

Li Ruo

Contact Information

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Research Interests

Adaptive Mesh Method, Numerical Method for Fluid Dynamics, Model Reduction of Kinetic Equation

Education

PhD in computational mathematics, Peking University, 2001

MSc in computational mathematics, Peking University, 1998

BSc in computational mathematics, Peking University, 1996

Working Experience

Sep 2008-Now, Professor, School of Mathematical Sciences, Peking University;

Sep 2003-Aug 2008, Associate Professor, School of Mathematical Sciences, Peking University;

Jan 2007-Jun 2007, Visiting Professor, Hong Kong Baptist University;

Feb 2005-Jan 2006, Visiting Reserach Scholar, California Institute of Technology, USA;

Feb 2003-Aug 2003, Assistent Professor, School of Mathematical Sciences, Peking University;

Feb 2002-Jan 2003, Post-doctoral Research Assistant, CBS, University of Kent at Canterbury, UK;

Awards/Honors

Distinguished Professor Chang Jiang Scholarships, Ministry of Education, 2016;

Leading Talents in Scientific and Technological Innovation, Ministry of Science and Technology, 2015;

National Science Fund for Distinguished Young Scholars, National Science Foundation, 2013;

Program for New Century Excellent Talents in University, Ministry of Education, 2009;

First Prize of Science and Technology in University, Ministry of Education, 2007;

National Excellent Doctorial Thesis, Ministry of Education, 2003;

Academic Duties

Associate editor, SIAM JOURNAL OF SCIENTIFIC COMPUTING, 2007-2015;

Associate editor, NUMERICAL MATHEMATICS: THEORY, METHOD AND APPLICATION, 2007-now;

Associate chief editor, JOURNAL ON NUMERICAL METHOD AND COMPUTER APPLICATIONS (in Chinese), 2015-now;

President, BEIJING SOCIETY FOR COMPUTATIONAL MATHEMATICS, 2015-now;

Recent Invited Presentations

Invited speaker, XVI International Conference on Hyperbolic Problems: Theory, Numerics, Applications, RWTH, Germany, 2016;

Plenary speaker, International Conference on Kinetic Equations and Related Topics, Wuhan University, 2015;

Invited speaker, The 12th Internal Conference for Mesoscopic Methods in Engineering and Science, Beijing Computational Science Research Center, 2015;

Invited speaker, International Conference on Numerical Mathematics and Scientific Computing, Nanjing University, 2015;

Invited speaker, International Workshop on Optimization, Sparsity, and Adaptive Data Analysis, Morningside Mathematical Center at Chinese Academy of Sciences, 2015;

Invited speaker, Workshop on Moment Methods in Kinetic Theory II, Fields Institute for Research in Mathematical Sciences, Canada, 2014;

Software

AFEPACK, R. Li and W.-B. Liu, <http://www.afepack.org>.

Publication List

Y.-H. GUO, R. LI AND C.-B. YAO , *A Numerical Method on Eulerian Grids for Two-phase Compressible Flow* , Advances in Applied Mathematics and Mechanics, 8(2), pp. 187-212, 2016. DOI: 10.4208/aamm.2014.m706, Published online: 27 January 2016.

Y.-W. FAN, J. KOELLERMEIER, J. LI, R. LI AND M. TORRILHON , *Model Reduction of Kinetic Equations by Operator Projection* , Journal of Statistical Physics, 162(2), pp. 457-486, 2016. First online: 29 October, 2015. DOI: 10.1007/s10955-015-1384-9

2016

Y.-W. FAN AND R. LI , *Globally hyperbolic moment system by generalized Hermite expansion* , (in Chinese). Sci Sin Math, 45, 2015, pp. 1635-1676

Z.-N. CAI, Y.-W. FAN AND R. LI , *A Framework on Moment Model Reduction for Kinetic Equation* , SIAM Journal on Applied Mathematics, 75(5), pp. 2001-2023, <http://epubs.siam.org/toc/smjmap/75/5>, DOI: 10.1137/14100110X

Y.-N. DI, Z.-Z. KOU AND R. LI , *High Order Moment Closure for Vlasov-Maxwell Equations* , Front. Math. China, 10(5), 2015, pp. 1087-1100. DOI: 10.1007/s11464-015-0463-1

2015

Z.-C. HU AND R. LI , *A Nonlinear Multigrid Steady-State Solver for 1D Microflow* , Computer and Fluids, 103, 2014, pp. 193-203.

