# Jintao Cui

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#### Education

- Ph.D. in Mathematics August 2010
   Department of Mathematics, Louisiana State University, Baton Rouge, LA. United States.

  Dissertation: Multigrid Methods for Maxwell's Equations.

  Advisor: Prof. Susanne C. Brenner.
- **B.S.** in Mathematics July 2004 Department of Applied Mathematics, Dalian University of Technology, Dalian, Liaoning, China.

#### Academic Positions

- Research Assistant Professor August 2014 present Department of Applied Mathematics, The Hong Kong Polytechnic University, Hong Kong.
- Assistant Professor August 2012 August 2014 Department of Mathematics & Statistics, University of Arkansas at Little Rock, Little Rock, AR. United States.
- Postdoctoral Associate August 2010 August 2012
  Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. United States.
   Mentor: Prof. Bernardo Cockburn.

### **Research Interests**

- Computational Electromagnetics.
- Discontinuous Galerkin Methods.
- Multigrid Methods on Graded Meshes.
- Hybridizable Discontinuous Galerkin Methods.

### Awards

- Nomination of Best Teacher Award, Department of Applied Mathematics, The Hong Kong Polytechnic University, 2015/2016, 2017/2018.
- Distinguished Graduate Dissertation Fellowship, Center for Computation and Technology, Louisiana State University, July 2009–July 2010.
- Student Paper Prize, Student Paper Competition of 33rd SIAM Southeastern-Atlantic Section Conference, Columbia, SC, April 2009.
- Research Assistantship funded by NSF Grant, May–July 2007, May–July 2008, May–July 2009.

## **Research Grants**

- Numerical study on asymptotic coupled model of groundwater flow in fractured aquifer system, General Research Fund (GRF), Hong Kong Research Grants Council (Grant no. 15302518, 2019.01–2021.12, HK\$ 350,000, P.I.)
- Numerical methods for two-dimensional Maxwell's equations, National Natural Science Foundation of China (NSFC) (Grant no. 11771367, 2018.01–2021.12, RMB 480,000, P.I.)
- Numerical Methods for an acoustic fluid-structure interaction problem, The Hong Kong Polytechnic University central research grant, (G-YBT2, 2017–2019, P.I.)
- Multigrid fast solvers for fourth order curl problems based on Hodge decomposition, The Hong Kong Polytechnic University central research grant, (G-YBME, 2016–2018, P.I.)
- Multigrid methods for Maxwell's equations on graded meshes, The Hong Kong Polytechnic University central research grant, (G-YBJZ, 2015–2017, P.I.)

# Publications

- Wei Liu, Jintao Cui<sup>\*</sup> and Zhifeng Wang, A new numerical method for an asymptotic coupled model of fractured media aquifer system, Journal of Scientific Computing, 82:9, 2020. DOI: 10.1007/s10915-019-01112-z
- Gang Chen and Jintao Cui<sup>\*</sup>. On the error estimates of a hybridizable discontinuous Galerkin method for second-order elliptic problem with discontinuous coefficients, IMA Journal of Numerical Analysis, 42(2):1577–1600, 2020.
- Wei Liu, Jintao Cui and Zhifeng Wang. A finite difference approximation of reduced coupled model for slightly compressible Forchheimer fractures in Karst aquifer system, Numerical Algorithms, 84:133–163, 2020.

