


Curriculum Vitae of Junming Duan


MATH-MCSS, School of Basic Sciences, École Polytechnique Fédérale de Lausanne (EPFL)
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Employment








Sep, 2021 – present  **Postdoc**, MCSS, École Polytechnique Fédérale de Lausanne (EPFL), Switzerland
Mentor: Prof. Jan S. Hesthaven

Education

Sep, 2016 – Jul, 2021  **Ph.D. in Computational Mathematics**, Peking University, China
Thesis title: *Entropy stable numerical methods for special relativistic (magneto)hydrodynamics*
Advisor: Prof. Huazhong Tang

Sep, 2012 – Jul, 2016  **B.Sc. in Information and Computing Science**, Peking University, China

Research Interests

-  Numerical methods for hyperbolic conservation laws
-  Computational fluid dynamics
-  High-order accurate numerical methods
-  Structure-preserving methods
-  Moving mesh methods
-  Reduced-order modeling
-  Data-driven methods and scientific machine learning

Research Publications

Journal Articles (Appeared or Accepted)

- 1 S.T. Li, **J.M. Duan**, and H.Z. Tang, High-order accurate entropy stable adaptive moving mesh finite difference schemes for (multi-component) compressible Euler equations with the stiffened equation of state, *Comput. Methods Appl. Mech. Engrg.*, 399: 115311, 2022. *arXiv:2202.07989*.
- 2 **J.M. Duan** and H.Z. Tang, High-order accurate entropy stable adaptive moving mesh finite difference schemes for special relativistic (magneto)hydrodynamics, *J. Comput. Phys.*, 456: 111038, 2022. *arXiv:2107.12027*.
- 3 **J.M. Duan** and H.Z. Tang, An analytical solution of the isentropic vortex problem in the special relativistic magnetohydrodynamics, *J. Comput. Phys.*, 456: 110903, 2022. *arXiv:2107.01966*.
- 4 **J.M. Duan** and H.Z. Tang, High-order accurate entropy stable finite difference schemes for the shallow water magnetohydrodynamics, *J. Comput. Phys.*, 431: 110136, 2021. *arXiv:2003.10081*.
- 5 **J.M. Duan** and H.Z. Tang, Entropy stable adaptive moving mesh schemes for 2D and 3D special relativistic hydrodynamics, *J. Comput. Phys.*, 426: 109949, 2021. *arXiv:2007.12884*.
- 6 **J.M. Duan** and H.Z. Tang, High-order accurate entropy stable nodal discontinuous Galerkin schemes for the ideal special relativistic magnetohydrodynamics, *J. Comput. Phys.*, 421: 109731, 2020. *arXiv:1911.03825*.

- 7 **J.M. Duan** and H.Z. Tang, High-order accurate entropy stable finite difference schemes for one- and two-dimensional special relativistic hydrodynamics, *Adv. Appl. Math. Mech.*, 12(1): 1-29, 2020. *arXiv:1905.06092*.
- 8 **J.M. Duan** and H.Z. Tang, An efficient ADER discontinuous Galerkin scheme for directly solving Hamilton-Jacobi equation, *J. Comput. Math.*, 38(1): 58-83, 2020. *arXiv:1901.10228*.
- 9 D. Ling, **J.M. Duan**, and H.Z. Tang, Physical-constraints-preserving Lagrangian finite volume schemes for one- and two-dimensional special relativistic hydrodynamics, *J. Comput. Phys.*, 396: 507-543, 2019. *arXiv:1901.10625*.
- 10 **J.M. Duan** and H.Z. Tang, A second-order accurate scheme for a kinetic equation of two-dimensional Vicsek swarming model, *Nat. Sci. J. Xiangtan Univ.*, 41(1): 1-14, 2019. (in Chinese)
- 11 **J.M. Duan**, Y.Y. Kuang, and H.Z. Tang, Model reduction of a two-dimensional kinetic swarming model by operator projections, *East Asian J. Appl. Math.*, 8(1): 151-180, 2018. *arXiv:1701.02888*.

Preprints

- 12 **J.M. Duan**, Q. Wang, and J.S. Hesthaven, Machine learning enhanced aerodynamic forces prediction based on sparse pressure sensor inputs, submitted to *AIAA J.*, 2023. *arXiv:2305.09199*.
- 13 J. Wang, **J.M. Duan**, Z.W. Ma, and W. Zhang, An adaptive moving mesh finite difference scheme for tokamak magneto-hydrodynamic simulations, submitted to *Comput. Phys. Commun.*, 2023.
- 14 Z.H. Zhang, **J.M. Duan**, and H.Z. Tang, High-order accurate well-balanced energy stable adaptive moving mesh finite difference schemes for the shallow water equations with non-flat bottom topography, submitted to *J. Comput. Phys.*, 2023. *arXiv:2303.06924*.
- 15 **J.M. Duan** and J.S. Hesthaven, Non-intrusive data-driven reduced-order modeling for time-dependent parametrized problems, submitted to *J. Comput. Phys.*, 2023. *arXiv:2303.02986*.

