ANTHONY GRUBER

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PROFESSIONAL EXPERIENCE

Sandia National Laboratories August 2022—Present
John von Neumann Fellow *Albuquerque, NM*

- Funded half-time for self-directed research on scientific machine learning with applications to model reduction and structure-preserving discretization methods for PDEs.
- Remaining time covered by related projects under the supervision of Dr. Nathaniel Trask and Dr. Eric Cyr.
- Funded by the DOE ASCR applied mathematics research program in conjunction with the Sandia LDRD program.

Florida State University January 2021—August 2022
Postdoctoral Research Associate *Tallahassee, FL: stationed in Columbia, SC*

- Advised by Prof. Max Gunzburger on the design of numerical algorithms for function approximation and reduced-order modeling related to the simulation of ocean dynamics.
- Further advised on related work by Prof. Lili Ju and Prof. Zhu Wang at the University of South Carolina.
- Funded by DOE grant DE-SC0020418: Efficient and Scalable Time-Stepping Algorithms and Reduced-Order Modeling for Ocean System Simulations.

Texas Tech University August 2019–December 2020*
Assistant Professor of Practice *Lubbock, TX: stationed in San José, Costa Rica*

- Program director of the Dept. of Mathematics at the TTU satellite campus in San José.
- Taught a 2-2 load of mathematics courses, conducted research, and served the University as needed. Occasionally provided short courses to local professionals. See "Technical Skills" section below for a teaching resume.
- Coordinated with TTU faculty and administration state-side to further the University mission in Costa Rica.
- Funded by Edulink Inc. in conjunction with TTU.
- (*) Remained employed on unpaid leave until August 2022.

Oak Ridge National Laboratory June 2018–August 2018
NSF Graduate Research Fellow *Oak Ridge, TN*

- Advised by Dr. Robert Bridges on a project called Active Manifolds (see publications below) applying geometric methods to data science problems involving high-dimensional function approximation.
- Established mathematics justifying the method and implemented new algorithms in Python.
- Produced results specially selected for presentation to the leaders of the Computing and Computational Sciences Division at ORNL.
- Funded through the NSF Mathematical Sciences Graduate Internship (MSGI) program.

Texas Tech University August 2015–August 2019
Graduate Part-Time Instructor *Lubbock, TX*

- Served as instructor of record for a 2-2 load of mathematics courses each year, which ranged from College Algebra to Introductory PDEs.
- Responsible for all aspects of instruction, including delivering lectures and writing exams.
- Experience teaching large (up to 170 students), small, and online classes.
- Funded through scholarships/endowments at TTU.

University of Texas at Dallas May 2014–August 2014
Materials Science Research Intern *Richardson, TX*

- Designed, constructed, and characterized TiSi and CrB2-Si-SiC thin-film resistors using a combination of lithography, x-ray photoelectron spectrometry, and Hall-effect measurements.
- Worked closely with a diverse team under Prof. Manuel Quevedo, some members of which spoke no English. Presented results at weekly meetings.
- Generated data that facilitated the identification of a superior ratio of Ti:Si, thereby improving resistivity of previous TFR's by 30%.

· Funded through the NSF Research Experiences for Undergraduates (REU) program.

EDUCATION

Texas Tech University *August 2019*
Ph.D. Mathematics
Overall GPA: **4.0** (*summa cum laude*)

M.S. Mathematics *May 2017*
Overall GPA: **4.0** (*summa cum laude*)

B.G.S. Mathematics/Chemistry/Music Performance *May 2015*
Overall GPA: **3.9** (*summa cum laude*)
183 credit hours completed

· Transferred from Ohio Wesleyan University after 5 semesters 2011-2013.
· Awarded Dean's list recognition all semesters at OWU and TTU.

PUBLICATIONS

In reverse chronological order—submitted articles available at my website or upon request.

Journal Articles

1. A. Gruber. Parallel Codazzi tensors with submanifold applications. *Math. Nachr.* (to appear).
2. A. Gruber, M. Gunzburger, L. Ju, Z. Wang. Stationary surfaces with boundaries. *Ann. Glob. Anal. Geom.* (2022).
3. A. Gruber, M. Gunzburger, L. Ju, Z. Wang. A Comparison of Neural Network Architectures for Data-Driven Reduced-Order Modeling. *Comput. Methods Appl. Mech. Eng.* (2022).
4. A. Gruber. Planar Immersions with Prescribed Curl and Jacobian Determinant are Unique. *Bull. Aust. Math. Soc.* 1-6 (2021).
5. A. Gruber, M. Gunzburger, L. Ju, Y. Teng, Z. Wang. Nonlinear Level Set Learning for Function Approximation on Sparse Data with Applications to Parametric Differential Equations. *Numer. Math. Theory Methods Appl.* (2021).
6. A. Gruber, A. Pámpano, M. Toda. Regarding the Euler-Plateau Problem with Elastic Modulus. *Ann. Mat. Pura Appl.* (2021).
7. A. Gruber, E. Aulisa. Computational p-Willmore Flow with Conformal Penalty. *ACM Trans. Graph.* 39, 5, Article 161 (September 2020), 16 pages.
8. A. Gruber, M. Toda, H. Tran. On the variation of curvature functionals in a space form with application to a generalized Willmore energy. *Ann. Glob. Anal. Geom.* 56, 147–165 (2019).

