersed boundary and immersed interface methods

Modeling and simulations for interfacial flow problems

Fast solvers for elliptic equations in non-Cartesian coordinates

Appointments:

2014/12 - present, *Chair Professor*, Department of Applied Mathematics, NCTU

2013/08 - present, *Joint Appointment Research Fellow*, Institute of Mathematics, Academia Sinica

2013/01 - 2013/05 *Visiting Professor*, Hong Kong Baptist University

2012/09 - 2012/12 *Visiting Professor*, Research Institute for Mathematical Sciences (RIMS), Kyoto University

2009/08 - 2012/07, *Founding Director*, Center of Mathematical Modeling and Scientific Computing, NCTU

2007/08 - 2009/07, *Chair*, Department of Applied Mathematics, NCTU

2005/08 - present, *Professor*, Department of Applied Mathematics, NCTU

2002/08 - 2005/07, *Associate Professor*, Department of Applied Mathematics, NCTU

1999/08 - 2002/07, *Assistant Professor*, Department of Mathematics, National Chung Cheng University

1998/08 - 1999/07, *Research Associate*, Department of Physics, Duke University

International and Domestic Committees:

SIAM Membership committee, 2014 - 2016

SIAM East Asia Section (EASIAM), President 2013 - 2014, Vice-President 2011 - 2012

Mathematical Society of ROC (Taiwan), President, 2016 -

National Center for Theoretical Sciences (NCTS), Deputy Director, 2016 -

Ministry of Science and Technology (previous National Science Council) Mathematics Division, Panel Chair, 2012 - 2014

Prizes and Awards:

Ministry of Education, Academic Award, 2014

National Science Council, Outstanding Research Award, 2011

Mathematical Society of ROC, Academic Award, 2011

National Science Council, Outstanding Scholar Research Grant, 2009/08 - 2012/07

NCTU, Academic Research Award, 2005

National Science Council, Outstanding Research Award, 2003

Dean's Special Recognition Award, 2003

Kurt O. Friedrichs Prize for an outstanding dissertation in Mathematics at Courant Institute, NYU, 1999

Editorial Boards:

Taiwanese Journal of Mathematics, 2014/08 -

Communications in Computational Physics, 2012 -

East Asian Journal of Applied Mathematics, 2010 -

Advances in Applied Mathematics and Mechanics, 2009 -

Selected Organizers and Invited Talks

- SIAM Conference on the Life Sciences (SIAM LS16, being held jointly with SIAM annual meeting), Mini-symposium speaker, Boston, USA, July 11-14, 2016
- The 7th PRCM, Section organizer and speaker on "Computational Aspects of Interface Problems with Applications", NSU, Seoul, Korea, June 27-July 1, 2016
- International Workshop on Fluid-Structure Problems (invited speaker) NUS, Singapore, May 30-June 3, 2016
- ICIAM 2015 , Mini-symposium co-organizer and speaker, Beijing, China, August 10-14, 2015
- JSIAM 2014 Annual Meeting (invited speaker), Tokyo, Japan, September 3-5, 2014
- The 39th Sapporo Symposium on PDE (invited speaker), Hokkaido University, Sapporo, August 25-29, 2014
- SIAM 2014 Annual Meeting, Mini-symposium speaker, Chicago, USA, July 7-11, 2014
- KSIAM 2014 Spring Conference (plenary speaker), National Seoul University, Korea, May 23-24, 2014
- Workshop on Fluid-Structure Interaction Problems (invited speaker), INS, Shanghai Jiao Tung University, July 27-30, 2013
- Annual meeting of Mathematical Society of ROC (plenary speaker), NCTU, December 7-9, 2012
- Biological Complex Fluids, 2012 Cargese summer school (invited lecturer), Corsica Island, France, June 25th-July 7th, 2012
- Workshop on Fluid Motion Driven by Immersed Structures (tutorial speaker on the immersed boundary method), Fields Institute, Canada, August 9-13, 2010
- Fluid dynamics, Analysis and Numerics (invited speaker, 40 mins talk), Duke University, USA, June 28-30, 2010
- Soft Matter Seminar Series (SMSS'09, invited speaker, one hour talk), Hong Kong University of Science and Technology, 2009
- The 3rd International Conference on Scientific Computing and Partial Differential Equations (plenary speaker, 45 mins talk), Hong Kong Baptist University, December 8-13, 2008

Selected Publications

1. M.-C. Lai and C. S. Peskin, An immersed boundary method with formal second-order accuracy and reduced numerical viscosity, *Journal of Computational Physics*, 160, 705-719 (2000).

2. M.-C. Lai and Z. Li, A remark on jump conditions for the three-dimensional Navier-Stokes equations involving an immersed moving membrane, *Applied Mathematics Letters*, 14, vol 2, 149-154, (2001).

3. J. T. Beale and M.-C. Lai, A method for computing nearly singular integrals, *SIAM Journal on Numerical Analysis*, vol 38, No 6, 1902-1925, (2001).

4. Z. Li and M.-C. Lai, The immersed interface method for the Navier-Stokes equations with singular forces, *Journal of Computational Physics*, vol 171, No 2, 822-842, (2001).

5. M.-C. Lai, W.-W. Lin and W. Wang, A fast spectral/difference method without pole conditions for Poisson-type equations in cylindrical and spherical geometries, *IMA Journal of Numerical Analysis*, vol 22, No 4, 537-548, (2002).

6. M.-C. Lai, A simple compact fourth-order Poisson solver on polar geometry, *Journal of Computational Physics*, vol 182, 337-345, (2002).