Awards & Honors

Jul, 2021	🏆	Outstanding Graduate of Peking University , Peking University
Dec, 2020	🏆	National Scholarship for Graduate Student , Chinese Ministry of Education
Oct, 2020	🏆	Merit Student of Peking University , Peking University
Aug, 2020	🏆	The First Prize in Outstanding Youth Paper Award of Beijing Society of Computational Mathematics , Beijing Society of Computational Mathematics
2019–2020	🏆	BICMR Scholarship for Graduate Student , Beijing International Center for Mathematical Research (BICMR), Peking University
2018–2020	🏆	President Scholarship for PhD Student , Peking University
Sep, 2019	🏆	Founder Scholarship , Peking University
Sep, 2017	🏆	DTZ Cushman & Wakefield Scholarship , Peking University
Jul, 2016	🏆	Outstanding Undergraduate of Peking University , Peking University





Conferences & Talks

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| Jun 19-21, 2023 | 🏆 | ECCOMAS YIC 2023: 7th Young Investigators Conference, University of Porto, Porto, Portugal. (Talk: <i>Non-intrusive data-driven reduced-order modeling for time-dependent parametrized problems</i>) |
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Conferences & Talks (continued)

- Jun 07, 2023 ■ Swiss Numerics Day 2023, Universität Bern, Bern, Switzerland. (Talk: *Machine learning enhanced aerodynamic forces prediction based on sparse pressure sensor inputs*)
- Jun 05-06, 2023 ■ MATHICSE Retreat, Bienne, Switzerland. (Talk: *Machine learning enhanced aerodynamic forces prediction based on sparse pressure sensor inputs*)
- Nov 17, 2022 ■ Invited talk to the Oberseminar host by Prof. Christian Klingenberg, online. (Talk: *Data-driven reduced-order modeling for time-dependent parametrized problems*)
- Aug 22-26, 2022 ■ MultiMat 2022: 10th International Conference on Numerical Methods for Multi-Material Fluid Flow, Universität Zürich, Zürich, Switzerland. (Talk: *High-order accurate entropy stable adaptive moving mesh methods*)
- Jun 27-29, 2022 ■ MATHICSE Retreat, Villars-sur-Ollon, Switzerland. (Talk: *High-order accurate entropy stable adaptive moving mesh methods*)
- Jun 05-07, 2021 ■ Symposium on High-Fidelity Numerical Simulation of Fluid Problems, Peking University, Beijing, China. (Talk: *Entropy stable schemes for RHD*)
- Dec 11-13, 2020 ■ Forum of Numerical Methods and Applications in Fluids, Xiangtan University, Xiangtan, China. (Talk: *Entropy stable adaptive moving mesh schemes for RHD*)
- Nov 14-15, 2020 ■ Student Forum of Chinese Society of Industrial and Applied Mathematics, online. (Talk: *Entropy stable adaptive moving mesh schemes for RHD*)
- Nov 06-08, 2020 ■ The National Mechanics Graduate Student Forum, Peking University, Beijing, China. (Talk: *High-order entropy stable DG schemes for RMHD*)
- Aug 30, 2020 ■ Selection of Excellent Young Scholar's paper of Beijing Society of Computational Mathematics, online. (Talk: *PCP Lagrangian scheme for RHD. The first prize.*)
- Jan 10-13, 2020 ■ Trends of High-Order Numerical Methods for Computational Fluid Dynamics and Their Applications, Beijing, China. (Attended)
- Nov 29-Dec 01, 2019 ■ Annual Meeting on High Resolution Method for Multi-Material Hydrodynamics of Science Challenge Project, Xiamen University, Xiamen, China. (Talk: *PCP Lagrangian scheme for RHD*)
- Sep 25-27, 2019 ■ Sino-German Workshop on Advanced Numerical Methods for Hyperbolic Balance Laws, Beijing Institute of Applied Physics and Computational Mathematics, Beijing, China. (Attended)
- Aug 28-30, 2019 ■ Workshop on Numerical Methods for Complex Physical Problems, Nanjing University of Aeronautics and Astronautics, Nanjing, China. (Talk: *High-order entropy stable finite difference schemes for RHD*)
- Jul 31-Aug 04, 2019 ■ The 12th National Annual Meeting of Computational Mathematics, Harbin, China. (Talk: *High-order entropy stable finite difference schemes for RHD*)
- Jun 22, 2019 ■ Graduate Student Forum of Chinese Society of Industrial and Applied Mathematics, Academy of Mathematics and System Science, Chinese Academy of Science, Beijing, China. (Talk: *PCP Lagrangian scheme for RHD*)
- Dec 13, 2018 ■ Annual Meeting of Center for Applied Physics and Technology, Peking University, Beijing, China. (Talk: *PCP Lagrangian scheme for RHD*)
- Nov 17-19, 2018 ■ Annual Meeting of Science Challenge Project, Jilin University, Changchun, China. (Poster: *PCP Lagrangian scheme for RHD* (with Dan Ling), selected as one of the five best posters)
- Nov 11, 2018 ■ Beijing Seminar on Computational Fluid Dynamics, Beijing Institute of Applied Physics and Computational Mathematics, Beijing, China. (Talk: *PCP Lagrangian scheme for RHD*)




