

# Curriculum Vitae

HAO WU

Room A119, New Sciences Building  
Department of Mathematical Sciences  
Tsinghua University, Beijing, P.R. China 100084  
(86 10) 6278 5977  
hwu@tsinghua.edu.cn  
<http://faculty.math.tsinghua.edu.cn/~hwu/>  
<http://www.researcherid.com/rid/A-1195-2011>

**Personal Information** Born on Jan. 1983 in Anhui Province, P.R. China.

## Education Experiences

- Ph.D. in Applied Mathematics, Tsinghua University, Jul. 2009.
  - Thesis Advisor: Prof. Shi Jin
  - Thesis Title: Fast computational methods for high frequency waves
- B.S. in Mathematics, Tsinghua University, Jul. 2004.

## Research Interests

- Inverse Problem in Seismology
- Optimal Transport Problems
- High Frequency Waves
- Big Data, Deep Learning and Quantitative Finance

## Academic Experiences

- Regular position
  - Associate Professor (tenured), Dec. 2016 - , Department of Mathematical Sciences, Tsinghua University.
  - Associate Professor (tenure track), Dec. 2013 - Nov. 2016, Department of Mathematical Sciences, Tsinghua University.
  - Assistant Professor, Jun. 2011 - Nov. 2013, Department of Mathematical Sciences, Tsinghua University.
  - Research Associate, Jul. 2009 - May. 2011, Department of Mathematical Sciences, Tsinghua University.
- Visiting positions
  - Visiting fellow of the program (Partial Differential Equations in Kinetic Theories), Isaac Newton Institute for Mathematical Sciences, University of Cambridge, UK, Sep. 2010 and Dec. 2010.
  - Postdoctoral fellow(Supervisor: Prof. Naoufel Ben Abdallah), Institute of Mathematics, University of Paul Sabatier(Toulouse III), France, Nov. 2009 – Oct. 2010.

- Visiting student, Mathematics Department, University of Wisconsin-Madison, USA, Sep. 2007 – Aug. 2008.
- Visiting student, Wolfgang Pauli Institute, University of Vienna, Austria, Feb. 2007 – Mar. 2007.

## Services

- Assistant Dean, Department of Mathematical Sciences, Tsinghua University, Sep. 2017 -
- Member of Education Committee of China Society for Industrial and Applied Mathematics, Dec. 2016 -

## Awards

- Academic
  - [1] Award of nomination for Excellent Doctoral Dissertation of China, Academic Degrees Committee of the State Council, 2012.
  - [2] Excellent Youth Paper Award, Chinese Society for Computational Mathematics, 2011.
  - [3] Excellent Doctoral Dissertation and Outstanding Ph.D. Graduation Award, Tsinghua University, 2009.
- Teaching and Service
  - [4] Excellent Youth-Teaching Award, Tsinghua University, 2017.
  - [5] Outstanding award of Class tutor, Tsinghua University, 2015.
  - [6] Meritorious award of Class tutor, Tsinghua University, 2013.
  - [7] Outstanding award for Youth-Teaching Contest of Universities in Beijing, Educational Committee of Beijing, 2013.
  - [8] Outstanding award for Youth-Teaching Contest of Tsinghua University, Tsinghua University, 2013.

## Research Grants

- Current Grants
  - [1] PI, NSFC Project 11871297, *On the mathematical theory and fast algorithm in waveform based earthquake location*, 2019-2022.
  - [2] Participator, National Key Research and Development Program 2017YFC1500301, *The full waveform inversion for the 3D lithosphere and upper mantle structure in Sichuan-Yunnan region*, 2018-2021.
  - [3] Participator, NSFC Project 41390452, *Math-physics models for the unconventional oil/gas reservoirs and their solutions*, 2014-2018.
- Past Grants
  - [3] PI, NSFC Project 11101236, *Efficient and accurate schemes for Schrödinger equation with discontinuous potential*, 2012-2014.
  - [4] PI, SRF for ROCS-SEM, *Efficient numerical methods for Schrödinger equation with singular potential*, 2013-2015.

