Wei SU
Assistant Professor

Division of Emerging Interdisciplinary Areas
Department of Mathematics

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RESEARCH INTERESTS

- Models and methods for gas/phonon kinetic equations and multiscale simulations
- High-order discontinuous Galerkin methods and high fidelity solutions
- Transport physics in micro-/nano-flows, high-altitude flights, vacuum sciences and semiconductors
- Sophisticated modelling of non-equilibrium thermochemical relaxation in shock-heated gases

EDUCATION

PhD. Eng. in *Aerospace Propulsion Theory and Engineering* — 2015
Beihang University — *China*

BSc. Eng. in *Aerospace Power Engineering* — 2008
Beihang University — *China*

Undergraduate Training Program in *Computer Aided Engineering and Design* — 2008
Ecole Supérieure des Techniques Aéronautiques et de Construction Automobile — *France*

EXPERIENCES

Assistant Professor — 08/2022 - present
EMIA & MATH, HKUST — *HK*

Research Associate — 10/2020 - 08/2022
Institute for Multiscale Thermofluids, University of Edinburgh — *UK*

Research Associate — 10/2018 - 09/2020
Department of Mechanical & Aerospace Engineering, University of Strathclyde — *UK*

Visiting Researcher — 10/2017 - 09/2018
Department of Mechanical & Aerospace Engineering, University of Strathclyde — *UK*

Postdoctoral Researcher — 11/2015 - 11/2016
Institute of Nanotechnology, National Research Council — *Italy*

Visiting PhD Student — 09/2011 - 09/2012
School of Aeronautics & Astronautics, Purdue University — *USA*

TEACHING

Under-/Post-graduate Teaching — *EMIA & MATH, HKUST*

· MATH2011 Introduction to Multivariable Calculus
· EMIA6500 Special Topics: Discontinuous Galerkin Methods

Undergraduate Teaching — *MAE, Strathclyde University*

· ME107/EF016 Experimental and Laboratory Skills: Wind Tunnel
· ME301 Heat Transfer & Thermodynamics

PUBLICATIONS

Peer-Reviewed Journals

[1] Z Shi, Y Zhao, **W Su**, L Wu (2023) Highly rarefied gas flows in rough channels of finite length. *AIP Advances.* Accepted.

[2] **W Su**, L Gibelli, J Li, M K Borg, Y Zhang (2023) Kinetic modelling of non-equilibrium flow of hard-sphere dense gases. *Physical Review Fluids*, 8: 013401. 10.1103/PhysRevFluids.8.013401

[3] J Liu, C Zhang, H Yuan, **W Su**, L Wu (2022) A fast-converging scheme for the phonon Boltzmann equation with dual relaxation times. *Journal of Computational Physics*, 467: 111436. 10.1016/j.jcp.2022.111436

[4] **W Su**, Q Li, Y Zhang, L Wu (2022) Temperature jump and Knudsen layer in rarefied molecular gas. *Physics of Fluids.* 34: 032010, 10.1063/5.0086076

[5] **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. 10.1016/j.cma.2020.113548

[6] Q Li, J Zeng, **W Su**, L Wu (2021) Uncertainty quantification in rarefied dynamics of molecular gas: rate effect of thermal relaxation. *Journal of Fluid Mechanics*, 917: A58. 10.1017/jfm.2021.338

[7] 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 Computational Physics*, 430: 110091. 10.1016/j.jcp.2020.110091

[8] **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. 10.1137/20M132691X

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

[10] **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. 10.1016/j.compfluid.2020.104576

[11] 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. 10.1017/jfm.2020.585

[12] **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. 10.1007/s10915-020-01139-7

[13] **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. 10.1016/j.jcp.2020.109245

[14] **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. 10.1080/10618562.2019.1666110 (On the special issue of 'Discontinuous Galerkin methods: new trends and applications')

[15] 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. 10.1016/j.ijheatmasstransfer.2018.11.060

[16] **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. 10.1016/j.jcp.2018.11.015

[17] **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. 10.1016/j.jcp.2018.08.050

[18] P Wang, **W Su**, Y Zhang (2018) Oscillatory rarefied gas flow inside a three dimensional rectangular cavity. *Physics of Fluids*, 30: 102002. 10.1063/1.5052253

[19] **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. 10.2514/1.T5271

[20] 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. 10.1063/1.5037430

[21] 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. 10.1103/PhysRevE.97.043103

[22] **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. 10.1063/1.4999696

[23] **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. 10.1103/PhysRevE.96.023309

[24] **W Su**, Z Tang, B He, G Cai (2017) Stable Runge-Kutta discontinuous Galerkin solver for hypersonic rarefied gaseous flows based on 2D Boltzmann kinetic equations. *Applied Mathematics and Mechanics*, 38: 343-362. 10.1007/s10483-017-2177-8

[25] **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. 10.1016/j.compfluid.2014.12.015

[26] **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. 10.1016/j.cja.2012.12.010

[27] G Cai, **W Su**, F Hou (2012) Theoretical development for DSMC local time stepping technique. *Science China: Technological Sciences*, 55: 2750-2756. 10.1007/s11431-012-4913-7

Preprints

[28] B Shan, **W Su**, L Gibelli, Y Zhang. Molecular kinetic modelling of non-equilibrium transport of surface-confined van der Waals fluids. Submitted to *Journal of Fluid Mechanics*.