- Jintao Cui, Fuzheng Gao, Zhengjia Sun and Peng Zhu. A posteriori error estimate for discontinuous Galerkin finite element method on polytopal mesh, Numerical Methods for Partial Differential Equations, 36(3):601–616, 2020.
- Jintao Cui<sup>\*</sup> and Yi Zhang. A new analysis of discontinuous Galerkin methods for a fourth order variational inequality, Computer Methods in Applied Mechanics and Engineering, 351:531–547, 2019.
- Gang Chen, Jintao Cui and Liwei Xu. Analysis of a hybridizable discontinuous Galerkin method for the Maxwell operator, ESAIM: Mathematical Modelling and Numerical Analysis, 53(1):301–324, 2019.
- Yunqing Huang, Wei Yang, Hao Wang and Jintao Cui<sup>\*</sup>. Adaptive operator splitting finite element method for Allen-Cahn equation, Numerical Methods for Partial Differential Equations, 35(3):1290–1300, 2019.
- Susanne C. Brenner, Jintao Cui and Li-yeng Sung. *Multigrid methods based on Hodge decomposition for a quad-curl problem*, Computational Methods in Applied Mathematics, 19(2):215–232, 2019.
- Wei Yang, Luling Cao, Yunqing Huang and Jintao Cui<sup>\*</sup>. A new a posteriori error estimate for the interior penalty discontinuous Galerkin method, International Journal of Numerical Analysis and Modeling, 16(2):210–224, 2019.
- Wei Liu, Jintao Cui and Jie Xin. A block-centered finite difference method for an unsteady asymptotic coupled model in fractured media aquifer system, Journal of Computational and Applied Mathematics, 337:319–340, 2018.
- Susanne C. Brenner, Aycil Cesmelioglu, Jintao Cui and Li-yeng Sung. A nonconforming finite element method for an acoustics fluid-structure interaction problem, Computational Methods in Applied Mathematics, 18(3): 383–406, 2018.
- Wei Liu and Jintao Cui. A two-grid block-centered finite difference algorithm for slightly compressible Darcy-Forchheimer model in porous media, Journal of Scientific Computing, 74(3):1786–1815, 2018.
- Zhaoliang Meng, Jintao Cui and Zhongxuan Luo. A new rotated nonconforming quadrilateral element, Journal of Scientific Computing, 74(2):324–335, 2018.
- Jintao Cui and Thirupathi Gudi. *Finite element approximation of a free boundary plasma problem*, Advances in Computational Mathematics, 43:517–535, 2017.
- Wei Liu and Jintao Cui. Anisotropic quasi-Wilson element with conforming finite element approximation for coupled continuum pipe-flow/Darcy model in Karst aquifers, Mathematical Modelling and Analysis, 21(4):431–449, 2016.
- Jintao Cui. Multigrid methods for two-dimensional Maxwell's equations on graded meshes, Journal of Computational and Applied Mathematics, 255:231–247, 2014.

- Jintao Cui\* and Wujun Zhang. An analysis of HDG methods for the Helmholtz equation, IMA Journal of Numerical Analysis, 34:279–295, 2014.
- Bernardo Cockburn and Jintao Cui<sup>\*</sup>. *Divergence-free HDG methods for the vorticity-velocity formulation of the Stokes problem*, Journal of Scientific Computing, 52(1):256–270, 2012.
- Bernardo Cockburn and Jintao Cui<sup>\*</sup>. An analysis of HDG methods for the vorticityvelocity-pressure formulation of the Stokes problem in three dimensions, Mathematics of Computation, 81:1355–1368, 2012.
- Susanne C. Brenner, Jintao Cui, Zhe Nan and Li-yeng Sung. *Hodge decomposition for divergence-free vector fields and two-dimensional Maxwell's equations*, Mathematics of Computation, 81:643–659, 2012.
- Susanne C. Brenner, Jintao Cui, Thirupathi Gudi and Li-yeng Sung. *Multigrid algorithms for symmetric discontinuous Galerkin methods on graded meshes*, Numerische Mathematik, 119:21–47, 2011.
- Susanne C. Brenner, Jintao Cui and Li-yeng Sung. *Multigrid methods for the symmetric interior penalty method on graded meshes*, Numerical Linear Algebra with Applications, 16:481–501, 2009.
- Susanne C. Brenner, Jintao Cui and Li-yeng Sung. An interior penalty method for a two dimensional curl-curl minus grad-div problem, ANZIAM, 50:947–975, 2009.
- Susanne C. Brenner, Jintao Cui, Fengyan Li and Li-yeng Sung. A nonconforming finite element method for a two-dimensional curl-curl and grad-div problem, Numerische Mathematik, 109:509–533, 2008.

### Invited Conference Talks

- A two-grid finite difference algorithm for compressible Darcy-Forchheimer model in porous media, International Multigrid Conference (IMG2019), Kuming, August 2019.
- C<sup>0</sup> Interior Penalty Method for Quad-Curl Problem and Multigrid Fast Solvers, Workshop on Recent Development of Discontinuous Galerkin Methods, University of Science and Technology of China Hefei, November 2018.
- Finite Element Approximation of a Free Boundary Plasma Problem, IEEE International Conference on Computational Electromagnetics, Chengdu, March 2018.
- Finite Element Approximation of a Free Boundary Plasma Problem, International Workshop on Numerical Methods for Partial Differential Equations, The Hong Kong Polytechnic University, Hong Kong, March 2018.

