

# Curriculum Vitae

## ZHONGYI HUANG

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### PERSONAL INFORMATION:

Born on Nov. 1, 1975 in Hunan Province, P.R. China.  
Nationality: Chinese.

### EDUCATION:

**Ph.D. & M.S., Tsinghua University, 1999**

*Dissertation:* The discrete method of separation of variables for solving the composite materials problems

*Advisor:* Professor Houde Han

**B.S., Tsinghua University, 1994**

### ACADEMIC EXPERIENCES:

#### Regular positions:

*Professor*, Tsinghua University, 12/2008 - date

*Associate Professor*, Tsinghua University, 12/2002 - 12/2008

*Assistant Professor*, Tsinghua University, 03/1999 - 12/2002

#### Visiting positions:

*Visiting Professor*, University of Mannheim, 7/2017

*Visiting Professor*, NCTS, NTHU, Taiwan, 7/2013-8/2013

*Visiting Professor*, KAUST, 2/2013

*Visiting Fellow*, Isaac Newton Institute for Mathematical Sciences, 8/2010-9/2010

*Visiting Professor*, University of Cambridge, 2/2008, 1/2009-2/2009, 9/2011-11/2011

*Visiting Professor*, University of Vienna, 2/2006, 2/2007

*Visiting Scholar*, University of Wisconsin-Madison, 9/2003-12/2003, 9/2007-2/2008

*Post Doc*, Princeton University, 9/2000-1/2002

### RESEARCH INTERESTS:

Computational methods for problems with multi-scale phenomena;

Artificial boundary methods for problems in unbounded domain;

Numerical Methods for Quantum Mechanics;

Big Data Science.

## **AWARDS & HONORS:**

National Science Fund for Excellent Young Scholars, 2013.

Basic Research Project for Young Talents, Tsinghua University, 2009.

Hemker Prize, (With Houde Han, R. Bruce Kellogg), 2008.

Beijing Science and Technology Awards, (with Houde Han, Weizhu Bao, Xiaonan Wu, Chunxiong Zheng and Xin Wen), 2002.

Teaching Awards of Tsinghua University, (with Tiecheng Li and Xiaofeng Wang), 2000.

“Chia-chiao Lin” Applied Mathematics scholarship, Tsinghua University, 1999.

## **GRANTS:**

Principal Investigator, Project Based Personnel Exchange Program with China Scholarship Council and German Academic Exchange Service for “Computational Modeling and Analysis for Complex Systems”, 2016-2017.

Co-Principal Investigator, NSFC - Project 91330203, for “Computational Methods for Multi-scale, Multi-physics Transport Problems in Hyperbolic Vehicles”, 2014-2017.

Principal Investigator, NSFC - Project 11322113, for “Multiscale modeling and computation”, 2014-2016.

Principal Investigator, NSFC-RFBR Joint Project 11211120151, for “Conservative finite-difference scheme for multi-dimensional Schrödinger equation with adaptive non-reflecting boundary conditions”, 2012-2013.

National Basic Research Program of China - Grant 2011CB309705, for “The Novel Computational Model for Petascale Scientific Computation”, 2011-2015.

Principal Investigator, NSFC - Project 11071139, for “Coupling methods for multi-scale problems based on eigenfunction expansion”, 2011-2013.

Co-Principal Investigator, NSFC - Project 10971116, for “Tailored finite point method and singular perturbation problems”, 2010-2012.

Principal Investigator, NSAF - Project 10676017, for “Study of the Euler Numerical Methods for Large deformation Multi-phase flow with high temperature and high density”, 2007-2009.

National Basic Research Program of China - Grant 2005CB321701, for “High Performance Scientific Computation Research”, 2005-2010.

Principal Investigator, NSFC - Project 10301017, for “Coupled Numerical Methods for Multi-scale Phenomena”, 2004-2006.

Principal Investigator, Scientific Foundation for Returned Overseas Chinese Scholars, Ministry of Education of China, 2004-2006.

