ANDREW GIULIANI

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RESEARCH INTERESTS

High-order numerical methods, optimization of complex systems, gas dynamics, high-performance computing.

WORK EXPERIENCE

2022 - Present Research Scientist
Flatiron Institute, Simons Foundation, New York, USA.

2020 - 2022 Postdoctoral Associate
Courant Institute of Mathematical Sciences, New York University USA.

2018 - 2020 Assistant Professor/Courant Instructor
Courant Institute of Mathematical Sciences, New York University USA

Postdoc mentor: Dr. Marsha Berger · berger@cims.nyu.edu
Postdoc mentor: Dr. Georg Stadler · stadler@cims.nyu.edu

EDUCATION

2013 - 2018 University of Waterloo, Canada
Ph.D - Applied mathematics
Supervisor: Dr. Lilia Krivodonova · lgk@uwaterloo.ca

2013 L'Institut National des Sciences Appliquées de Lyon, France
Master's - Mechanical engineering · Laboratoire de Mécanique des Contacts et des Structures

2008-2013 L'Institut National des Sciences Appliquées de Lyon, France
Bachelor's - Mechanical engineering · Génie Mécanique et Développement (GMD).

TEACHING EXPERIENCE

2018-2020 Instructor, Courant Institute, NYU, USA
Numerical Analysis - Spring 2020, Spring 2019, Fall 2018,
Linear Algebra - Fall 2019

2016 Instructor, University of Waterloo, Canada
Calculus I for Honors Mathematics - Fall 2016

REFEREED PUBLICATIONS

1. M. Berger, **A. Giuliani**. (2023) A new provably stable weighted state redistribution algorithm. Submitted.

2. **A. Giuliani**, F. Wechsung, A. Cerfon, M. Landreman, G. Stadler. (2023) Direct stellarator coil optimization for nested magnetic surfaces with precise quasisymmetry. Physics of Plasmas 30, 042511.

3. F. Wechsung, **A. Giuliani**, M. Landreman, A. Cerfon, G. Stadler. (2022) Stochastic and a posteriori optimization to mitigate coil manufacturing errors in stellarator design. Plasma Physics and Controlled Fusion, 64 (10), 105021.

4. **A. Giuliani**, A. S. Almgren, J. B. Bell, M. J. Berger, M. T. Henry de Frahan, D. Rangarajan. (2022) A weighted state redistribution algorithm for embedded boundary grids. Journal of Computational Physics, 464, 111305.

5. **A. Giuliani**, F. Wechsung, G. Stadler, A. Cerfon, M. Landreman. (2022) Direct computation of magnetic surfaces in Boozer coordinates and coil optimization for quasisymmetry. Journal of Plasma Physics 88 (4), 905880401

6. **A. Giuliani**, F. Wechsung, A. Cerfon, G. Stadler, M. Landreman. (2022) Single-stage gradient-based stellarator coil design: Optimization for near-axis quasi-symmetry. Journal of Computational Physics, 459, 111147.

7. F. Wechsung, **A. Giuliani**, M. Landreman, A. Cerfon, G. Stadler. (2022) Single-stage gradient-based stellarator coil design: stochastic optimization. Nuclear Fusion 62.7 (2022): 076034.

8. F. Wechsung, M. Landreman, **A. Giuliani**, A. Cerfon, G. Stadler. (2022) Precise stellarator quasi-symmetry can be achieved with electromagnetic coils. Proceedings of the National Academy of Sciences 119 (13), e2202084119.

9. **A. Giuliani**. (2022) A two-dimensional stabilized discontinuous Galerkin method on curvilinear embedded boundary grids. SIAM Journal on Scientific Computing, 44(1), A389-A415.

10. M. Landreman, B. Medasani, F. Wechsung, **A. Giuliani**, R. Jorge, C. Zhu, *SIMSOPT: A flexible framework for stellarator optimization*. Journal of Open Source Software, 6 (2021), pp. 3525.

11. M. Berger, **A. Giuliani**. *A state redistribution algorithm for finite volume schemes on cut cell meshes*. Journal of Computational Physics, 428 (2021), pp. 109820.

12. **A. Giuliani**, L. Krivodonova. *A moment limiter for the discontinuous Galerkin method on unstructured tetrahedral meshes*. Journal of Computational Physics, 404 (2020)

13. **A. Giuliani**, L. Krivodonova. *A moment limiter for the discontinuous Galerkin method on unstructured triangular meshes*. SIAM Journal on Scientific Computing, 41 (2019), pp. A508–A537.

14. **A. Giuliani**, L. Krivodonova. *Adaptive mesh refinement on graphics processing units for applications in gas dynamics*. Journal of Computational Physics, 381 (2019), pp. 67-90.

15. **A. Giuliani**, L. Krivodonova. *On the optimal CFL number of SSP methods for hyperbolic problems*. Applied Numerical Mathematics, 135 (2019), pp. 165-172.

16. **A. Giuliani**, L. Krivodonova. *Analysis of slope limiters on unstructured triangular meshes*. Journal of Computational Physics, 374 (2018), pp. 1–26.

17. J. Resch, **A. Giuliani**, L. Krivodonova, J. Vanderkooy. *Axisymmetric simulations of nonlinear sound propagation in a trumpet*. Recent Advances in Mathematical and Statistical Methods, Springer, (2018), pp. 229-238.

18. **A. Giuliani**, L. Krivodonova. *Face coloring in unstructured CFD codes*. Parallel Computing, 63 (2017), pp. 17-37.

