Tarik Dzanic

Curriculum Vitae

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Google Scholar
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Academic & Professional Experience

June 2023 – Present — **Sidney Fernbach Postdoctoral Fellow**
Lawrence Livermore National Lab, *Center for Applied Scientific Computing*

May 2023 – Aug. 2023 — **Visiting Scholar**
Princeton University, *Department of Mechanical and Aerospace Engineering*

April 2023 – May 2023 — **Visiting Researcher**
NASA Ames Research Center, *Aerothermodynamics Branch*

June 2020 – May 2023 — **Computing Scholar Intern**
Lawrence Livermore National Lab, *Center for Applied Scientific Computing*

May 2017 – Sep. 2017 — **Computational Aerodynamicist Intern**
Haas Formula One Team

Education

Aug. 2019 – May 2023 — **Texas A&M University**
Ph.D. Ocean Engineering

Aug. 2018 – July 2019 — **Georgia Institute of Technology**
M.Sc. Aerospace Engineering

Sep. 2014 – May 2018 — **Princeton University**
B.S.E. Mechanical and Aerospace Engineering, *cum laude*

Publications

Journal Articles

15. PyFR v2.0.3: Towards industrial adoption of scale-resolving simulations
    F. Witherden, P. Vincent, W. Trojak, Y. Abe, A. Akbarzadeh, S. Akkurt, M. Alhawwary, L. Caros, **T. Dzanic**, G. Giangaspero, A. Iyer, A. Jameson, M. Koch, N. Loppi, S. Mishra, R. Modi, G. Saez-Mischlich, J.S. Park, B. Vermeire, L. Wang. *Preprint, in review*.
14. High-order limiting methods using maximum principle bounds derived from the Boltzmann equation I: Euler equations
    T. Dzanic, L. Martinelli. *Preprint, in review*.
13. A note on higher-order and nonlinear limiting approaches for continuously bounds-preserving discontinuous Galerkin methods
    T. Dzanic. *Journal of Computational Physics*, 516, 113367, 2024.
12. Continuously bounds-preserving discontinuous Galerkin methods for hyperbolic conservation laws
    T. Dzanic. *Journal of Computational Physics*, 508, 113010, 2024.
11. Positivity-preserving discontinuous spectral element methods for compressible multi-species flows
    W. Trojak, **T. Dzanic**. *Computers & Fluids*, 280, 106343, 2024.
10. DynAMO: Multi-agent reinforcement learning for dynamic anticipatory mesh optimization with applications to hyperbolic conservation laws
    T. Dzanic, K. Mittal, D. Kim, J. Yang, S. Petrides, B. Keith, R. Anderson. *Journal of Computational Physics*, 506, 112924, 2024.

9. On the anti-aliasing properties of entropy filtering for under-resolved turbulent flows
   T. Dzanic, W. Trojak, F. Witherden. *International Journal of Computational Fluid Dynamics*, 37, 474-486, 2024.
8. Validation of wall boundary conditions for simulating complex fluid flows via the Boltzmann equation: Momentum transport and skin friction
   T. Dzanic, F. Witherden, L. Martinelli. *Physics of Fluids*, 36, 017109, 2024.
7. A positivity-preserving and conservative high-order flux reconstruction method for the polyatomic Boltzmann–BGK equation
   T. Dzanic, F. Witherden, L. Martinelli. *Journal of Computational Physics*, 486, 112146, 2023.
6. Positivity-preserving entropy filtering for the ideal magnetohydrodynamics equations
   T. Dzanic, F. Witherden. *Computers & Fluids*, 266, 106056, 2023.
5. Bounds preserving temporal integration methods for hyperbolic conservation laws
   T. Dzanic, W. Trojak, F. Witherden. *Computers & Mathematics with Applications*, 135, 6-18, 2023.
4. Positivity-preserving entropy-based adaptive filtering for discontinuous spectral element methods
   T. Dzanic, F. Witherden. *Journal of Computational Physics*, 468, 111501, 2022.
3. Utilizing time-reversibility for shock capturing in nonlinear hyperbolic conservation laws
   T. Dzanic, W. Trojak, F. Witherden. *Computers & Fluids*, 247, 105652, 2022.
2. Partially-averaged Navier–Stokes simulations of turbulence within a high-order flux reconstruction framework
   T. Dzanic, S. Girimaji, F. Witherden. *Journal of Computational Physics*, 456, 110992, 2022.
1. Accuracy, stability, and performance comparison between the spectral difference and flux reconstruction schemes
   C. Cox, W. Trojak, **T. Dzanic**, F. Witherden, A. Jameson. *Computers & Fluids*, 221, 104922, 2021.