Co-Principal Investigator, Basic Research Foundation of Tsinghua University- Project JC2003005, for Three Dimensional Finite Element Numerical Analysis for Geotectonic Structure, 2003-2006.

## **CONFERENCE SPEECHES:**

### **Invited:**

Chinese Mathematical Society 2017 Annual Conference, Xiangtan, China, Oct 20-24, 2017.

Workshop on “Reliable Methods of Mathematical Modeling”, Humboldt-Universität, Berlin, Germany, July 31 - August 04, 2017.

Workshop on “Mathematical and Computational methods for Quantum and Kinetic Problems”, Beijing Computational Science Research Center (CSRC), Beijing, China, June 11-14 2017.

Workshop on “Recent Advances in Scientific and Engineering Computation”, Shanghai Jiaotong University, Shanghai, China, May 4-7, 2017.

The 10th International Conference on Computational Physics (ICCP10), Macau SAR, China, January 16-20, 2017.

International Conference on Boundary and Interior Layers (BAIL 2016), Beijing Computational Science Research Center & Tsinghua University, Beijing, China, Aug 15-19, 2016.

The international conference on Nonlinear Partial Differential Equations and Scientific Computing, Beijing Computational Science Research Center (CSRC), Beijing, China, July 5-10, 2016.

International Conference on Nonlinear Partial Differential Equations: Theories, Numerics and Application, Hong Kong, China, May 21-23, 2016.

Workshop on Computational Quantum Systems at the Institute of Natural Sciences, Shanghai Jiao Tong University, Shanghai, China, December 18-20, 2015.

The 5th German-Chinese Workshop on Computational and Applied Mathematics, University of Augsburg, Germany, Sep 21-25, 2015.

The International Conference on Numerical Partial Differential Equations and Their Applications, May 25-29, 2015, Wuhan, China.

Workshop on ‘Mathematical and Computational Methods for Transport Equations’, Nov. 8-9, 2014, Shanghai Jiaotong University, Shanghai, China.

BAIL2014: Boundary and Interior Layers: Computational and Asymptotic Methods, Sep 15-19, 2014, Charles University, Prague, Czech Republic.

Workshop on Mathematical and Numerical Methods for Quantum, Kinetic and Nonlocal Problems, May 22-24, 2014, Beijing Computational Science Research Center (CSRC), Beijing.

The 9th Annual Conference of China Academy of Engineering Physics, Aug. 19-21, 2013, Mianyang, China.

Workshop on “Confined Quantum Systems: Modeling, Analysis and Computation”, Feb. 4-8, 2013, Wolfgang Pauli Institute (WPI), Vienna, Austria.

The Second Cross-straits Workshop on Computational Mathematics, Jul 27-30, 2012, National Sun Yat-sen University, Kaohsiung.

Workshop on “Semiclassical & multiscale aspects of wave propagation”, May 28-June 1, 2012, Heraklion, Crete, Greece.

International Conference on Boundary and Interior Layers: Computational and Asymptotic Methods, February 6-10, 2012, POSTECH, Korea.

Program on “Multiscale Modeling, Simulation, Analysis and Applications”, Nov 1, 2011 - Jan 20, 2012, Institute for Mathematical Sciences, National University of Singapore, Singapore.

“Fourth Chinese-German Workshop on Computational and Applied Mathematics”, Sep 26-30, 2011, South China Normal University, Guangzhou, China.

“Fifth Workshop on Frontiers in Computational and Applied Mathematics”, August 13-14, 2011, Shanghai Jiao Tong University, Shanghai, China.

“International Congress of Chinese Mathematicians (ICCM2010)”, December 17-22, 2010, Mathematical Sciences Center, Tsinghua University, Beijing, China.

“PDE Models for Quantum Fluids”, December 13-17, 2010, Isaac Newton Institute for Mathematical Sciences, University of Cambridge, UK.

“PDEs in kinetic theories: kinetic description of biological models”, November 8-12, 2010, International Centre for Mathematical Sciences (ICMS), Edinburgh, UK.

“The Second International Conference: Nonlinear Waves—Theory and Applications”, June 26-29, 2010, Beijing, China.

