Tommaso Buvoli

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RESEARCH INTERESTS

Scientific computing, high performance computing, numerical analysis, time integration, parallel-in-time methods, scientific machine learning.

EMPLOYMENT

2022-current Assistant Professor, Mathematics, Tulane University

2018-2022 Visiting Assistant Professor, Applied Mathematics, University of California Merced

EDUCATION

2018 **University of Washington, Seattle**
Ph.D. in Applied Mathematics,
Advisor: Randall J. LeVeque, *Thesis:* Polynomial-Based Methods for Time Integration

2013 **University of Colorado at Boulder**
M.S. in Applied Mathematics,
Advisor: Mark J. Ablowitz, *Thesis:* Rogue Waves in Optics and Water

2013 **University of Colorado at Boulder**
B.S. in Applied Mathematics, B.S. in Computer Science,
International Engineering Certificate in Italian

GRANTS

PI, NSF-OIA-2327484. RII Track-4:NSF: Construction of New Additive and Semi-Implicit General Linear Methods. July 1, 2024.
Amount: $212,174.

Co-PI, NSF-DMS-2012875. Construction of New Parallel Time Integrators. July 27, 2020.
Amount: $250,000.

PREPRINTS

4. Tran, B., Southworth, B. S., & Buvoli, T. "Order Conditions for Nonlinearly Partitioned Runge-Kutta Methods," https://arxiv.org/abs/2401.12427.
3. Buvoli, T., & Southworth, B. S. "A New Class of Runge-Kutta Methods for Nonlinearly Partitioned Systems," https://arxiv.org/abs/2401.04859.

2. Southworth, B. S., Olivier, S. S., Park, H., & Buvoli, T. "One-sweep moment-based semi-implicit-explicit integration for gray thermal radiation transport," https://arxiv.org/abs/2401.04285.
1. Buvoli, T. "Constructing Polynomial Block Methods", https://arxiv.org/abs/2011.00671.

PUBLICATIONS

8. Buvoli, T., & Minion, M. (2024). Exponential Runge-Kutta Parareal for non-diffusive equations. Journal of Computational Physics, 497, 112623. https://doi.org/10.1016/j.jcp.2023.112623
7. Buvoli, T., & Southworth, B. S. (2023). Additive Polynomial Time Integrators, Part I: Framework and Fully Implicit-Explicit Collocation Methods. SIAM Journal on Scientific Computing, 45(6), A2945-A2972. https://doi.org/10.1137/21M1446988
6. Dallerit, V., Buvoli, T., Tokman, M., & Gaudreault, S. (2023). Second-order Rosenbrock-exponential (ROSEXP) methods for partitioned differential equations. Numerical Algorithms, 1-19. https://doi.org/10.1007/s11075-023-01698-4
5. Buvoli, T., & Minion, M. L. (2022). On the stability of exponential integrators for non-diffusive equations. Journal of Computational and Applied Mathematics, 409, 114126. https://doi.org/10.1016/j.cam.2022.114126
4. Buvoli T., & Minion, M. (2021). IMEX Runge-Kutta Parareal for Non-diffusive Equations. In: Ong B., Schroder J., Shipton J., Friedhoff S. (eds) "Parallel-in-Time Integration Methods." PinT 2020. Springer Proceedings in Mathematics & Statistics, vol 356. Springer, Cham. https://doi.org/10.1007/978-3-030-75933-9_5
3. Buvoli, T. (2021). "Exponential Polynomial Block Methods." SIAM Journal on Scientific Computing, *43*(3), A1692-A1722. https://doi.org/10.1137/20M1321346
2. Buvoli, T. (2020). "A Class of Exponential Integrators Based on Spectral Deferred Correction." SIAM Journal on Scientific Computing, 42(1), A1-A27. https://doi.org/10.1137/19M1256166
1. Buvoli, T., & Tokman, M. (2019). "Constructing New Time Integrators Using Interpolating Polynomials." SIAM Journal on Scientific Computing, 41(5), A2911-A2937, https://doi.org/10.1137/18M1203808.