Z.-N. CAI, Y.-W. FAN AND R. LI , *On Hyperbolicity of 13-Moment System* , Kinetic and Related Models, 7(3), 2014, pp. 415-432.

R. LI, T. LU AND Z.-P. SUN , *Stationary Wigner Equation with Inflow Boundary Conditions: Will a Symmetric Potential Yield a Symmetric Solution?* , SIAM Journal on Applied Mathematics, 74(3), 2014, pp. 885-897, DOI: 10.1137/130941754, <http://epubs.siam.org/toc/smjmap/74/3>

R. LI, T. LU AND W.-Q. YAO , *Discrete Kernel Preserving Model for 1D Electron-Optical Phonon Scattering* , Journal of Scientific Computing, February 2015, 62(2), pp. 317-335, DOI: 10.1007/s10915-014-9858-5

Z.-N. CAI AND R. LI , *The NRxx Method for Polyatomic Gases* , Journal of Computational Physics, Available online 28 February 2014. 267(15), June 2014, pp. 63-91, DOI: 10.1016/j.jcp.2014.02.026

Z.-C. HU, R. LI, T. LU, Y.-L. WANG AND W.-Q. YAO , *Simulation of an $n^+ - n - n^+$ Diode by Using Globally-Hyperbolically-Closed High-Order Moment Models* , Journal of Scientific Computing, 59(3), Page 761-774, 2014, DOI: 10.1007/s10915-013-9781-1

R. LI, T. LU, Y.-L. WANG AND W.-Q. YAO , *Numerical Validation for High Order Hyperbolic Moment System of Wigner Equation* , Communications in Computational Physics, Vol. 15, pp. 569-595, 2014. DOI: 10.4208/cicp.091012.120813a.

Z.-N. CAI, Y.-W. FAN, R. LI, AND Z.-H. QIAO , *Dimension-Reduced Hyperbolic Moment Method for the Boltzmann Equation with BGK-Type Collision* , Communications in Computational Physics, 15(5), pp. 1368-1406, May 2014, DOI: 10.4208/cicp.220313.281013a.

Z.-N. CAI, R. LI AND Y.-L. WANG , *Solving Vlasov Equations Using NRxx Method* , SIAM Journal on Scientific Computing, 35(6), pp. A2807-A2831, 5 December, 2014, DOI: 10.1137/120871791

2014

W.-Q. YAO, R. LI, T. LU, X.-Y. LIU, G. DU AND K. ZHAO , *Globally hyperbolic moment method for BTE including phonon scattering* , The International Conference on Simulation of Semiconductor Processes and Devices (SISPAD 2013) 3-5 September, 2013, Glasgow, Scotland, UK. Pages: 300-303, Product Type: Conference Publications

Z.-N. CAI, Y.-W. FAN AND R. LI , *Globally Hyperbolic Regularization of Grad's Moment System* , Communications on Pure and Applied Mathematics, First online at 1 July 2013, DOI: 10.1002/cpa.21465. Published as 67(3):464-518, 2014.

Z.-N. CAI, R. LI AND Z.-H. QIAO , *Globally Hyperbolic Regularized Moment Method with Applications to Microflow Simulation* , Computer and Fluids, 81, 20 July 2013, Pages 95-109.

J. DENG, R. LI, T. SUN AND S.-N. WU , *A Robust Simulation for Shallow Flows on Complex Rough Topography* , Numerical Mathematics: Theory , Methods and Applications, 6(2), 2013, pp. 384-407.

Z.-N. CAI, Y.-W. FAN, R. LI, T. LU AND W.-Q. YAO , *Quantum Hydrodynamic Model of Density Functional Theory* , Journal of Mathematical Chemistry, Vol. 51, No. 5, pp. 1747-1771, 2013, DOI: 10.1007/s10910-013-0176-1.

