

Wei Su

Research Associate

The University of Edinburgh

Affiliation: Institute for Multiscale Thermofluids,
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Gender: Female

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Webpages: [Google Scholar](#), [Publons](#), [Personal homepage](#)

[†] information highlighted by red contains a hyperlink.

- My research focuses on the computational non-equilibrium gas dynamics, aiming to develop accurate and efficient numerical models and methods for gas kinetic equations and multiscale simulations.
- I have been applying my computational models and methods in a variety of engineering applications, e.g. micro/nano-flows, porous media flows, CO₂ storage, high-altitude flights, and vacuum technologies.
- I am also interested in the sophisticated modelling of non-equilibrium relaxation in shock-heated flow, occurring in the context of space exploration.
- My long-term research goal is to establish a powerful multiscale computational tool to enable the development of emerging technologies.

EDUCATION

PhD. Eng.

Beihang University

01/2015

Beijing, China

- in **Aerospace Propulsion Theory and Engineering**
- School of Astronautics & School of Advanced Engineering
- Supervisors: [Prof Guobiao Cai](#) (Beihang) & [Prof Alina Alexeenko](#) (Purdue)
- Thesis: ‘*Solving Boltzmann model equations with high-order Runge-Kutta discontinuous Galerkin method: the research and application*’
- Grade: A level

BSc. Eng.

Beihang University

07/2008

Beijing, China

- in **Aerospace Power Engineering**
- School of Astronautics
- GPA: 3.6/4.0

Undergraduate Training Program

ESTACA, School of Engineering

06/2008

Paris, France

- in **Computer Aided Engineering and Design**
- ECTS Letter Grade: A

EXPERIENCES

Research Associate 10/2020 - Present

Institute for Multiscale Thermofluids, The University of Edinburgh

Referee: [Prof Yonghao Zhang](#)

Edinburgh, UK

Research Associate 10/2018 - 09/2020

James Weir Fluids Laboratory, University of Strathclyde

Referee: [Prof Lei Wu](#)

Glasgow, UK

Visiting Researcher 10/2017 - 09/2018

James Weir Fluids Laboratory, University of Strathclyde

Referee: [Prof Lei Wu](#)

Glasgow, UK

Career Break 12/2016 - 09/2017

Family reason

Postdoctoral Researcher 11/2015 - 11/2016

Institute of Nanotechnology, National Research Council

Referee: **Dr Domenico Bruno**

Bari, Italy

Visiting PhD Student 09/2011 - 09/2012

School of Aeronautics and Astronautics, Purdue University

Referee: **Prof Alina Alexeenko**

West Lafayette, USA

AWARDS

Innovative Award for Young Researchers 2019 Northwestern Polytechnical University, China
Symposium on 'Modelling and Numerical Methods for Non-Equilibrium Transport Problem'

Referee: **Prof Kun Xu**

Postdoc Mobility Travel Grant 2017

Technical University of Munich, Germany

Travel fellowship for 50 (out of 273) worldwide participants in the 'Research Opportunity Week'

National Scholarship 2012

Chinese Government

Chinese national scholarship for the top 0.2% postgraduate students

International Scholarship 2011

Chinese Scholarship Council

Support my one-year visit at Purdue University, USA

Oversea Scholarship 2008

Beihang University, China

Support my half-year visit at ESTACA, France

Outstanding Student 2007

China Aerospace Science and Technology Corporation

Third-class industrial scholarship

Outstanding Academic Performance 2005/2006/2007

Beihang University, China

First-class scholarship for outstanding academic performance

Outstanding Student 2005

Shanghai Baosteel Group Corporation, China

Third-class industrial scholarship

GRANTS

National Science Foundation for Young Scientists

01/2014 – 12/2016

£ 30,000

Chinese Government

- 'The direct numerical simulation of Boltzmann model equations based on high-order Runge-Kutta discontinuous Galerkin method'
- As the Co-I, I participated in generating research ideas, writing the proposal and conducting research.
- Referee: **Dr Bijiao He** (PI)

Innovation Foundation for Postgraduate Students

09/2010 – 08/2011

£ 1,500

Beihang University

- 'Extension of the low diffusion particle method in simulating near continuum two-phase flow'
- I successfully obtained this personal grant to support my research.