Conferences & Talks (continued)

- Sep 13-16, 2018  The 16th Annual Meeting of Chinese Industrial and Applied Mathematics, Chengdu, China. (Attended)
- Apr 27-30, 2018  The 2nd Workshop on Simulation and Algorithm for Complex Physical Problems, Xiangtan University, Xiangtan, China. (Attended)
- Nov 10-12, 2017  Annual Meeting of Science Challenge Project, Xiamen University, Xiamen, China. (Attended)
- Jul 21-23, 2017  The 11th National Annual Meeting of Computational Mathematics, Xian, China. (Attended)
- Jul 03-07, 2017  The 5th International Conference on Numerical Simulation for Multi-material and Multi-physics Flows, Beijing Institute of Applied Physics and Computational Mathematics, Beijing, China. (Attended)




Teaching Assistant

- Fall, 2022  Analysis III (undergraduate), École Polytechnique Fédérale de Lausanne
- Fall, 2021  Advanced Analysis I (undergraduate), École Polytechnique Fédérale de Lausanne
- Fall, 2019  Numerical Methods of Partial Differential Equations (undergraduate and graduate), Peking University
- Fall, 2018  Linear Algebra B (undergraduate), Peking University
- Spring, 2018  Advanced Algebra II (undergraduate), Peking University
- Fall, 2017  Linear Algebra B (undergraduate), Peking University
- Spring, 2017  Mathematical Modeling (undergraduate), Peking University
- Fall, 2016  Partial Differential Equations (undergraduate), Peking University

Supervision

- Fall, 2022  Master thesis: Investigation of the aerosol evolution and delivery into the upper airway under transient conditions. Zacchei Filippo, EPFL, with Prof. Jan S. Hesthaven.
-  Master thesis: High-order entropy stable discontinuous Galerkin schemes using artificial viscosity. Jauguey Louis Vincent Marie, EPFL, with Prof. Jan S. Hesthaven.
-  Semester project: Scalable implementation of high-order entropy stable finite difference schemes. Kovacic Bartul, EPFL, with Prof. Jan S. Hesthaven.

Research Project (As participator)

- 2021-2022  Sense Dynamics: creating precise surrogate models of transient nonlinear physical phenomena related to aerodynamics. Supported by Swiss Data Science Center. (Design and verification of the numerical simulation for a 3D drone)
-  High-Order Accurate Adaptive Moving Mesh Methods for Compressible Fluid Flows: design and verification of the high-order accurate adaptive moving mesh methods for solving Euler and Navier-Stokes equations in 2D and 3D. Supported by National Numerical Wind-tunnel Project. (Design and verification of the numerical methods)
- 2019-2020  Computational Methods for the Interface and Elastoplastic Fracture in Fluid Mechanics: design and verification of the high-order accurate adaptive moving mesh methods for solving multi-material flows. Supported by Science Challenge Project. (Design and verification of the moving mesh schemes for multi-component flows)

Research Project (As participator) (continued)

2016-2018

- High-Order Accurate Robust Numerical Schemes for Multi-Material Implosion Hydrodynamics: research and verification of the high-order accurate Lagrangian schemes for solving compressible hydrodynamics. Supported by Science Challenge Project. (Coding and verification of the high-order accurate Lagrangian schemes)

Professional Services

- Reviewer for AMS Mathematical Reviews
- Referee for the following journals:
 - Journal of Computational Physics
 - Journal of Computational and Applied Mathematics
 - Communications in Nonlinear Science and Numerical Simulation
 - International Journal for Numerical Methods in Engineering
 - East Asian Journal on Applied Mathematics
 - Communications in Computational Physics
 - Journal of Scientific Computing
 - International Journal of Computational Methods

Other Information

Be familiar with C, C++, MPI, Python, PyTorch, MATLAB, OpenFOAM, PETSc, Linux shell, Fortran, \LaTeX , ...

References

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