R. LI AND S.-N. WU , *H-adaptive Mesh Method with Double Tolerance Adaptive Strategy for Hyperbolic Conservation Laws* , Journal of Scientific Computing, DOI: 10.1007/s10915-013-9692-1

2013

Z.-N. CAI, Y.-W. FAN AND R. LI , *Globally Hyperbolic Regularization of Grad's Moment System in One Dimensional Space* , Communications in Math Sciences, 11(2), 2012, pp. 547-571.

Z.-N. CAI, Y.-W. FAN, R. LI, T. LU AND Y.-L. WANG , *Quantum Hydrodynamic Model by Moment Closure of Wigner Equation* , Journal of Mathematical Physics, 53(10), 2012, DOI: 10.1063/1.4748971, <http://link.aip.org/link/?JMP/53/103503>

R. LI, P.-B. MING AND F.-Y. TANG , *An Efficient High Order Heterogeneous Multi-scale Method for Elliptic Problems* , SIAM Multiscale Modelling and Simulation, 10(1), 2012, pp. 259-283, DOI: 10.1137/110836626, <http://link.aip.org/link/?MMS/10/259>

Z.-N. CAI, R. LI AND Z.-H. QIAO , *NRxx Simulation of Microflows with Shakhov Model* , SIAM Journal on Scientific Computing, 34(1), 2012, pp. A339-A369 DOI: 10.1137/110828551, <http://link.aip.org/link/?SCE/34/A339>

Z.-N. CAI, R. LI AND Y.-L. WANG , *Numerical Regularized Moment Method for*

High Mach Number Flow , Communication in Computational Physics, 11(5), 2012, pp. 1415-1438.

2012

Z.-N. CAI, R. LI AND Y.-L. WANG , *An Efficient NRxx Method for Boltzmann-BGK Equation* , Journal of Scientific Computing, 50, 2012, pp. 103-119, DOI: 10.1007/s10915-011-9475-5.

G. YUAN AND R. LI , *Sharp a Posteriori Error Estimate for Elliptic Equation with Singular Data* , Frontiers of Mathematics in China, 6(1), 2011, pp. 177-202.

G.-H. HU, R. LI, AND T. TANG , *A robust WENO type finite volume solver for steady Euler equations on unstructured grids* , Communications in Computational Physics, 9 (2011), pp. 627-648.

2011

K. KUNISCH, W.-B. LIU, Y.-Z. CHANG, N.-N. YAN AND R. LI , *Adaptive finite element approximation for a class of parameter estimation problems* , Journal of Computational Mathematics (28), 01/2010, pp. 645-675.

Z.-N. CAI AND R. LI , *Numerical Regularized Moment Method of Arbitrary Order for Boltzmann-BGK Equation* , SIAM Journal on Scientific Computing, Volume 32, Issue 5, September 23, 2010, pp. 2875-2907.

D. WANG, R. LI AND N.-N. YAN , *An Edge-based Anisotropic Mesh Refinement Algorithm and its Application to Interface Problems* , Communications in Computational Physics Volume 8 (2010), pp. 511-540.

Z.-N. CAI AND R. LI , *An h-Adaptive Mesh Method for Boltzmann-BGK/Hydrodynamics Coupling* , Journal of Computational Physics Volume 229, Issue 5, 1 March 2010, Pages 1661-1680. DOI:10.1016/j.jcp.2009.10.050.

G.-H. HU, R. LI AND T. TANG , *A Robust High-order Residual Distribution Type Scheme for Steady Euler Equations on Grids* , Journal of Computational Physics Volume 229, Issue 5, 1 March 2010, Pages 1681-1697. DOI:10.1016/j.jcp.2009.11.002.

2010

X.-L. HU, R. LI AND T. TANG , *A Multi-Mesh Adaptive Finite Element Approximation to Phase Field Equations* , Commun. Comput. Phys., 5 (2009), pp. 1012-1029.