UNDERGRADUATE TEACHING AND SUPERVISION

Undergraduate Teaching

2018/2019 & 2019/2020

ME301 Heat Transfer & Thermodynamics

University of Strathclyde

- served as a tutor to lead tutorials and mark examinations

Undergraduate Teaching

ME107/EF016 Experimental and Laboratory Skills: Wind Tunnel

2018/2019 & 2019/2020

University of Strathclyde

- served as a lecturer to independently run the lab for instruction and marking reports

4th-Year Undergraduate Projects

2018/2019

Co-supervision

University of Strathclyde

- 1. ‘The rarefied gas properties of porous media constructed by Sierpinski carpet and channel with rectangular obstacles’
- 2. ‘Investigation of gas flow through fractal structures’
- 3[‡]. ‘Investigation of rarefied gas flows through 2D Bifurcating channels using the BGK model of the Boltzmann equation’
- ‡ Best Project Award of Institute of Mechanical Engineers for Project 3

4th-Year Undergraduate Project

2014/2015

Supervision

Beihang University

- ‘RKDG based adaptive mesh for 1D Boltzmann kinetic model equation’
- as the mentor, I generated the topic from my PhD research and conducted day-to-day supervision.
- Excellent Project Awarded by School of Astronautics of Beihang University

PUBLICATIONS

Journal Publications

- [1] **W Su**, Y Zhang, L Wu (2021). Multiscale simulation of molecular gas flows by the general synthetic iterative scheme. *Computer Methods in Applied Mechanics and Engineering*. 373: 113548. DOI: [10.1016/j.cma.2020.113548](https://doi.org/10.1016/j.cma.2020.113548)
- [2] **W Su**, L Zhu, L Wu (2020). Fast convergence and asymptotic preserving of the general synthetic iterative scheme. *SIAM Journal on Scientific Computing*. 42(6): B1517-B1540. DOI: [10.1137/20M132691X](https://doi.org/10.1137/20M132691X)
- [3] P Wang, **W Su**, L Wu (2020). Thermal transpiration in molecular gas. *Physics of Fluids*, 32: 082005. DOI: [10.1063/5.0018505](https://doi.org/10.1063/5.0018505)
- [4] **W Su**, M T Ho, Y Zhang, L Wu (2020). GSIS: an efficient and accurate numerical method to obtain the apparent gas permeability of porous media. *Computers & Fluids*, 206: 104576. DOI: [10.1016/j.compfluid.2020.104576](https://doi.org/10.1016/j.compfluid.2020.104576)
- [5] M T Ho, J Li, **W Su**, L Wu, M Borg, Y Zhang (2020). Rarefied flow separation in microchannel with bends. *Journal of Fluid Mechanics*, 901: A26. DOI: [10.1017/jfm.2020.585](https://doi.org/10.1017/jfm.2020.585)
- [6] **W Su**, P Wang, Y Zhang, L Wu (2020). Implicit discontinuous Galerkin method for the Boltzmann equation with full collision operator. *Journal of Scientific Computing*, 82: 39. DOI: [10.1007/s10915-020-01139-7](https://doi.org/10.1007/s10915-020-01139-7)
- [7] **W Su**, L Zhu, P Wang, Y Zhang, L Wu (2020). Can we find steady-state solutions to multiscale rarefied gas flows within dozens of iterations? *Journal of Computational Physics*, 407: 109245. DOI: [10.1016/j.jcp.2020.109245](https://doi.org/10.1016/j.jcp.2020.109245)
- [8] **W Su**, P Wang, Y Zhang (2019). High-order hybridizable discontinuous Galerkin method for the gas kinetic equation. *International Journal of Computational Fluid Dynamics*, 33: 335-342. DOI: [10.1080/10618562.2019.1666110](https://doi.org/10.1080/10618562.2019.1666110) (Invited paper on the special issue of ‘Discontinuous Galerkin methods: new trends and applications’)
- [9] P Wang, **W Su**, L Zhu, Y Zhang (2019). Heat and mass transfer of oscillatory lid-driven flow in the continuum, transition and free molecular flow regimes. *International Journal of Heat and Mass Transfer*, 131: 291-300. DOI: [10.1016/j.ijheatmasstransfer.2018.11.060](https://doi.org/10.1016/j.ijheatmasstransfer.2018.11.060)
- [10] **W Su**, P Wang, H Liu, L Wu (2019). Accurate and efficient computation of the Boltzmann equation for Couette flow: influence of intermolecular potentials on Knudsen layer function and viscous slip coefficient. *Journal of Computational Physics*, 378: 573-590. DOI: [10.1016/j.jcp.2018.11.015](https://doi.org/10.1016/j.jcp.2018.11.015)