7. Z. Li, W.-C. Wang, I.-L. Chern and M.-C. Lai, New formulations for interface problems in polar coordinates, *SIAM Journal on Scientific Computing*, vol 25, No 1, 224-245, (2003).

8. K.-H. Chiam, M.-C. Lai and H. S. Greenside, Efficient algorithm on a non-staggered mesh for simulating Rayleigh-Bénard convection in a box, *Physical Review E*, 68, 026705, (2003).

9. M.-C. Lai and Y.-H. Tseng, A fast iterative solver for the variable coefficient diffusion equation on a disk, *Journal of Computational Physics*, vol 208, 196-205, (2005).

10. J. Huang, M.-C. Lai and Y. Xiang, An integral equation method for epitaxial step flow growth simulations, *Journal of Computational Physics*, vol 216, 724-743, (2006).

11. M.-C. Lai, Y.-H. Tseng and H. Huang, An immersed boundary method for interfacial flows with insoluble surfactant, *Journal of Computational Physics*, vol 227, 7279-7293, (2008).

12. K. Ito, M.-C. Lai and Z. Li, A well-conditioned augmented system for solving Navier-Stokes equations in irregular domains, *Journal of Computational Physics*, 228, 2616-2628 (2009).

13. M.-C. Lai, Y.-H. Tseng and H. Huang, Numerical simulation of moving contact lines with surfactant by immersed boundary method, *Communications in Computational Physics*, vol 8, 735-757 (2010).

14. Y. Kim, M.-C. Lai and C. S. Peskin, Numerical simulations of two-dimensional foam by the immersed boundary method, *Journal of Computational Physics*, vol 229, 5194-5207 (2010).

15. Y. Kim and M.-C. Lai, Simulating the dynamics of inextensible vesicles by the penalty immersed boundary method, *Journal of Computational Physics*, vol 229, 4840-4853 (2010).

16. K.-Y. Chen, K.-A. Feng, Y. Kim and M.-C. Lai, A note on pressure accuracy in immersed boundary method for Stokes flow, *Journal of Computational Physics*, vol 230, 4377-4383 (2011).

17. P. Constantin, M.-C. Lai, R. Sharma, Y.-H. Tseng and J. Wu, New numerical results for the surface quasi-geostrophic equation, *Journal of Scientific Computing*, Vol 50, Issue 1, 1-28 (2012).

18. M.-C. Lai, W.-F. Hu, and W.-W. Lin, A fractional step immersed boundary method for Stokes flow with an inextensible interface enclosing a solid particle, *SIAM Journal on Scientific Computing*, Vol 34, No 5, pp.B692-B710 (2012).

19. Y. Kim and M.-C. Lai, Numerical study for viscosity and inertial effects on tank-treading to tumbling motions of vesicle under shear flow, *Physical Review E*, 86, 066321 (2012).

20. K.-Y. Chen and M.-C. Lai, A conservative scheme for solving coupled surface-bulk convection-diffusion equations with an application to interfacial flows with soluble surfactant, *Journal of Computational Physics*, Vol 257, pp. 1-18 (2014).

21. J.-J. Xu, Y. Huang, M.-C. Lai and Z. Li, A coupled immersed interface and level set method for three-dimensional interfacial flows with insoluble surfactant, *Communications in Computational Physics*, Vol 15, No 2, pp. 451-469 (2014).

22. W.-F. Hu, Y. Kim, and M.-C. Lai, An immersed boundary method for simulating the dynamics of three-dimensional axisymmetric vesicles in Navier-Stokes flows, *Journal of Computational Physics*, Vol 257, pp. 670-686 (2014).

23. Y. Kim, M.-C. Lai, C. S. Peskin and Y. Seol, Numerical simulations of three-dimensional foam by the immersed boundary method, *Journal of Computational Physics*, Vol 269, pp. 1-21 (2014).

24. P.-W. Hsieh, M.-C. Lai, S.-Y. Yang, and C.-S. You, An unconditionally energy stable penalty immersed boundary method for simulating the dynamics of an inextensible interface interacting with a solid particle, *Journal of Scientific Computing*, Vol 64, pp. 289-316 (2015).

25. W.-F. Hu, M.-C. Lai, and Y.-N. Young, A hybrid immersed boundary and immersed interface method for electrohydrodynamic simulations, *Journal of Computational Physics*, Vol 282, pp. 47-61 (2015).

26. H. Wu, M. Thiebaud, W.-F. Hu, A. Farutin, S. Rafai, M.-C. Lai, P. Peyla, and C. Misbah, Amoeboid motion in confined geometry, *Rapid Communications, Physical Review E* 92, 050701(R) (2015).

27. H. Nganguia, Y.-N. Young, A. T. Layton, M.-C. Lai, and W.-F. Hu, Electrohydrodynamics of a viscous drop with inertia, *Physical Review E* 93, 053114 (2016).

28. W.-F. Hu, M.-C. Lai, Y. Seol and Y.-N. Young, Vesicle electrohydrodynamic simulations by coupling immersed boundary and immersed interface method, *Journal of Computational Physics*, Vol 317, pp. 66-81 (2016).

29. K.-L. Pan, Y.-H. Tseng, J.-C. Chen, K.-L. Huang, C.-H. Wang, and M.-C. Lai, Controlling droplet bouncing and coalescence with surfactant, *Journal of Fluid Mechanics*, Vol 799, pp. 603-636 (2016).

30. Y. Seol, W.-F. Hu, Y. Kim and M.-C. Lai, An immersed boundary method for simulating vesicle dynamics in three dimensions, *Journal of Computational Physics*, Vol 322, pp. 125-141 (2016).