19. **A. Giuliani**, L. Krivodonova. *An h-adaptive implementation of the discontinuous Galerkin method for nonlinear hyperbolic conservation laws on unstructured meshes for graphics processing units*. Mathematical and Computational Approaches in Advancing Modern Science and Engineering, Springer, (2016), pp. 435-445.

20. N. Voeltzel, **A. Giuliani**, N. Fillot, P. Verge and L. Joly. *Nanolubrication by ionic liquids: molecular dynamics simulations reveal an anomalous effective rheology*. Physical Chemistry Chemical Physics, 17 (2015), pp. 23226-23235.

21. M. Fuhry, **A. Giuliani** and L. Krivodonova. *Discontinuous Galerkin methods on graphics processing units for nonlinear hyperbolic conservation laws*. International Journal for Numerical Methods in Fluids, 76 (2014), pp. 982-1003.

NON PEER-REVIEWED REPORTS

1. S. Hudson, A. Wright, A. Ware, J. Schmitt, J. Hanson, M. Cianciosa, C. Zhu, and A. Giuliani. FES 2023 Theory & Simulation Performance Target report. 2022.

SCHOLARSHIPS

2020-2022 · NSERC Postdoctoral Fellowship.
2015-2018 · NSERC Alexander Graham Bell Canada Graduate Scholarship - Doctoral
2013-2018 · University of Waterloo — President's scholarship
2014-2015 · NSERC Alexander Graham Bell Canada Graduate Scholarship - Masters
2013-2014 · Ontario Graduate Scholarship

AWARDS

2019 · Courant Institute, NYU — Joseph B. Keller Postdoctoral Fellowship.
2019 · University of Waterloo — Huawei Prize for Best Research Paper
2018 · University of Waterloo — Applied Mathematics Doctoral Award
2015 · University of Waterloo — Applied Mathematics Outstanding TA Award

INVITED TALKS AND CONFERENCE PRESENTATIONS

2023 · **A. Giuliani**, M. Berger. High-Order State Redistribution Methods on Cut Cell Grids. Invited talk for *Jesse Chan's research group*.

2023 · **A. Giuliani**, M. Berger. High-Order State Redistribution Methods on Cut Cell Grids. Invited talk in the *Recent Advances in Numerical Methods and Scientific Computing minisymposium at AMMCS 2023*.

2023 · **A. Giuliani**. Introduction to discontinuous Galerkin methods. Talk in the *Center for Computational Astrophysics, Flatiron Institute, CFD summer school.*

2023 · **A. Giuliani**, M. Berger. High-Order State Redistribution Methods on Cut Cell Grids. Talk in the *Structure Preserving and Robust Techniques for the Simulation of Transport Phenomena and Fluid Flows* minisymposium at SIAM-CSE23.

2021 · **A. Giuliani**, Florian Wechsung, Antoine Cerfon, Georg Stadler, Matt Landreman. Single-stage gradient-based stellarator coil design: optimization for quasi-symmetry on surfaces. 63rd Annual Meeting of the APS Division of Plasma Physics.

2021 · **A. Giuliani**, M. Berger. State redistribution methods for hyperbolic problems on cut cells grids. CCM Seminar at the Flatiron Institute, NYC.

2021 · **A. Giuliani**. A two-dimensional stabilized discontinuous Galerkin method on curvilinear embedded boundary grids. Talk for the Numerical Simulation Research Group at the University of Cologne.

2021 · M. Berger, **A. Giuliani**. A state redistribution algorithm for finite volume schemes on cut cell meshes. Talk in the *Recent Advances in Cut Cell Discretizations: Accuracy, Stability, and Applications* minisymposium at SIAM-CSE21.

2021 · **A. Giuliani**, M. Berger. A stabilized discontinuous Galerkin method for hyperbolic problems on cut cell meshes. Talk at the *Cut-DG methods for hyperbolic problems* minisymposium at ICOSAHOM 2020 (held in 2021 due to COVID).

2020 · **A. Giuliani**. A state redistribution algorithm for finite volume schemes on cut cell meshes. Talk for the numerical analysis seminar at Heinrich-Heine-Universitat Dusseldorf.

2019 · **A. Giuliani**. Adjoint-Based Vacuum-Field Stellarator Optimization. SIAM conference on Analysis of Partial Differential Equations.

2019 · **A. Giuliani**. Adaptive mesh refinement on graphics processing units for applications in gas dynamics. North American High Order Methods Conference, San Diego State University.

2018 · **A. Giuliani**. Moment Limiters for the discontinuous Galerkin method on unstructured meshes. Mid-atlantic numerical analysis day, Temple University.

2018 · **A. Giuliani**. Moment Limiters for the discontinuous Galerkin method on unstructured meshes. Numerical Analysis and Scientific Computing (NASC) Seminar, Courant Institute, New York University.

2018 · **A. Giuliani**. Adaptive mesh refinement for applications in gas dynamics. Research Training Group in Mathematical Modeling and Simulation, Courant Institute, New York University.

2018 · **A. Giuliani**. The discontinuous Galerkin method for hyperbolic conservation laws on graphics processing units. Institute for Computational Engineering and Sciences (ICES) at the University of Texas at Austin.

ADDITIONAL INFORMATION

Journal reviewer: SIAM Journal on Scientific Computing, Journal of Scientific Computing, Journal of Computational Physics, Computers and Mathematics with Applications, Applied Mathematics and Computation, Journal of Plasma Physics, Scientific Reports.

Outreach: Speaker at CSplash 2019: lecture aimed at high school students
http://www.csplash.org/
Mentor for GSTEM 2021: summer program for communities underrepresented in STEM
https://cims.nyu.edu/gstem/

Languages: English (Native) · French (Fluent)

Citizenship: Canadian · Italian