- [11] **W Su**, P Wang, Y Zhang, L Wu (2019). A high-order hybridizable discontinuous Galerkin method with fast convergence to steady-state solutions of the gas kinetic equation. *Journal of Computational Physics*, 376: 973-991. DOI: [10.1016/j.jcp.2018.08.050](https://doi.org/10.1016/j.jcp.2018.08.050)
- [12] P Wang, **W Su**, Y Zhang (2018). Oscillatory rarefied gas flow inside a three dimensional rectangular cavity. *Physics of Fluids*, 30: 102002. DOI: [10.1063/1.5052253](https://doi.org/10.1063/1.5052253)
- [13] W Liu, G Tang, **W Su**, L Wu, Y Zhang (2018). Rarefaction throttling effect: Influence of the bend in micro-channel gaseous flow. *Physics of Fluids*, 30: 082002. DOI: [10.1063/1.5037430](https://doi.org/10.1063/1.5037430)
- [14] P Wang, L Zhu, **W Su**, L Wu, Y Zhang (2018). Nonlinear oscillatory rarefied gas flow inside a rectangular cavity. *Physical Review E*, 97: 043103. DOI: [10.1103/PhysRevE.97.043103](https://doi.org/10.1103/PhysRevE.97.043103)
- [15] **W Su**, H Liu, Y Zhang, L Wu (2017). Rarefaction cloaking: Influence of the fractal rough surface in gas slider bearings. *Physics of Fluids*, 29: 102003. DOI: [10.1063/1.4999696](https://doi.org/10.1063/1.4999696)
- [16] **W Su**, D Bruno, Y Babou (2017). State-specific modeling of vibrational relaxation and nitric oxide formation in shock-heated air. *Journal of Thermophysics and Heat Transfer*, 32: 337-352. DOI: [10.2514/1.T5271](https://doi.org/10.2514/1.T5271)
- [17] **W Su**, S Lindsay, H Liu, L Wu (2017). Comparative study of the discrete velocity and lattice Boltzmann methods for rarefied gas flows through irregular channels. *Physical Review E*, 96: 023309. DOI: [10.1103/PhysRevE.96.023309](https://doi.org/10.1103/PhysRevE.96.023309)
- [18] **W Su**, Z Tang, B He, G Cai (2017). A stable Runge-Kutta discontinuous Galerkin solver for hypersonic rarefied gaseous flows based on 2D Boltzmann kinetic equations. *Applied Mathematics and Mechanics*, 38: 343-362. DOI: [10.1007/s10483-017-2177-8](https://doi.org/10.1007/s10483-017-2177-8)
- [19] **W Su**, A Alexeenko, G Cai (2015). A parallel Runge-Kutta discontinuous Galerkin solver for rarefied gas flows based on 2D Boltzmann kinetic equations. *Computers & Fluids*, 109: 123-136. DOI: [10.1016/j.compfluid.2014.12.015](https://doi.org/10.1016/j.compfluid.2014.12.015)
- [20] **W Su**, X He, G Cai (2013). Extension of the low diffusion particle method for near-continuum two-phase flow simulations. *Chinese Journal of Aeronautics*, 26: 37-46. DOI: [10.1016/j.cja.2012.12.010](https://doi.org/10.1016/j.cja.2012.12.010)
- [21] G Cai, **W Su**, F Hou (2012). Theoretical development for DSMC local time stepping technique. *Science China: Technological Sciences*, 55: 2750-2756. DOI: [10.1007/s11431-012-4913-7](https://doi.org/10.1007/s11431-012-4913-7)

Journal Submissions

- [22] Q Li, J Zeng, **W Su**, L Wu (2020). Uncertainty quantification in rarefied dynamics of molecular gas: rate effect of thermal relaxation. *Journal of Fluid Mechanics*. Submitted
- [23] L Zhu, X Pi, **W Su**, Y Zhang, L Wu (2020). General synthetic iteration scheme for gas-kinetic simulation of multi-scale rarefied gas flows. *Journal of Computational Physics*. Under review after minor revision. [ResearchGate](https://www.researchgate.net/publication/358111110)

Peer-Reviewed Conference Proceedings

- [24] **W Su**, D Bruno, Y Babou (2017). Investigations of vibrational kinetic relaxation within air shock wave plasma. *Journal of Physics: Conference Series*, 815: 012026. DOI: [10.1088/1742-6596/815/1/012026](https://doi.org/10.1088/1742-6596/815/1/012026)
- [25] **W Su**, D Bruno, Y Babou (2016). Vibrational specific simulation of nonequilibrium radiation from shock-heated air. *AIP Conference Proceedings*, 1786: 150001. DOI: [10.1063/1.4967642](https://doi.org/10.1063/1.4967642)
- [26] **W Su**, B He, G Cai (2014). A stable Runge-Kutta discontinuous Galerkin solver for hypersonic rarefied gaseous flows. *AIP Conference Proceedings*, 1628: 980-987. DOI: [10.1063/1.4902700](https://doi.org/10.1063/1.4902700)
- [27] **W Su**, A Alexeenko, G Cai (2012). A Runge-Kutta Discontinuous Galerkin solver for 2D Boltzmann model equations: verification and analysis of computational performance. *AIP Conference Proceedings*, 1501: 381-388. DOI: [10.1063/1.4769547](https://doi.org/10.1063/1.4769547)