- [5] Participator, NSFC Project 91330203, *Computational Methods for Multi-scale, Multi-physics Transport Problems in Hyperbolic Vehicles*, 2014-2017.
- [6] Participator, NSFC Project 41230210, *The full waveform inversion for lithosphere structure and its applications*, 2013-2017.
- [7] Participator, NSFC Project 11071139, *Coupling methods for multiscale problems based on eigenfunction expansion*, 2011-2013.
- [8] Participator, NSFC Project 10971115, *Numerical simulation of waves in periodic structures*, 2010-2012.
- [9] Participator, NSAF Project 10676017, *Study of the Euler numerical methods for large deformation multi-phase flow with high temperature and high density*, 2007-2009.

### Former Students

- [1] Dr. Xijun He, Ph.D. in Jul. 2015, co-advisor. First job after graduation: China Aerospace Science and Industry Group.
- [2] Ms. Zhongjun Wu, Msc Degree in Jul. 2015 (Outstanding Master Graduation Award in Beijing). First job after graduation: The People's Bank of China, Kunming Central Sub-branch.

### Current Students

- [1] Mr. Jing Chen, Ph.D. student since Sep. 2016.
- [2] Ms. Yijia Tang, Ph.D. student since Sep. 2016, co-advisor.
- [3] Mr. Guoxu Chen, Ph.D. student since Sep. 2018.
- [4] Mr. Zhengyang Li, Ph.D. student since Sep. 2018.
- [5] Ms. Wanyi Zheng, Master student since Sep. 2017.

### Research Activities

- Conference speeches and posters
  - [1] *The 2018 Annual meeting of Chinese Geoscience Union Mini-symposium on "Topic 42. Seismic wave propagation and imaging"*, Beijing International Convention Center, Oct 21-24, 2018. **(contributed talk)**
  - [2] *Scientific Computing Forum*, The Institute of Computational Mathematics and Scientific/Engineering Computing of Chinese Academy of Sciences, Beijing, China, Sep. 28-29, 2018. **(invited talk)**
  - [3] *The 9th International Conference on Partial Differential Equations & Numerical Analysis*, Hunan Normal University, Changsha, Hunan, Sep. 9-12, 2018. **(invited talk)**
  - [4] *Forum on Applied and Computational Mathematics*, Beijing Computational Science Research Center, Beijing, China, Jul. 22-23, 2018. **(invited talk)**
  - [5] *Workshop on Frontiers in Numerical Methods and Theories*, Sichuan University, Chengdu, Sichuan, China, Jun. 8-11, 2018. **(invited talk)**

- [6] *The 2017 Annual meeting of Chinese Geoscience Union Mini-symposium on “Topic 50. Seismic wave propagation and imaging”*, Beijing International Convention Center, Oct 15-18, 2017. **(contributed talk)**
- [7] *CSRC Summer School on Applied Inverse Problems*, Beijing Computational Science Research Center (CSRC), Beijing, China, Aug. 7-11, 2017. **(invited talk)**
- [8] *The 2017 annual meeting of NSFC key project “Computational Methods for Multi-scale, Multi-physics Transport Problems in Hyperbolic Vehicles”*, Shanghai Jiao Tong University, Shanghai, China, May 20, 2017. **(invited talk)**
- [9] *Workshop on Recent Advances in Scientific and Engineering Computation*, Shanghai Jiao Tong University, Shanghai, China, May 4-7, 2017. **(invited talk)**
- [10] *The 10th International Conference on Computational Physics Mini-symposium on “C4. Numerical Methods of Nonlinear Problems”*, Macao SAR, Jan. 16-20, 2017. **(invited talk)**
- [11] *The 2016 Annual meeting of Chinese Geoscience Union Mini-symposium on “Topic 46. Seismic wave propagation and imaging”*, Beijing International Convention Center, Oct. 14-18, 2016. **(invited talk)**
- [12] *2016 Workshop of Beijing-Tianjin-Hebei Society for Computational Mathematics*, Tianjing, China, Sep. 1-3, 2016. **(invited talk)**
- [13] *The Fourth International Conference Nonlinear Waves - Theory and Applications Mini-symposium on “MS3: Analysis, Modeling, and Numerical Methods for High Frequency Waves”*, Beijing, China, Jun. 25-28, 2016. **(invited talk)**
- [14] *Workshop on Frontiers in Computational and Applied Mathematics*, Tsinghua University, Beijing, China, Nov. 21-22, 2015. **(invited talk)**
- [15] *The 9th International Conference on Computational Physics Mini-symposium on “A1. Numerical Methods for Kinetic Equations” and “A2. Numerical Simulation of Quantum and Kinetic Problems”*, National University of Singapore, Singapore, Jan. 7-11, 2015. **(invited talk)**
- [16] *Workshop on Mathematical and Numerical Methods for Quantum, Kinetic and Non-local Problems*, Beijing Computational Science Research Center, Beijing, China, May 22-24, 2014. **(invited talk)**
- [17] *The 12th Quadrennial meeting of Chinese University Society for Computational Mathematics*, National University of Defense Technology, Changsha, Hunan, China, Oct. 19-23, 2013. **(contributed talk)**
- [18] *2013 Workshop of Beijing Society for Computational Mathematics*, Beijing, China, Sep. 6, 2013. **(contributed talk)**
- [19] *2012 Workshop of Beijing Society for Computational Mathematics*, Weihai, Shandong, China, Jul. 6-8, 2012. **(invited talk)**
- [20] *SIAM Conference on Nonlinear Waves and Coherent Structures Mini-symposium on “Computational High Frequency Waves”*, Seattle, USA, Jun. 13-16, 2012. **(invited talk)**
- [21] *International Conference in Applied Mathematics*, Shanghai Jiao Tong University, Shanghai, China, Apr. 16-22, 2012. **(invited talk)**

