Wei Su
Research Associate
The University of Edinburgh

Affiliation: Institute for Multiscale Thermofluids, School of Engineering, EH9 3FD, Edinburgh
Gender: Female
Email: wei.su@ed.ac.uk†
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, CO_2 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.	01/2015
Beihang University	*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.	07/2008
Beihang University	*Beijing, China*

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

Undergraduate Training Program	06/2008
ESTACA, School of Engineering	*Paris, France*

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

EXPERIENCES

Research Associate 10/2020 - Present		Referee: Prof Yonghao Zhang
Institute for Multiscale Thermofluids, The University of Edinburgh		*Edinburgh, UK*
Research Associate 10/2018 - 09/2020		Referee: Prof Lei Wu
James Weir Fluids Laboratory, University of Strathclyde		*Glasgow, UK*
Visiting Researcher 10/2017 - 09/2018		Referee: Prof Lei Wu
James Weir Fluids Laboratory, University of Strathclyde		*Glasgow, UK*

Career Break 12/2016 - 09/2017
Family reason

Postdoctoral Researcher 11/2015 - 11/2016 Referee: Dr Domenico Bruno
Institute of Nanotechnology, National Research Council *Bari, Italy*

Visiting PhD Student 09/2011 - 09/2012 Referee: Prof Alina Alexeenko
School of Aeronautics and Astronautics, Purdue University *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

4$^{\text{th}}$-Year Undergraduate Projects 2020/2021
Co-supervision *University of Edinburgh*

- · 'Heat conduction of rarefied gas through porous media'
- · Topic generate.

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   2018/2019 & 2019/2020
ME107/EF016 Experimental and Laboratory Skills: Wind Tunnel   *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] L Zhu, X Pi, **W Su**, Z Li, Y Zhang, L Wu (2021). General synthetic iterative scheme for nonlinear gas kinetic simulation of multi-scale rarefied gas flows. *Journal of Computatioinal Physics*. 430: 110091. DOI: 10.1016/j.jcp.2020.110091

[2] **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

[3] **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

[4] P Wang, **W Su**, L Wu (2020). Thermal transpiration in molecular gas. *Physics of Fluids*, 32: 082005. DOI: 10.1063/5.0018505

[5] **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

[6] 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

[7] **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

[8] **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

[9] **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 (Invited paper on the special issue of 'Discontinuous Galerkin methods: new trends and applications')

[10] 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

[11] **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

[12] **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

[13] 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

[14] **W Su**, D Bruno, Y Babou (2018). 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

[15] 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

[16] 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

[17] **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

[18] **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

[19] **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

[20] **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

[21] **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

[22] 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

Journal Submissions

[23] 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. ResearchGate

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

[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

[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

[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

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 Mesocale 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, Unversity 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