Posters

- [28] **W Su**, P Wang, Y Zhang, L Wu (2018). High-order hybridizable Discontinuous Galerkin method for the gas kinetic equation. *30th International Symposium on Rarefied Gas Dynamics*, July 2018, Glasgow, UK

TALKS

1. ‘Fast convergence and asymptotic preserving discontinuous Galerkin method for gas kinetic equation’ 14th World Congress in Computational Mechanics & ECCOMAS Congress, January 2021, Virtual congress
2. ‘Multiscale simulation of rarefied gas dynamics by the general synthetic iterative scheme’ 2020 International Workshop of UK Consortium on Mesoscale Engineering Sciences, December 2020, Virtual workshop
3. ‘Multiscale simulation of gas dynamics beyond Navier-Stokes limit’ Seminar series of Institute for Multiscale Thermofluids, December 2020, University of Edinburgh, Edinburgh, UK
4. ‘Solving the gas kinetic equation using synthetic iteration method’ 9th International Congress on Industrial and Applied Mathematics, July 2019, Valencia, Spain
5. ‘Can we find steady-state solutions to multiscale rarefied gas flows within dozens of iterations?’ 3th Symposium on Modelling and Numerical Methods for Non-Equilibrium Transport Problem, June 2019, Xi’an, China
6. ‘A high-order hybridizable discontinuous Galerkin method for gas kinetic equation’ 7th European Conference on Computational Fluid Dynamics, June 2018, Glasgow, UK
7. ‘Investigations of vibrational kinetic relaxation within air shock wave plasma’ 7th International Workshop on Radiation of High Temperature Gases in Atmospheric Entry, September 2016, Stuttgart, Germany
8. ‘Vibrational specific simulation of nonequilibrium radiation from shock-heated air’ 30th International Symposium on Rarefied Gas Dynamics, July 2016, Victoria BC, Canada
9. ‘A stable Runge-Kutta discontinuous Galerkin solver for hypersonic rarefied gaseous flows’ 29th International Symposium on Rarefied Gas Dynamics, July 2014, Xi’an, China
10. ‘A Runge-Kutta discontinuous Galerkin solver for 2D Boltzmann model equations’ 28th International Symposium on Rarefied Gas Dynamics, July 2012, Zaragoza, Spain

INDUSTRIAL PROJECTS

Chinese Academy of Space Technology

2009 – 2013

Main Participants Intensive group work with colleagues, professors and experts from industry

- 1. ‘Numerical and experimental analysis on the plume effects of CHANG’E-III main thruster during its landing’
- 2. ‘Numerical simulation on the plume effects of SHENZHOU-VIII spacecraft on TIANGONG-I space lab during docking and separating’
- 3[‡]. ‘Numerical study on the plume effects of a satellite’s thrusters’
- ‡ As the student leader, communicated with the industrial partner and led a group of 3 undergraduate students to complete Project 3

IN-HOUSE CODES

GSIS/GSIS-Poly

FORTRAN & OpenMP

‘Multi-scale simulation for monatomic/molecular gas flow by general synthetic iterative scheme’

DG-FSM

FORTRAN & OpenMP

‘1D/2D implicit DG solver combining FSM for the solution of the Boltzmann equation’

HDG

FORTRAN & OpenMP & MPI

‘2D HDG solver for the kinetic model equations and linearized Navier-Stokes equations’

RKDG

C/C++ & MPI

‘2D planar/axial RKDG solvers for the Boltzmann kinetic model equations’

StS

FORTRAN

'1D state-specific simulation solver for vibrational kinetics in shock-heated air'

DSMC-LD

C & MPI

'Coupled DSMC and low-diffusion particle solvers for multi-scale two-phase rarefied gas flow'

SERVICES

Peer-Review for Journals

*Journal of Computational Physics, Physics of Fluids, Computer & Fluids, Vacuum,
Advanced in Applied Mathematics and Mechanics,
International Journal of Computational Fluid Dynamics*

Voluntary

Coordinator for International Postgraduate Summer School in Aeronautics & Astronautics, Beihang University, 2009

Consultant to help first-year students integrating into the new environment, Beihang University, 2005 – 2008