Conference Papers

9. Direct molecular gas dynamics simulations of re-entry vehicles via the Boltzmann equation
   T. Dzanic, L. Martinelli. *AIAA SciTech*, 2024.
8. Towards full molecular gas dynamics simulations of complex flows via the Boltzmann equation
   T. Dzanic, L. Martinelli. *Cambridge Unsteady Flow Symposium*, 2024.
7. Multi-agent reinforcement learning for adaptive mesh refinement
   J. Yang, K. Mittal, **T. Dzanic**, S. Petrides, B. Keith, B. Peterson, D. Faissol, R. Anderson. *International Conference on Autonomous Agents and Multiagent Systems*, p.14-22, 2023.
6. Reinforcement learning for adaptive mesh refinement
   J. Yang, **T. Dzanic**, B. Peterson, J. Kudo, K. Mittal, V. Tomov, J.S. Camier, T. Zhao, H. Zha, Tz. Kolev, R. Anderson, D. Faissol. *International Conference on Artificial Intelligence and Statistics (AISTATS)*, 26, p.5997-6014, 2023.
5. Shock capturing methods in high-order flux reconstruction I: Graph viscosity and convex limiting approaches
   W. Trojak, **T. Dzanic**, F. Witherden. *AIAA SciTech*, 2021.
4. Numerical analysis and prediction of aero-optical effects
   D. Hartman, **T. Dzanic**, F. Witherden, A. Tropina, R. Miles. *AIAA SciTech*, 2021.
3. Fourier spectrum discrepancies in deep network generated images
   T. Dzanic, K. Shah, F. Witherden. *Neural Information Processing Systems (NeurIPS)*, 33, p.3022-3032, 2020.
2. Non-equilibrium wall modeling for large eddy simulation of stalled iced airfoils
   T. Dzanic, J. Oefelein. *AIAA SciTech*, 2020.
1. Higher-order implicit large eddy simulations of a VFE-2 delta wing
   T. Dzanic, L. Martinelii. *AIAA SciTech*, 2019.

Invited Talks & Conference Presentations

24. Towards full Boltzmann simulations of complex fluid flows via high-order, discretely-conservative numerical schemes
    High-Order Nonlinear Numerical Methods for Evolutionary PDEs (HONOM). Chania, Greece. Sep 2024.
23. Provably robust limiting schemes for high-order discontinuous spectral element methods
    Brown University. Providence, RI, USA. May 2024.
22. Towards full molecular gas dynamics simulations of complex flows via the Boltzmann equation
    Cambridge Unsteady Flow Symposium. Cambridge University, Cambridge, UK. March 2024.
21. Continuously bounds-preserving limiting methods for high-order discontinuous Galerkin schemes
    7th Chilean Workshop on Numerical Analysis of Partial Differential Equations. Concepcion, Chile. Jan 2024.
20. Structure-preserving finite element methods for multi-physics applications
    Office of Science Advanced Scientific Computing Research (ASCR) Principal Investigator Meeting. Albuquerque, NM, USA. Jan 2024.
19. Constructing provably robust, constraint-satisfying finite element methods for computational physics
    Brown University. Providence, RI, USA. Nov 2023.
18. High-order computational fluid dynamics schemes on GPU architectures
    NASA Ames Research Center. Mountain View, CA, USA. Jun 2023.
17. A positivity-preserving and conservative high-order flux reconstruction method for the polyatomic Boltzmann–BGK equation
    22nd IACM Computational Fluids Conference. Cannes, France. April 2023.
16. Constructing provably robust, constraint-satisfying finite element methods for computational physics
    Lawrence Livermore National Lab. Livermore, CA, USA. April 2023.
15. A positivity-preserving and conservative high-order flux reconstruction method for the polyatomic Boltzmann–BGK equation
    Society for Applied and Industrial Mathematics TX-LA Symposium. Houston, TX, USA. Nov 2022.
14. Positivity-preserving entropy-based adaptive filtering for shock capturing
    PyFR Seminar Series. Imperial College London, London, UK. Aug 2022.
13. Utilizing time-reversibility for shock capturing in nonlinear hyperbolic conservation laws
    15th World Congress on Computational Mechanics. Yokohama, Japan. Aug 2022.
12. Positivity-preserving entropy-based adaptive filtering for discontinuous spectral element methods
    8th European Congress on Computational Methods in Applied Sciences and Engineering. Oslo, Norway. June 2022.
11. Bounds preserving temporal integration methods for hyperbolic conservation laws
    Society for Applied and Industrial Mathematics TX-LA Symposium. South Padre Island, TX, USA. Nov 2021.
10. Shock capturing in nodal spectral element methods via Riemann solutions for intra-element fluxes
    16th U.S. National Congress on Computational Mechanics. Chicago, IL, USA. July 2021.
9. Shock capturing for high-order nodal spectral element methods
    PyFR Seminar Series. Imperial College London, London, UK. April 2021.
8. Variable resolution turbulence modeling within a flux reconstruction framework
    14th World Congress in Computational Mechanics/ECCOMAS. Paris, France. Jan 2021.
7. Fourier spectrum discrepancies in deep network generated images
    Neural Information Processing Systems. Vancouver, Canada. Dec 2020.
6. A Riemann difference scheme for shock capturing in discontinuous finite element methods
    Society for Applied and Industrial Mathematics TX-LA Symposium. College Station, TX, USA. Oct 2020.