“7th China-Norway-Sweden Workshop on Computational Mathematics”, June 8-10, 2010, Bergen, Norway.

Workshop on “Frontiers in Computational and Applied Mathematics”, August 9-10, 2009, Tsinghua University, Beijing, China.

“Mathematical Theory and Numerical Methods for Computational Materials Simulation and Design”, July 1 — August 31, 2009, IMS, National University of Singapore, Singapore.

Enumath 2009: The eighth European Conference on Numerical Mathematics and Advanced Applications, Uppsala University, Uppsala, Sweden, June 29 - July 3, 2009.

ICOSAHOM 09: International Conference on Spectral and High Order Methods, June 22-26, 2009, Trondheim, Norway.

2009 Annual Conference of Chinese Mathematical Society, April 21-24, 2009, Xiamen, China.

Conference On “Modern Topics in Nonlinear Kinetic Equations”, University of Cambridge, UK, April 20-22, 2009.

Workshop on Computational Methods for Quantum, High Frequency and Seismic Waves, Tsinghua University, December 20-22, 2008.

International Workshop on The Gross-Pitaevskii equation and its application for BEC in optical lattices, Wolfgang Pauli Institute, Vienna, Austria, Sep. 24-27, 2008.

The first French-Chinese summer Institute, Fudan University, Shanghai, China, Sep. 1-21, 2008.

2008 Frontiers of computational and applied mathematics, University of Science and Technology of China, July 19-22, 2008.

The International Conference: Nonlinear Waves – Theory and Applications, Beijing, June 9-12, 2008.

Workshop on Frontiers in Computational and Applied Mathematics, Peking University, Beijing, China, Aug.4-5, 2007.

International Conference On Spectral and High Order Methods (ICOSAHOM07), Institute of Computational Mathematics Chinese Academy of Sciences, Beijing, China, June 18-22, 2007.

Workshop on High Frequency Wave Computation, Wolfgang Pauli Institute, Vienna, Austria, February 26-March 2, 2007.

Workshop on Scientific Computing, Tsinghua University, Beijing, China, July 13-14, 2006.

The Second Workshop on Multi-scale Modelling and Computation, Peking University, P. R. China, Aug.15 - 16, 2003.

International Conference on Scientific Computing and Partial Differential Equations, On the Occasion of Stanley Osher's 60th birthday. Hong Kong Baptist University, Hong Kong, December 12-15, 2002.

The First Workshop on Multi-scale Modelling and Computation, Peking University, P. R. China, Aug.3 - 4, 2002.

12th International Conference on Domain Decomposition Methods, Chiba University, Chiba, Japan, October 25-29, 1999.

**Organized:**

Workshop on Numerical Partial Differential Equations and Scientific Computing, Tsinghua University, Beijing, China, May 27-29, 2017.

International Conference on Boundary and Interior Layers (BAIL 2016), Beijing Computational Science Research Center & Tsinghua University, Beijing, China, Aug 15-19, 2016.

The 4th international conference on Nonlinear Waves – Theory and Applications, Tsinghua University, Beijing, China, June 25-28, 2016.

The 8th Workshop on "Frontiers in Computational and Applied Mathematics", Tsinghua University, Beijing, China, November 21-22, 2015.

The annual meeting of Beijing Society of Computational Mathematics, Aug 28, 2014, Tsinghua University, Beijing.

Mini-Symposium on "Multi-scale methods for Quantum mechanics and high frequency waves" in CSIAM2012, Aug. 20-22, 2012, Hefei, China.

Workshop on "Frontiers in Computational and Applied Mathematics", August 9-10, 2009, Tsinghua University, Beijing, China.

Workshop on Computational Methods for Quantum, High Frequency and Seismic Waves, Tsinghua University, December 20-22, 2008.

Workshop on Scientific Computing, Tsinghua University, Beijing, China, July 13-14, 2006.

International Workshop on Wave Propagations -On the occasion of George Papanicolaou's 60th Birthday, Tsinghua University, Beijing, China, June 7-10, 2004.