PEER REVIEWED CONFERENCE PROCEEDINGS

1. Buvoli, T. "Polynomial multipoint methods." AIP Conference Proceedings. Vol. 1863. No. 1. AIP Publishing, 2017, https://doi.org/10.1063/1.4992337.

INVITED TALKS

2023 6th SIAM Texas-Louisiana Sectional Meeting (SIAM TX-LA 2023)
"Exponential Integrators and the Polynomial Time Integration Framework."

2023 Los Alamos Workshop on Time Integration for Multiphysics (TIM) 2023
"*Runge-Kutta Methods for Nonlinearly Partitioned Systems, and Polynomial-Based Time Integrators*."

2023 12th Workshop on Parallel-in-Time Integration (PinT) 2023
"*Exponential Integrators, Parareal, and Polynomial Time Integrators*."

2023 Auckland Numerical Ordinary Differential Equations (ANODE) 2023
"*A New Class of Fully Implicit-Explicit Time Integrators*."

2022 Scientific Computation and Differential Equations (SciCADE) 2022
"*Exponential Integrators for PinT methods*."

2022 Mathematics Colloquium — Tulane University
"*Novel Time Integration Methods for Solving Stiff Systems*."

2021 Numerical Analysis and Scientific Computing Seminar — University of Waterloo [Virtual]
"*Novel Time Integration Methods for Solving Stiff Systems*."

2021 Applied Mathematics Colloquium — University of California, Merced
"*Novel Time Integration Methods for Solving Stiff Systems*."

2021 Oden Institute Seminar – University of Texas Austin [Virtual]
"*Novel Time Integration Methods for Solving Stiff Systems*."

2021 Computational Science Seminar – University of Massachusetts Dartmouth [Virtual]
"*Novel Time Integration Methods for Solving Stiff Systems*."

2021 Applied Mathematics / PDE Seminar – UC Santa Barbara
"Constructing *BDF-Like Polynomial Integrators*."

2021 PinT 2021 – 10th Workshop on Parallel-in-Time Integration [Virtual]
"*Parareal with Exponential Integrators*." (Virtual Mini-Symposium Talk)

2021 SIAM Conference on Computational Science and Engineering (SIAM CSE) [Virtual]
"Polynomial-Based Time Integrators for Solving Stiff Systems." (Mini-Symposium Talk)

2020 Joint Mathematical Meeting (JMM)
"*New Developments in Exponential Integration for Stiff Systems*," (Mini-Symposium Talk)

2019 SIAM Conference on Computational Science and Engineering (SIAM CSE)
"*Exponential Integrators & Spectral Deferred Correction*." (Mini-Symposium Talk)

2018 UC Merced Applied Math Colloquium, September 2018.
"*Polynomial-based Time Integrators*."

2017 SIAM Conference on Computational Science and Engineering (SIAM CSE)
"*Parallel Exponential Integrators Based on General Linear Methods*." (Mini-Symposium Talk)

2016 International Conference of Numerical Analysis and Applied Mathematics (ICNAAM)
"*Polynomial Multipoint Methods*." (Mini-Symposium Talk)

STUDENTS

MASTER'S
- Ben Stager, Department of Mathematics, Tulane University; Fall 2022 - Spring 2023

UNDERGRADUATE
- Garrett Gilliom. Senior Seminar (Math 3990); Tulane University; Fall 2022 - Spring 2023
- Catherine Brooks. Senior Seminar (Math 3990); Tulane University; Fall 2023 - Spring 2024

TEACHING

Instructor ***Tulane University***

Spring 2023	Math 7580: Scientific Computing III
Fall 2023	Math 7570: Scientific Computing II
Spring 2023	Math 7570: Scientific Computing II
Fall 2022	Math 4240: Ordinary Differential Equations

Instructor ***University of California, Merced***

Spring 2022	Math 125: Advanced Differential Equations
	Math 286: Scientific Computing & Data Analysis Seminar
Fall 2021	Math 22: Calculus II for Physical Sciences and Engineering
	Math 286: Scientific Computing & Data Analysis Seminar
Spring 2021	Math 22: Calculus II for Physical Sciences and Engineering
	Math 286: Scientific Computing & Data Analysis Seminar
Fall 2020	Math 125: Advanced Differential Equations
	Math 286: Scientific Computing & Data Analysis Seminar
Spring 2020	Math 22: Calculus II for Physical Sciences and Engineering
Fall 2019	Math 22: Calculus II for Physical Sciences and Engineering
Spring 2019	Math 22: Calculus II for Physical Sciences and Engineering
Fall 2018	Math 125: Advanced Differential Equations