5. Partially-averaged Navier-Stokes in PyFR
   PyFR Symposium. Imperial College London, London, UK. July 2020.
4. Non-equilibrium wall modeling for large eddy simulation of stalled iced airfoils
   AIAA SciTech. Orlando, FL, USA. Jan 2020.
3. Higher-order implicit large eddy simulations of a VFE-2 delta wing
   AIAA SciTech. San Diego, CA, USA. Jan 2019.
2. Toward high-fidelity, high-resolution aerodynamic analysis of iced airfoils
   Federal Aviation Administration JUP Conference. The University of Ohio, Athens, Ohio, USA. July 2018.
1. Implicit large eddy simulations of vortex dominated flows
   Federal Aviation Administration JUP Conference. Massachusetts Institute of Technology, Cambridge, MA, USA. Oct 2017.

Funding & Grants

Principal Investigator

2024 – 2025 Continuously bounds-preserving finite element methods for multi-physics applications
Sponsor: Office of Science Advanced Scientific Computing Research
Award: $\$258{,}000$

2023 – 2024 Continuously bounds-preserving finite element methods for multi-physics applications
Sponsor: Department of Energy Laboratory Directed Research and Development
Award: $\$207{,}000$

Co-principal Investigator

2024 – 2025 Direct numerical simulation of the Boltzmann equation for hypersonic transitional boundary layers
Sponsor: Oak Ridge Leadership Computing Facility Director's Discretionary Program
Award: $125{,}600$ GPU-hours on Frontier at OLCF

Selected Honors & Awards

2024 Computing Directorate SPOT Award, *Lawrence Livermore National Lab*
2023 – 2025 Sidney Fernbach Postdoctoral Fellowship, *Lawrence Livermore National Lab*
2023 Editor's Pick, *Physics of Fluids*
2023 Art of Science Showcase, *Air Force Office of Scientific Research*
2021 SIAM Travel Award, *Society for Industrial and Applied Mathematics*
2019 Department Excellence Fellowship, *Texas A&M University*
2018 George Bienkowski Memorial Prize Recipient, *Princeton University*
2014 – 2018 Questbridge Scholar, *Princeton University*

Service

Reviewed for: AIAA Journal, Cambridge Unsteady Flow Symposium, Computers & Mathematics with Applications, Computer Physics Communications, International Journal of Computational Fluid Dynamics, Journal of Computational Physics, Journal of Computational and Theoretical Transport, Journal of Ocean Engineering, Physics of Fluids

Volunteering: Girls Who Code, LLNL Summer Research Slam, QuestBridge

Teaching Experience

2022 Teaching Assistant for OCEN 345: Theory of Ocean Engineering Structures
Texas A&M University

2021 Teaching Assistant for OCEN 405: Finite Element Analysis in Engineering Design
Texas A&M University

2020 Teaching Assistant for OCEN 261: Applied Numerical Methods with Python
Texas A&M University

2019 Teaching Assistant for AE 3340: Design and Systems Engineering Methods
Georgia Institute of Technology

2018 Teaching Assistant for AE 3340: Design and Systems Engineering Methods
Georgia Institute of Technology