**INVITED COLLOQUIA/SEMINAR TALKS/SUMMER SCHOOLS:**

Peking University, 20 Apr., 2015.

Beijing Computational Science Research Center, 2 Mar. 2015.

Institute of Computational Mathematics and Scientific/Engineering Computing, CAS, 4 Sep. 2014.

National Center for Theoretical Sciences (12 hours summer course), Jul.-Aug. 2013.

Beijing Computational Science Research Center, Apr. 2013.

Beijing Institute of Applied Physics and Computational Mathematics, Oct., 2012.  
 Beijing Institute of Applied Physics and Computational Mathematics, Aug., 2012.  
 NCTS & NTHU Joint Seminar on Scientific Computation, National Tsing Hua University, Jul., 2012.  
 Beijing Institute of Applied Physics and Computational Mathematics, Jul., 2009.  
 Institute of Computational Mathematics and Scientific/Engineering Computing, CAS, Dec. 2008  
 University of Wisconsin-Madison, Sep. 2007.  
 University of Science and Technology of China, Apr. 2007.  
 Institute of Computational Mathematics and Scientific/Engineering Computing, CAS, Dec. 2006.  
 BICMR, Peking University, Oct. 2006.  
 RICAM, Austrian Academy of Sciences, Feb. 2006.  
 Dept. of Scientific & Engineering Computing, School of Mathematical Sciences, Peking University, Sep. 2005.  
 Institute of Computational Mathematics and Scientific/Engineering Computing, CAS, Dec. 2002.

#### **PROFESSIONAL SERVICES:**

Vice President of Beijing Society of Computational Mathematics, 1/2010 –

#### **EDITORIAL BOARDS:**

*Numerical Mathematics: A Journal of Chinese Universities*, 01/2007 –  
*Mathematica Numerica Sinica*, 2014.7-2020.6

#### **PUBLICATIONS:**

- [48] *The direct method of lines for elliptic problems in star-shaped domains*, (with Zhizhang Wu, Wei-Cheng Wang, Yi Yang), *J. Comput. Appl. Math.*, 327: 350-361, 2017.
- [47] *Tailored finite point method for parabolic problems*, (with Yi Yang), *Comput. Meth. Appl. Math.*, 16 (2016): 543-562.
- [46] *A Bloch decomposition-based stochastic Galerkin method for quantum dynamics with a random external potential*, (with Zhizhang Wu), *J. Comput. Phys.* 317 (2016): 257-275.
- [45] *Monotone finite point method for non-equilibrium radiation diffusion equations*, (with Y. Li), *BIT Numer. Math.* 56 (2016): 659-679.
- [44] *An equation decomposition based tailored finite point method for linearized incompressible flow in two dimensional space*, (with Y. Li, H. Han), *Comput. Meth. Appl. Math.* 15 (1): 39-58, 2015.
- [43] *Numerical simulations of X-rays Free Electron Lasers (XFEL)*, (with P. Antonelli, A. Athanassoulis, P. Markowich), *Multiscale Model. Simul.* 12 (4): 1607-1621, 2014.