Teaching Assistant ***University of Washington***

Spring 2018	AMATH 483/583: High-Performance Scientific Computing.
Winter 2017	AMATH 585: Numerical Analysis of Boundary Value Problems.
Fall 2016	AMATH 352: Applied Linear Algebra and Numerical Analysis.
Winter 2016	AMATH 585: Numerical Analysis of Boundary Value Problems.
Fall 2015	MATH 126: Calculus with Analytic Geometry III.
Spring 2015	AMATH 483/583: High-Performance Scientific Computing.
Spring 2014	AMATH 301: Beginning Scientific Computing.

Winter 2014 MATH 124: Calculus with Analytic Geometry I.

PRESENTATIONS, POSTERS, AND WORKSHOPS

2023 Tulane University AMS/AWM Research Seminar
"*Five Flavors of Euler's Method*."

2023 Scientific Computing Across Louisiana (SCALA) 2023
"*A New Class of Fully Implicit-Explicit Time Integrators.*"

2022 Tulane University AMS/AWM Research Seminar
"*An Overview of Various Time-Integration Methods for Solving PDEs and ODEs*."

2020 University of California, Merced Scientific Computing and Data Science Seminar
"*An Introduction to Containers for Scientific Computing and Data Science*."

2019 University of California, Merced Scientific Computing and Data Science Seminar
"*Four Time-Integration Techniques for Stiff Systems*."

2015 University of Washington Numerical Analysis Research Club (NARC)
"*ETD Spectral Deferred Correction Methods*."

2015 Clawpack developers conference, Salt Lake City Utah.

2014 SIAM Conference on Computational Science and Engineering (SIAM CSE 2014)
"*High-Order Exponential Integrators Based on Spectral Deferred Correction*," (Poster)

2012 SIAM Front Range Student Conference
"*Rogue Waves in Water and Optics.*"

SERVICE

DEPARTMENTAL SEMINARS:

2023-present	Co-organizer of Tulane Mathematics Colloquium
2022-present	Co-organizer of Tulane Applied and Computational Mathematics Seminar
2020-2022	Co-organizer of UC Merced Scientific Computing and Data Science Seminar

DEPARTMENTAL COMMITTEES

2023-present	Member of Undergraduate Studies Committee

REFEREE FOR JOURNALS
- Applied Numerical Mathematics (APNUM)
- Numerical Algorithms (Springer)
- SIAM Review (SIREV)
- SIAM Journal on Scientific Computing (SISC)
- Transactions on Mathematical Software (TOMS)

AWARDS AND SCHOLARSHIPS

2018 Boeing Research Award.
Awarded for outstanding research by a student in University of Washington Department of Applied Mathematics.

2016 NSF Eastern Asia Pacific Summer Institutes (EAPSI).
Awarded 8 week NSF grant covering summer stipend, and travel expenses to visit New Zealand and work with Dr. John Butcher at the University of Auckland.

2007 Discovery Learning Apprenticeship Program, University of Colorado at Boulder
Seagate Scholarship. Awarded merit scholarship of $2000 for one year.

SOFTWARE DEVELOPMENT

1. PIPACK (Polynomial Integrator Package) https://github.com/pipack
   A collection of Matlab packages for analyzing and testing polynomial time integrators.
2. CJR (Container Job Runner) https://container-job-runner.github.io/
   A command line tool for developing scientific codes in containers and running containerized jobs on local and remote resources.
3. GotProject http://www.gotproject.com/
   A web application which allows users to save urls, images, and videos from the web.

Coding Languages: Matlab, Mathematica, Python, Julia, Fortran90/2003, C, C++, Javascript, node.js, PHP.

Parallel frameworks: MPI, OpenMP.