Y.-N. DI AND R. LI , *Computation of Dendritic Growth with Level Set Model Using a Multi-Mesh Adaptive Finite Element Method* , Journal of Scientific Computing 39 (2009), pp. 441-453. DOI:10.1007/s10915-009-9275-3.

2009

T. Y. HOU AND R. LI , *Numerical Study of Nearly Singular Solutions of the 3-D Incompressible Euler Equations* , Mathematics and Computation, a Contemporary

View, Abel Symposium 3 (2008), pp. 39-66. DOI:10.1007/978-3-540-68850-1_3.

Y.-N. DI, R. LI AND T. TANG , *A General Moving Mesh Framework in 3D and Its Application for Simulating the Mixture of Multi-Phase Flows* , Communications in Computational Physics 3(3), 2008, pp. 582-602.

R. LI, X. WANG AND W.-B. ZHAO , *A Multigrid Block LU-SGS Algorithm for Euler Equations on Unstructured Grids* , Numerical Mathematics: Theory, Methods and Applications 1(1), 2008, pp. 92-112.

T. Y. HOU AND R. LI , *Blowup or No Blowup? The Interplay between Theory and Numerics* , Physics D, published online Jan. 25, 2008, DOI:10.1016/j.physd.2008.01.018.

H.-Y. WANG, R. LI AND T. TANG , *An Efficient r-adaptive Finite Element Method for Phase Field Model of Dendritic Growth* , Journal of Computational Physics, 2008, vol 227, pp. 5984-6000, DOI:10.1016/j.jcp.2008.02.016.

W. GONG, R. LI, N.-N. YAN AND W.-B. ZHAO , *An Improved Error Analysis for Finite Element Approximation of Bioluminescence Tomography* , Journal of Computational Mathematics 26(3), 2008, pp. 297-309.

H.-Y. WANG AND R. LI , *Mesh Sensitivity for Numerical Solutions of Phase-field Equations Using r-adaptive Finite Element Methods* , Communications in Computational Physics 3(2), 2008, pp. 357-375.

2008

R. LI, W.-B. LIU AND N.-N. YAN , *A Posteriori Error Estimates of Recovery Type for Distributed Convex Optimal Control Problems* , Journal of Scientific Computing 33(2), November 2007, pp. 155-182, DOI:10.1007/s10915-007-9147-7.

Y.-N. DI, R. LI, T. TANG AND P.-W. ZHANG , *Level Set Calculations for Incompressible Two-phase Flows on a Dynamically Adaptive Grid* , Journal of Scientific Computing, 31(2007), 1-2, pp. 75-98, DOI:10.1007/s10915-006-9119-3.

T. Y. HOU AND R. LI , *Computing Nearly Singular Solutions Using Pseudo-Spectral Methods* , Journal of Computational Physics, 226 , pp. 379-397, 2007, DOI:10.1016/j.jcp.2007.04.014.

D.-M. LI, R. LI AND P.-W. ZHANG , *A Cellular Automaton Technique for Modelling of a Binary Dendritic Growth with Convection* , Applied Mathematical Modelling, 31(2007), pp. 971-982. DOI:10.1016/j.apm.2006.04.004.

T. Y. HOU AND R. LI , *Nonexistence of Local Self-Similar Blow-up for the 3D Incompressible Navier-Stokes Equations* , Discrete and Continuous Dynamical Systems, Series A , 18(4) , pp. 637-642, 2007,

Y.-Q. HUANG, R. LI AND W.-B. LIU , *Preconditioned Descending Algorithms for p-Laplacian* , Journal of Scientific Computing 32(2), 2007, pp. 342-371, DOI:10.1007/s10915-007-9134-z.

2007

D.-M. LI, R. LI, P.-W. ZHANG , *A Cellular Automaton Technique for the Modeling of Solidification Microstructure in Multi-Component Alloys* , Computer and Computational Sciences, 2006. IMSCCS '06. First International Multi-Symposiums on; 07/2006.