- [42] *The Tailored finite point method*, (with H. Han), *Comput. Meth. Appl. Math.*, 14 (3): 321-345, 2014.
- [41] *A Semi-discrete tailored finite point method for a class of anisotropic diffusion problems*, (with H. Han and W. Ying), *Comput. Math. Appl.* 65 (11): 1760C1774, 2013.
- [40] *An Iterative Method based on equation decomposition for the fourth-order singular perturbation problem*, (with H. Han and S. Zhang), *Numer. Meth. Part. D. E.* 29 (3): 961-978, 2013.
- [39] *A class of nonconforming quadrilateral finite elements for incompressible flow*, (with Y. Li), *Sci. China Math.* 56 (2): 379-393, 2013.
- [38] *Tailored finite point method based on exponential bases for convection-diffusion-reaction equation*, (with H. Han), *Math. Comp.* 82 (281): 213-226, 2013.
- [37] *Gaussian Beam Methods for the Dirac Equation in the Semi-classical Regime.*, (with H. Wu, S. Jin and D. Yin), *Commun. Math. Sci.* 10 (4): 1301-1315, 2012
- [36] *Tailored finite cell method for solving Helmholtz equation in layered heterogeneous medium*, (with X. Yang), *J Comput. Math.* 30 (4): 381-391, 2012
- [35] *An equation decomposition method for the numerical solution of a fourth-order elliptic singular perturbation problem*, (with H. Han), *Numer. Meth. Part. D. E.*, 28 (3): 942-953, 2012.
- [34] *Tailored finite point method for numerical simulation of partial differential equations*, In L. Ji et al (eds.), *AMS/IP Studies in Advanced Mathematics*, Vol 51, Cambridge: AMS/IP. 2012, pp. 593-608
- [33] *Tailored finite point method for first order wave equation*, (with X. Yang), *J. Sci. Comput.*, 49 (3): 351-366, 2011.
- [32] *Tailored finite point method for steady-state reaction-diffusion equation*, (with H. Han), *Comm. Math. Sci.*, 8 (4): 887-899, 2010.
- [31] *Bloch Decomposition-Based Gaussian Beam Method for the Schrödinger equation with Periodic Potentials*, (with S. Jin, H. Wu and X. Yang), *J. Comput. Phys.*, 229 (13): 4869-4883, 2010.
- [30] *Numerical simulation of trapped dipolar quantum gases: Collapse studies and vortex dynamics*, (with P. Markowich, and C. Sparber), *Kinetic and Related Models*, 3 (1):181-194, 2010.
- [29] *Bloch Decomposition method for waves in periodic media*, (with S. Jin, P. Markowich, and C. Sparber), *Series in Contemporary Applied Mathematics*, CAM 15 (2010), *Some Problems on Nonlinear Hyperbolic Equations and Applications*, pp. 161-188.
- [28] *Tailored finite point method for a singular perturbation problem with variable coefficients in two dimensions*, (with H. Han), *J Sci. Comp.*, 41 (2): 200-220, 2009.
- [27] *Tailored finite point method for the interface problem*, *Networks and Heterogeneous Media*, 4 (1): 91-106, 2009.
- [26] *On the Bloch decomposition based spectral method for wave propagation in periodic media*, (with S. Jin, P. Markowich, and C. Sparber), *Wave Motion*, 46 (1): 15-28, 2009.