- Fast Numerical Methods for a Fourth-Order Curl Problem, PolyU-HKBU-SDU Workshop on Applied Mathematics with Financial Applications, The Hong Kong Polytechnic University, Hong Kong, February 2018.
- A New Numerical Approach for an Acoustic Fluid-Structure Interaction, 11th National Annual Meeting on Computational Mathematics, Xi'an, July 2017.
- Multigrid Methods for Maxwell's Equations and a Quad-Curl Problem based on Hodge Decomposition, Mathematical Analysis of Metamaterials and Applications Workshop, Tsinghua Sanya International Mathematics Forum (TSIMF), Sanya, December 2016.
- Multigrid Methods for Two-Dimensional Maxwell's Equations based on Hodge Decomposition, International Conference on Computational Mathematics and Inverse Problems, Michigan Technological University, Houghton, MI. USA, August 2016.
- *IPDG and HDG Methods for the Helmholtz Equation*, The International Conference on Applied Mathematics 2016, City University of Hong Kong, May 2016.
- A Nonconforming Finite Element Method for a Fluid-Structure Interaction Problem, The International Congress on Industrial and Applied Mathematics (ICIAM), Beijing, August 2015.
- Multigrid Methods for Two-Dimensional Maxwell's Equations on Graded Meshes, Hong Kong Mathematical Society Annual Meeting, Chinese University of Hong Kong, May 2015.
- A Nonconforming Finite Element Method for a Fluid-Structure Interaction Problem, AMSS-PolyU Joint Research Institute 10th Anniversary Workshop, The Hong Kong Polytechnic University, February 2015.
- Finite Element Methods for Elliptic Boundary Value Problems, 5th Mathematical and Statistical Salon Series, The Hong Kong Polytechnic University, December 2014.
- Numerical Method for an Acoustic Fluid-Structure Interaction Problem, Copper Country Workshop on Numerical Analysis and Inverse Problems, Michigan Technological University, Houghton, MI, August 2013.
- *HDG Methods for the Helmholtz Equation*, South Central Conference on Advanced Numerical Methods and Applications, Little Rock, AR, April 2013.
- *HDG Methods for the Helmholtz Equation*, 2013 Joint Mathematics Meetings, San Diego, CA, January 2013.
- An Analysis of HDG Methods for the Helmholtz Equation, Finite Element Circus, Fall 2012, University of Pittsburgh, Pittsburgh, PA, October 2012.
- An Analysis of HDG Methods for the Three-Dimensional Stokes Problem, 2012 SIAM Annual Meeting, Minneapolis, MN, July 2012.