- [22] *The 9th Quadrennial meeting of Chinese Society for Computational Mathematics*, Zhengzhou, China, Sep. 19-22, 2011. **(contributed talk)**
  - [23] *The fifth Workshop of Young Chinese Computational Mathematicians*, Shanghai Jiao Tong University, Shanghai, China, Aug. 13-14, 2011. **(invited talk)**
  - [24] *2011 International Conference on Applied Mathematics and Interdisciplinary Research*, Nankai University, Tianjin, China, Jun 13-16, 2011. **(contributed talk)**
  - [25] *Kinetic Models of Classical and Quantum Particle Systems: a Conference in the Memory of Naoufel Ben Abdallah*, Toulouse, France, Mar. 14-18, 2011. **(invited talk)**
  - [26] *International Congress of Chinese Mathematicians*, Tsinghua University, China, Dec. 17-22, 2010. **(contributed talk)**
  - [27] *PDE Models for Quantum Fluids*, Isaac Newton Institute for Mathematical Sciences, University of Cambridge, UK, Dec. 13-17, 2010. **(invited talk)**
  - [28] *ESF Research Conferences - Highly Oscillatory Problems: From Theory to Applications*, Isaac Newton Institute, University of Cambridge, UK, Sep. 12-17, 2010. **(contributed talk)**
  - [29] *2010 Frontiers of computational and applied mathematics*, Suzhou University, China, Jul. 31 - Aug. 1, 2010. **(invited talk)**
  - [30] *DEASE QUATRRAIN meeting: PDEs for Engineering NanoScience and Biology*, Hotel Le Royal Hammamet, Tunisia, May 17-21, 2010. **(invited talk)**
  - [31] *IP 2010 - MathNanoSci Intensive Programme*, University of L'Aquila, Italy, May 3-21, 2010. **(ten hours mini course)**
  - [32] *Workshop on Frontiers of Computational and Applied Mathematics*, Tsinghua University, China Aug. 9-10, 2009. **(invited talk)**
  - [33] *Workshop on Computational Methods for Quantum, High Frequency and Seismic Waves*, Tsinghua University, China, Dec. 20-21, 2008. **(invited talk)**
  - [34] *12th International Conference on Hyperbolic Problems: Theory, Numerics, Applications*, University of Maryland, College Park, USA, Jun. 9-13, 2008. **(contributed talk)**
  - [35] *Workshop on Multiscale Modeling, Analysis, and Simulations*, Michigan State Univ., East Lansing, USA, Mar. 27-28, 2008. **(presenting poster)**
- Conference Organized:
    - [1] *Computing approaches in imaging sciences*, Tsinghua University, Beijing, China, Dec. 1-2, 2018.
    - [2] *The Youth Forum in the 16th Annual Meeting of CSIAM*, Chengdu, Sichuan, China, Sep. 13-16, 2018.
    - [3] *Recent and Future Developments in Exploration of Deep Internal Structure of the Earth*, Guanfang Hotel, Mengzi, Honghe, Yunnan, China, Aug. 17-20, 2018.
    - [4] *The 6th Workshop on Tectonics and Geophysics in the east part of Tibetan Plateau & The 2018 Annual meeting of China Continental dynamics Committee of Chinese Geophysical Society & The 2018 Annual meeting of Solid Geophysics Committee of Chinese Geophysical Society*, Guanfang Hotel, Mengzi, Honghe, Yunnan, China, Aug. 15-19, 2018.