[29] B Shan, L Ju, **W Su**, Z Guo, Y Zhang. Non-equilibrium flow of dense inhomogeneous fluids in nano-channels. Submitted to *Physics of Fluids*.

[30] J Zeng, **W Su**, L Wu. General synthetic iterative scheme for unsteady rarefied gas flows. Submitted to *Communications in Computational Physics*.

Peer-Reviewed Conference Proceedings

[31] **W Su**, D Bruno, Y Babou (2017) Investigations of vibrational kinetic relaxation within air shock wave plasma. *Journal of Physics: Conference Series*, 815: 012026. 10.1088/1742-6596/815/1/012026

[32] **W Su**, D Bruno, Y Babou (2016) Vibrational specific simulation of nonequilibrium radiation from shock-heated air. *AIP Conference Proceedings*, 1786: 150001. 10.1063/1.4967642

[33] **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. 10.1063/1.4902700

[34] **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. 10.1063/1.4769547

Posters

[35] **W Su**, M T Ho, Y Zhang, L Wu (2021) Multiscale simulation of gas transport in porous media. *25th International Congress of Theoretical and Applied Mechanics*, August 2021, online.

[36] **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

‡ **Invited talk**, § **keynote**

1†. 'Heat conduction of rarefied gas in porous media', *32th International Symposium on Rarefied Gas Dynamics*, 07/2022, Seoul, Korean.

2§. 'General synthetic iterative scheme for multiscale rarefied gas', *17th International Conference for Mesoscopic Methods in Engineering & Science*, 07/2021, online.

3†. 'Fast converging and asymptotic preserving method for multiscale rarefied gas flows', *International Workshop and Summer School on Kinetic Theory and Related Application, Beijing Computational Science Research Center*, 06/2021, online.

4†. 'GSIS: efficient and accurate methods for multiscale rarefied gas flows', *Academic Salons for Young Researchers, Chinese Society of Theoretical and Applied Mechanics*, 05/2021, online.

5†. 'Multiscale simulation of gas transport in porous media', *5th International Conference on Digital Core Analysis & The Workshop on Multiscale Numerical and Experimental Approaches for Multiphysics Problems in Porous Media*, 04/2021, online.

6. 'Fast convergence and asymptotic preserving discontinuous Galerkin method for gas kinetic equation', *14th World Congress in Computational Mechanics & ECCOMAS Congress*, 01/2021, online.

7. 'Multiscale simulation of rarefied gas dynamics by the general synthetic iterative scheme', *2020 International Workshop of UK Consortium on Mesocale Engineering Sciences*, 12/2020, online.

8. 'Multiscale simulation of gas dynamics beyond Navier-Stokes limit', *Seminar series of Institute for Multiscale Thermofluids*, 12/2020, University of Edinburgh, Edinburgh, UK.

9. 'Solving the gas kinetic equation using synthetic iteration method', *9th International Congress on Industrial and Applied Mathematics*, 07/2019, Valencia, Spain.

10. '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*, 06/2019, Xi'an, China.

11. 'A high-order hybridizable discontinuous Galerkin method for gas kinetic equation', *7th European Conference on Computational Fluid Dynamics*, 06/2018, Glasgow, UK.

12†. 'Solving Boltzmann model equations with high-order Runge-Kutta discontinuous Galerkin method', *Academic visit in School of Energy and Power Engineering of Xi'an Jiaotong University*, 10/2017, Xi'an China.

13. 'Investigations of vibrational kinetic relaxation within air shock wave plasma', *7th International Workshop on Radiation of High Temperature Gases in Atmospheric Entry*, 09/2016, Stuttgart, Germany.

14. 'Vibrational specific simulation of nonequilibrium radiation from shock-heated air', *30th International Symposium on Rarefied Gas Dynamics*, 07/2016, Victoria BC, Canada.

15. 'A stable Runge-Kutta discontinuous Galerkin solver for hypersonic rarefied gaseous flows', *29th International Symposium on Rarefied Gas Dynamics*, 07/2014, Xi'an, China.

16. 'A Runge-Kutta discontinuous Galerkin solver for 2D Boltzmann model equations', *28th International Symposium on Rarefied Gas Dynamics*, 07/2012, Zaragoza, Spain.