- (Poster) An Analysis of HDG Methods for the Vorticity-Velocity-Pressure Formulation of the Stokes Problem, 2012 John H. Barrett Lectures, University of Tennessee, Knoxville, TN, May 2012.
- Multigrid Methods for Two-Dimensional Maxwell's Equations on Graded Meshes,, Finite Element Circus, Spring 2012, Rutgers University, New Brunswick, NJ, April 2012.
- HDG Methods for the Vorticity-Velocity-Pressure Formulation of the Stokes Problem in Three Dimensions, 36th SIAM Southeastern-Atlantic Section Conference, Huntsville, AL, March 2012.
- HDG Methods for the Vorticity-Velocity-Pressure Formulation of the Stokes Problem, 2012 Joint Mathematics Meetings, Boston, MA, January 2012.
- HDG Methods for the Vorticity-Velocity-Pressure Formulation of the Stokes Problem, Finite Element Circus, Fall 2011, University of Connecticut, Groton, CT, October 2011.
- Multigrid Methods for Symmetric Discontinuous Galerkin Methods on Graded Meshes, 11th US National Congress on Computational Mechanics, Minneapolis, MN, July 2011.
- Multigrid Methods for Two-Dimensional Maxwell's Equations on Graded Meshes, 15th Copper Mountain Conference on Multigrid Methods, Copper Mountain, CO, March 2011.
- Hodge Decomposition and Maxwell's Equations, 2011 Joint Mathematics Meetings, New Orleans, LA, January 2011.
- *Multigrid Methods for Maxwell's Equations*, Postdoctoral Fellow Seminar Series, IMA, Institute for Mathematics and Its Applications, University of Minnesota, Minneapolis, MN, October 2010.
- Nonconforming Finite Element Methods for a Two-Dimensional Curl-Curl and Grad-Div Problem, Louisiana State University and University of Illinois at Chicago SIAM Student Chapters Conference, Louisiana State University, March 2010.
- Nonconforming Finite Element Methods for a Two-Dimensional Curl-Curl and Grad-Div Problem, 33rd SIAM Southeastern-Atlantic Section Conference, Columbia, SC, April 2009.
- Multigrid Methods for Symmetric Discontinuous Galerkin Methods on Graded Meshes, 14th Copper Mountain Conference on Multigrid Methods, Copper Mountain, CO, March 2009.
- Multigrid Methods for a Class of Discontinuous Galerkin Methods on Graded Meshes, 2009 Joint Mathematics Meetings, Washington, D.C., January 2009.
- Multigrid Solvers for Symmetric Interior Penalty Methods on Graded Meshes, 2008 SIAM Annual Meeting, San Diego, CA, July 2008.

### **Teaching Experience**

- The Hong Kong Polytechnic University
  - \* Mathematics II Semester 2, 2018/19
  - \* Mathematical Modelling for Science and Technology Semester 2, 2015/16, Semester 2, 2016/17, Semester 2, 2017/18
  - \* Calculus for Engineers
    Semester 1 & 2, 2014/15, Semester 1, 2015/16, Semester 1, 2016/17, Semester 1, 2017/18, Semester 1, 2018/19, Semester 1, 2019/20
  - \* Foundation Mathematics for Accounting and Finance Semester 1, 2014/15, Semester 1, 2015/16, Semester 1, 2016/17, Semester 1, 2017/18, Semester 1, 2018/19, Semester 1, 2019/20
  - \* Calculus I Semester 2, 2014/15
- University of Arkansas at Little Rock
  - \* Advanced Numerical Analysis, Spring 2014.
  - \* Advanced Linear Algebra, Spring 2014.
  - \* Partial Differential Equations, Fall 2013.
  - \* Calculus I, Fall 2012, Spring 2013, Fall 2013.
- Louisiana State University
  - \* Analytic Geometry and Calculus II, Spring 2009.
  - \* Analytic Geometry and Calculus I, Fall 2008.
  - \* Calculus with Business and Economic Applications, Spring 2007, Fall 2007, Spring 2008.

### **Professional Service**

- Deputy Service Teaching Co-ordinator, Department of Applied Mathematics, The Hong Kong Polytechnic University, 2018–present.
- Student Exchange Programme Officer, Department of Applied Mathematics, The Hong Kong Polytechnic University, 2014–2018.
- Member of Gold Committee, Department of Mathematics & Statistics, University of Arkansas at Little Rock, 2012–2014.

# Journal Referee Activities

- Mathematics of Computation
- SIAM Journal on Numerical Analysis
- IMA Journal of Numerical Analysis
- ESAIM: Mathematical Modelling and Numerical Analysis
- Journal of Scientific Computing
- Numerical Algorithms
- Journal of Computational and Applied Mathematics

## **Advising Activities**

- Chao Wang, Ph.D. Student, 2016–2019, as Chief Supervisor Thesis: *Efficient Numerical Methods for Quad-curl Problem and Fast Solvers* Current position: Postdoctoral Fellow, Southern University of Science and Technology, China
- Wei Liu, Postdoctoral Fellow, 2016–2017, The Hong Kong Polytechnic University
- CHAU Chun Fai, LAM Chi Ho, CHAN Hung Lok, LAU Wai shan, LEUNG Ka Man, CHAN Yoha Rebecca, LAM Ching Yee, TES Uen Lok.
   BSc (Hons) in Investment Science, Capstone Project, 2016/17, 2017/18, 2018/19, 2019/20. The Hong Kong Polytechnic University