- [5] *Tsinghua Youth Forum on Pure Mathematics*, Tsinghua University, Beijing, China, Apr. 13-16, 2018. (Department Affairs)
  - [6] *Mathematical Model and Computation of Nonlinear Problems*, Tsinghua Sanya International Mathematics Forum, Sanya, Hainan, Jan. 15-19, 2018.
  - [7] *Tsinghua Forum of Mathematics Education for High School and University*, Tsinghua University, Beijing, China, Dec. 9, 2017. (Department Affairs)
  - [8] *The 2017 annual meeting of NSFC key project “Math-physics models for the unconventional oil/gas reservoirs and their solutions”*, Tsinghua University, Beijing, China, Dec. 15-17, 2017 .
  - [9] *The Youth Forum in the 15th Annual Meeting of CSIAM*, Qingdao, Shandong, China, Oct. 12-15, 2017.
  - [10] *Recent Developments in Seismic Wave Propagation, Imaging and the Continental Dynamics*, Yilong Binhai Hotel, Dali, Yunnan, China, Jul. 6-10, 2017.
  - [11] *The 2016 annual meeting of NSFC key project “Computational Methods for Multi-scale, Multi-physics Transport Problems in Hyperbolic Vehicles”*, Tsinghua University, Beijing, China, Jun. 3-4, 2016.
  - [12] *The 2015 annual meeting of NSFC key project “The full waveform inversion for lithosphere structure and its applications”*, Tsinghua University, Beijing, China, Dec. 18, 2015.
  - [13] *The 2015 annual meeting of NSFC key project “Computational Methods for Multi-scale, Multi-physics Transport Problems in Hyperbolic Vehicles”*, Tsinghua University, Beijing, China, Jul. 10, 2015.
  - [14] *The 8th International Conference on Computational Physics Mini-symposium on “Computational high frequency waves and related problems”*, Hong Kong, Jan. 7-11, 2013.
  - [15] *The 12th Biennially Conference of CSIAM Mini-symposium on “Multiscale computational methods in quantum mechanics and high frequency waves”*, USTC, Hefei, China, Aug. 19-24, 2012.
- Invited colloquia and seminar talks
    - [1] The Institute of Computational Mathematics and Scientific/Engineering Computing of Chinese Academy of Sciences, Jun. 2018.
    - [2] Laboratory of Computation Physics, Institute of Applied Physics and Computational Mathematics, Jun. 2018.
    - [3] The Institute of Computational Mathematics and Scientific/Engineering Computing of Chinese Academy of Sciences, Jun. 2017.
    - [4] Yau Mathematical Sciences Center, Tsinghua University, May 2017.
    - [5] School of Mathematical Sciences, Peking University, Apr. 2017.
    - [6] Beijing Computational Science Research Center, Jul. 2015.
    - [7] The Institute of Computational Mathematics and Scientific/Engineering Computing of Chinese Academy of Sciences, May 2015.
    - [8] Department of Automation, Tsinghua University, Jun. 2013.
    - [9] Department of Mathematics and Computer Science, Freie Universität Berlin, Dec. 2008.

• Conference Attended:

- [1] *Workshop of Numerical Methods and Applications*, Xiamen Hotel, Xiamen, Fujian, China, Nov. 2-4, 2018.
- [2] *Belt and Road Forum for Young Scientist & Technologist*, Chengdu, Sichuan, China, Sep. 30-31, 2018.
- [3] *2018 Workshop of Beijing-Tianjin-Hebei Society for Computational Mathematics*, Hengshui, Hebei, China, Aug. 24-28, 2018.
- [4] *International Conference on Applied Math and Computational Neuroscience in Memory of David Cai*, Shanghai Jiao Tong University (SJTU), Shanghai, China, Jul. 23-27, 2018.
- [5] *Modeling and Simulation of Interface-related Problems*, Institute for Mathematical Sciences, National University of Singapore, Apr. 30 - May 3, 2018.
- [6] *The 2018 annual meeting of National Key Research and Development Program "The underground Velocity structure model, the Deformation characteristics and Seismogenic zone of Sichuan-Yunnan region"*, University of Chinese Academy of Sciences, Beijing, China, Mar. 17-18, 2017.
- [7] *Workshop on Seismology*, Baiyin, Gansu, China, Sep. 22-25, 2017.
- [8] *Workshop on Numerical Partial Differential Equations and Scientific Computing — On the occasion of Prof. Houde Han's 80th Birthday*, Tsinghua University, Beijing, China, May 27-28, 2017.
- [9] *The Seventh International Congress of Chinese Mathematicians*, Beijing, China, Aug. 7-11, 2016.
- [10] *Computational Seismology*, Tsinghua Sanya International Mathematics Forum, Sanya, Hainan, Jan. 4-8, 2016.
- [11] *2015 Workshop of Beijing Society for Computational Mathematics*, Beijing, China, Jul. 30-31, 2015.
- [12] *8th International Congress on Industrial and Applied Mathematics*, Beijing, China, Aug. 10-14, 2015.
- [13] *2008 AMS Spring Central Section Meeting*, Bloomington, IN, Apr. 5-6, 2008.
- [14] *2007-2008 Program on Random Media, Interface Problems Workshop*, Radisson Hotel in Research Triangle Park, NC, Nov. 15-16, 2007.
- [15] *2007 AMS Fall Central Section Meeting*, Chicago, IL, Oct. 5-6, 2007.
- [16] *Workshop on Computational High Frequency Waves*, Wolfgang Pauli Institute, Univ. of Vienna, Austria, Feb. 21-23, 2007.
- [17] *2006 International Conference on Applied Mathematics and Interdisciplinary Research*, Univ. Nankai, Tianjin, China, Jun. 12-15, 2006.

## Publications

- [1] S. Jin, H. Wu and Z.Y. Huang, *A Hybrid Phase-Flow Method for Hamiltonian Systems with Discontinuous Hamiltonians*, SIAM Journal on Scientific Computing, 31(2008), no. 2, pp. 1303-1321.

- [2] S. Jin, H. Wu and X. Yang, *Gaussian Beam Methods for the Schrödinger Equation in the Semi-classical Regime: Lagrangian and Eulerian Formulations*, Communications in Mathematical Sciences, 6(2008), no. 4, pp. 995-1020.
- [3] S. Jin, H. Wu and X. Yang, *A numerical study of Gaussian beam methods for the Schrödinger-Poisson equations*, Journal of Computational Mathematics, 28(2010), no. 2, pp. 261-272.
- [4] S. Jin, H. Wu, X. Yang and Z.Y. Huang, *Bloch Decomposition-Based Gaussian Beam Method for the Schrödinger equation with Periodic Potentials*, Journal of Computational Physics, 229(2010), no. 13, pp. 4869-4883.
- [5] S. Jin, H. Wu and X. Yang, *Semi-Eulerian and High Order Gaussian Beam Methods for the Schrödinger Equation in the Semiclassical Regime*, Communications in Computational Physics, 9(2011), no. 3, pp. 668-687.
- [6] H. Wu and X. Yang, *A Hybrid Phase-Flow Method for solving the Liouville Equation in Bounded Domain*, SIAM Journal on Numerical Analysis, 49(2011), no. 2, pp. 733-754.
- [7] N. Ben Abdallah and H. Wu, *A generalized stationary algorithm for resonant tunneling: multi-mode approximation and high dimension*, Communications in Computational Physics, 10(2011), no. 4, pp. 882-898.
- [8] H. Wu, *High order scheme for Schrödinger equation with discontinuous potential I: immersed interface method*, Numerical Mathematics: Theory, Methods and Applications, 4(2011), no. 4, pp. 576-597.
- [9] H. Wu, Z.Y. Huang, S. Jin and D.S. Yin, *Gaussian beam methods for the Dirac equation in the Semi-classical Regime*, Communications in Mathematical Sciences, 10(2012), no. 4, pp. 1301-1315.
- [10] H. Wu and X. Yang, *Eulerian Gaussian beam method for high frequency wave propagation in the reduced momentum space*, Wave Motion, 50(2013), no. 6, pp. 1036-1049.
- [11] X.J. He, D.H. Yang and H. Wu, *Numerical dispersion and wave-field simulation of the Runge-Kutta discontinuous Galerkin method*, Chinese Journal of Geophysics-Chinese Edition, 57(2014), no. 3, pp. 906-917.
- [12] X.J. He, D.H. Yang and H. Wu, *A weighted Runge-Kutta discontinuous Galerkin method for wavefield modelling*, Geophysical Journal International, 200(2015), no. 3, pp. 1389-1410.
- [13] J.T. Huang, H. Wu and W.A. Yong, *On Initial Conditions for the Lattice Boltzmann Method*, Communications in Computational Physics, 18(2015), no. 2, pp. 450-468.
- [14] H. Jing, D.H. Yang and H. Wu, *Dynamic inversion method based on the time-staggered stereo-modeling scheme and its acceleration*, Geophysical Journal International, 207(2016), no. 3, pp. 1675-1687.
- [15] J.S. Li, D.H. Yang, H. Wu and X. Ma, *A low-dispersive method using the high-order stereo-modeling operator for solving wave equations*, Geophysical Journal International, 210(2017), no. 3, pp. 1938-1964.
- [16] H. Wu, J. Chen, X.Y. Huang and D.H. Yang, *A new earthquake location method based on the waveform inversion*, Communications in Computational Physics, 23(2018), no. 1, pp. 118-141.