- [25] *A Hybrid Phase-Flow Method for Hamiltonian Systems with Discontinuous Hamiltonians*, (with S. Jin, H. Wu), SIAM J Scientific Computing, 31(2):1303-1321, 2008.
- [24] *A Tailored finite point method for the Helmholtz equation with high wave numbers in heterogeneous medium*, (with H. Han), J Comput. Math., 26 (5):728-739, 2008.
- [23] *A Tailored finite point method for a singular perturbation problem on an unbounded domain*, (with H. Han and B. Kellogg), J Sci. Comp., 36 (2): 243-261, 2008.
- [22] *Numerical simulation of the nonlinear Schroedinger equation with multi-dimensional periodic potentials*, (with S. Jin, P. Markowich, and C. Sparber), MMS, 7 (2): 539-564, 2008.
- [21] *Exact artificial boundary conditions for quasilinear elliptic equation in unbounded domains*, (with H. Han and D. Yin), Comm. Math. Sci., 6 (1): 71-82, 2008.
- [20] *Numerical solutions of Schrodinger equations in  $R^3$* , (with H. Han and D. Yin), Numer. Meth. For Diff. Eqns, 23 (3): 511-533, 2007.
- [19] *A Bloch decomposition based split-step pseudo spectral method for quantum dynamics with periodic potentials*, (with S. Jin, P. Markowich, and C. Sparber), SIAM J Scientific Computing, 29 (2): 515-538, 2007.
- [18] *Numerical Simulation for Crack Propagation in Two-Dimensional*, (in Chinese) (with Q. Liu), J. Tsinghua University, 46 (9): 1604-1607, 2006.
- [17] *Wavelet-Galerkin method for reaction-diffusion equation*, (in Chinese) (with X. Yang and L. Zhu), J. Tsinghua University, 46 (3): 392-395, 2006.
- [16] *Numerical Study of a Domain Decomposition Method For a Two-Scale Linear Transport Equation*, (with X. Yang, F. Golse, S. Jin), Networks and Heterogeneous Media, 1(1):143-166, 2006.
- [15] *A time-splitting spectral method for Maxwell-Dirac system*, (with S. Jin, P. Markowich, C. Sparber, C. Zheng), J. Comput. Phys., 208 (2): 761-789, 2005.
- [14] *Exact artificial boundary conditions for Schrodinger equation in  $R^2$* , (with H. Han) Comm. Math. Sci., 2 (1): 79-94, 2004.
- [13] *Heterogeneous multi-scale method: A general methodology for multi-scale modeling*, (with W. E and B. Engquist) Phys. Rev. B, 67 (9): 092101, 2003.
- [12] *High accuracy numerical method of thin-film problems in micromagnetics*, J Comput. Math. 21 (1): 33-40, 2003.
- [11] *A dynamic atomistic-continuum method for the simulation of crystalline materials*, (with W. E), J Comput. Phys. 182 (1): 234-261, 2002.
- [10] *Exact and Approximating Boundary Conditions for the Parabolic Problems on Unbounded Domains*, (with H. Han), Comput. Math. Appl., 44 (5-6): 655-666, 2002.
- [9] *A Class of Artificial Boundary Conditions for Heat Equation in Unbounded Domains*, (with H. Han), Comput. Math. Appl., 43 (6-7): 889-900, 2002.
- [8] *The discrete method of separation of variables for composite material problems*, (with H. Han), Int. J Fracture 112 (4): 379-402, 2001.
- [7] *Matching conditions in atomistic-continuum modeling of materials*, (with W. E), Phys. Rev. Lett., 87 (13): 5501-5504, 2001.



- [6] *Numerical simulations of fracture problems by coupling the FEM and the direct method of lines*, (with W.Z. Bao and H. Han), *Comput. Method Appl. Mech. Eng.*, 190 (37-38): 4831-4846, 2001.
- [5] *Wavelet-Galerkin method for the singular perturbation problem with boundary layers*, *Tsinghua Science & Technology*, 5(4): 365-369, 2000.
- [4] *The discrete method of separation of variables for computation of stress intensity factors*, (with H. Han and W.Z. Bao), *Chinese J Comp. Phys.*, 17(5): 483-496, 2000.
- [3] *The direct method of lines for the numerical solutions of interface problem*, (with H. Han), *Comput. Method Appl. Mech. Eng.*, 171(1): 61-75, 1999.
- [2] *A semi-discrete numerical procedure for composite material problems*, (with H. Han), *Mathematical Sciences and Applications Vol. 12(1999)*, *Advances in numerical mathematics*, pp. 35-44.
- [1] *A semi-discrete method for the solution of elliptic equation with singularities*, (with H. Han), *CSIAM98 VI: 17 (1998)*, pp.541-545.

**REFEREEING SERVICES:**

BIT Numerical Mathematics  
 Chinese Journal of Computational Physics  
 Communications in Computational Physics  
 CMES: Computer Modeling in Engineering & Sciences.  
 Computers and Mathematics with Applications  
 Computer Physics Communications  
 Engineering Analysis with Boundary Elements  
 IMA Journal of Numerical Analysis  
 International Journal of Computer Mathematics  
 Journal of Computational Mathematics  
 Journal of Computational Physics  
 Journal of Jilin University  
 Journal of Scientific Computing  
 Mathematical Methods in the Applied Sciences  
 Mathematics of Computation  
 Multiscale Modeling & Simulation  
 Numerical Mathematics: A Journal of Chinese Universities  
 Numerical Methods for Partial Differential Equations  
 Science China - Mathematics  
 SIAM J Numerical Analysis  
 etc.