R. LI AND T. TANG , *Moving Mesh Discontinuous Galerkin Method for Hyperbolic Conservation Laws* , Journal of Scientific Computing, 27, 2006, pp. 347-363, DOI:10.1007/s10915-005-9045-9.

J. DENG, T. Y. HOU, R. LI AND X.-W. YU , *Level Set Dynamics and the Non-blowup of the 2D Quasi-geostrophic Equation* , Methods and Applications of Analysis 13(2), 2006, pp. 157-180.

Y.-N. DI, R. LI, T. TANG AND P.-W. ZHANG , *Moving Mesh Methods for Singular Problems on a Sphere Using Perturbed Harmonic Mappings* , SIAM Journal on Scientific Computing, 28(2006), pp. 1490-1508, DOI:10.1137/050642514.

T. Y. HOU AND R. LI , *Dynamic Depletion of Vortex Stretching and Non-blowup of the 3D Incompressible Euler Equations* , Journal of Nonlinear Science, 16(6), pp. 639-664, 2006. DOI:10.1007/s00332-006-0800-3.

D.-M. LI, R. LI, P.-W. ZHANG , *A Cellular Automaton Technique for the Modeling of Solidification Microstructure in Multi-component Alloys* , First International Multi-Symposiums on Computer and Computational Sciences (IMSCCS 2006), Proceedings, Vol 2, 2006, pp. 800-806, DOI:10.1109/IMSCCS.2006.142.

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Y.-N. DI, R. LI, T. TANG AND P.-W. ZHANG , *Moving Mesh Finite Element Methods for the Incompressible Navier-Stokes Equations* , SIAM Journal on Scientific Computing, 26 (2005), 1036-1056, DOI:10.1137/030600643.

R. LI , *on Multi-Mesh h -Adaptive Algorithm* , Journal of Scientific Computing 24(3), 2005, pp.321-341, DOI:10.1007/s10915-004-4793-5.

2005

D.-M. LI, R. LI AND P.-W. ZHANG , *A New Coupled Model for Alloy Solidification* , Science in China Series A-Mathematics 47: 41-52 Suppl. S Apr 2004,

R. LI, C. LUO AND P.-W. ZHANG , *Numerical Simulation of Doi Model of Polymeric Fluids* , Adv. in Sci. Comput. & Appl. (Y. Lu, W. Sun and T. Tang eds), 2004, pp. 258-273. DOI:10.1.1.110.7638.

2004

R. LI, W.-B. LIU AND H.-P. MA , *Moving Mesh Finite Element Approximations for Variational Inequality I: Static Obstacle Problem* , Journal of Scientific Computing, 21(1), pp. 31-55 (2003), DOI:10.1023/B:JOMP.0000027954.83289.00.

2003

R. LI, T. TANG AND P.-W. ZHANG , *A Moving Mesh Finite Element Algorithm for Singular Problems in Two and Three Space Dimensions* , Journal of Computational Physics 177, 365-393 (2002), DOI:10.1006/jcph.2002.7002.

R. LI, W.-B. LIU, H.-P. MA AND T. TANG , *Adaptive Finite Element Approximations for Distributed Optimal Control Problems* , SIAM Journal on Control and Optimization, 41 : pp. 1321-1349 (2002), DOI:10.1137/S0363012901389342.

2002

R. LI, T. TANG AND P.-W. ZHANG , *Moving Mesh Methods in Multiple Dimensions Based on Harmonic Maps* , Journal of Computational Physics 170, pp. 562-588 (2001), DOI:10.1006/jcph.2001.6749.

R. LI, W.-B. LIU, T. TANG AND P.-W. ZHANG , *Moving Mesh Finite Element Methods Based on Harmonic Maps* , Proc. of 2nd Intl. Workshop on Sci. Comput. and Appl. (P. Minev and Y. Lin eds), 2001, pp. 143-156,

Q. DU, D.-Z. LI, Y.-Y. LI, R. LI AND P.-W. ZHANG , *Simulating a Double Casting Technique Using Level Set Method* , Computational Materials Science, 22, pp. 200-212, 2001, DOI:10.1016/S0927-0256(01)00190-2.

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