- [17] J. Chen, Y.F. Chen, H. Wu and D.H. Yang, *The quadratic Wasserstein metric for Earthquake Location*, Journal of Computational Physics, 373(2018), pp. 188-209.
- [18] H. Wu, J. Chen, H. Jing, P. Tong and D.H. Yang, *The auxiliary function method for waveform based earthquake location*, arXiv:1706.05551, 2017.

## Teaching

- Academic Year 2018-2019 (160 hours in total)
  - [1] Methods of Mathematical physics (64 hours), Fall 2018.
  - [2] Functions of Complex Variables and Equations of Mathematical Physics (48 hours + 48 hours), Fall 2018.
- Academic Year 2017-2018 (160 hours in total)
  - [1] Numerical Solutions for Partial Differential Equations (64 hours), Spring 2018.
  - [2] Functions of Complex Variables and Equations of Mathematical Physics (48 hours + 48 hours), Fall 2017.
- Academic Year 2016-2017 (160 hours in total)
  - [1] Numerical Solutions for Partial Differential Equations (64 hours), Spring 2017.
  - [2] Functions of Complex Variables and Equations of Mathematical Physics (48 hours + 48 hours), Fall 2016.
- Academic Year 2015-2016 (192 hours in total)
  - [1] Introduction of Scientific Computing with Matlab (32 hours), Summer 2016.
  - [2] Numerical Solutions for Partial Differential Equations (64 hours), Spring 2016.
  - [3] Functions of Complex Variables and Equations of Mathematical Physics (48 hours + 48 hours), Fall 2015.
- Academic Year 2014-2015 (208 hours in total)
  - [1] Computing Practice (48 hours), Summer 2015.
  - [2] Numerical Solutions for Partial Differential Equations (64 hours), Spring 2015.
  - [3] Functions of Complex Variables and Equations of Mathematical Physics (48 hours + 48 hours), Fall 2014.
- Academic Year 2013-2014 (160 hours in total)
  - [1] Computing Practice (48 hours), Summer 2014.
  - [2] Numerical Solutions for Partial Differential Equations (64 hours), Spring 2014.
  - [3] Functions of Complex Variables and Equations of Mathematical Physics (48 hours), Fall 2013.
- Academic Year 2012-2013 (144 hours in total)
  - [1] Computing Practice (48 hours), Summer 2013.
  - [2] Stochastic Mathematical Methods (48 hours), Spring 2013.
  - [3] Stochastic Mathematical Methods (48 hours), Fall 2012.
- Academic Year 2011-2012 (144 hours in total)

- [1] Computing Practice (48 hours), Summer 2012.
- [2] Stochastic Mathematical Methods (48 hours), Spring 2012.
- [3] Stochastic Mathematical Methods (48 hours), Fall 2011.