Articles in Refereed Conference Proceedings

1. A. Gruber, E. Aulisa. Quaternionic remeshing during surface evolution. *AIP Conference Proceedings* 2425, 330003 (2022).
2. A. Gruber, M. Toda, H. Tran. Willmore-stable minimal surfaces. *AIP Conference Proceedings* 2425, 330004 (2022).
3. E. Aulisa, A. Gruber, M. Toda, H. Tran. New Developments on the p-Willmore Energy of Surfaces. *Proceedings of the Twenty-First International Conference on Geometry, Integrability and Quantization*: 57-65 (2020).
4. R. Bridges, A. Gruber, C. Felder, M. Verma, C. Hoff. Active Manifolds: Reducing high dimensional functions to 1-D; A non-linear analogue to Active Subspaces. *ICML* (2019), PMLR 97:764-772.

Submitted Articles

1. A. Gruber, M. Gunzburger, L. Ju, R. Lan, Z. Wang. Multifidelity Monte Carlo Estimation for Efficient Uncertainty Quantification in Climate-Related Modeling, (under review).
2. A. Gruber, E. Aulisa. Quasiconformal Mappings with Surface Domains, (under review).

3. A. Gruber, M. Gunzburger, L. Ju, Z. Wang. A Multifidelity Monte Carlo Method for Realistic Computational Budgets, (under review).
4. A. Gruber, M. Gunzburger, L. Ju, Z. Wang. Energetically Consistent Model Reduction for Metriplectic Systems, (under review).
5. Y. Teng, Z. Wang, L. Ju, A. Gruber, G. Zhang. Learning Level Sets with Pseudo-Reversible Neural Networks for Nonlinear Dimension Reduction in Function Approximation, (under review).
6. A. Gruber, A. Pámpano, M. Toda. On p-Willmore Disks with Boundary Energies, (under review).

Other

1. A. Gruber, Curvature Functionals and p-Willmore Energy, *TTU Electronic Thesis and Dissertation Repository*, 2019, `https://ttu-ir.tdl.org/handle/2346/85351`.

PRESENTATIONS/SERVICE/INVOLVEMENT

Invited External Presentations

· A. Gruber, Invited talk, "Graph neural networks for model reduction", Minisymposium on machine learning for large-scale scientific data analytics, SIAM MDS, San Diego, CA. (25 min; Sep. 2022)

· A. Gruber, Invited talk, "Computing quasiconformal mappings between immersed surfaces", AMS Fall Central Sectional, UT at El Paso, TX. (20 min; Sep. 2022).

· A. Gruber, Invited Talk, CU Mathematics Seminar Series, "Calculus in Computer Graphics and Data Science" (virtual), Cameron University (50 min; Oct 19, 2021).

· A. Gruber, Invited Colloquium, "Some nonlinear PDEs in computer graphics and data science", Texas Tech University (50 min; Sep 29, 2021).

· A. Gruber, Invited Talk, SIAM SEAS special session on Deep Learning Methods for Data Driven Models, "Convolutional neural networks for data compression and reduced order modeling", Auburn University (30 min; Sep 18, 2021).

· A. Gruber, Invited talk, AMS special session #1159, Geometry of Submanifolds and Integrable Systems (virtual), Sep 12-13, 2020, "Codazzi tensors with parallel mean curvature", University of Texas at El Paso. (25 min; September 12, 2020.)

· A. Gruber, Plenarly lecture as early career speaker, 63rd Texas Geometry and Topology Conference (virtual), Apr 24-26, 2020, "Stationary surfaces for curvature functionals", Texas Tech University, Lubbock. (50 min; April 23, 2020.)

· R. Bridges (presenter), A. Gruber, C. Felder, M. Verma, C. Hoff, Paper presentation, 36th International Conference on Machine Learning, June 9-15, 2019, "Active Manifolds: A non-linear analogue to Active Subspaces", Long Beach, California.

· E. Aulisa, A. Gruber, M. Toda (presenter), H. Tran, Plenary lecture, XXIst International Conference on Geometry, Integrability, and Quantization, June 3-9, 2019, "p-Willmore Energies", Bulgarian Academy of Science, Institute of Biophysics, Bulgaria.

Seminar and Contributed Talks

· A. Gruber, Seminar talk, "Artificial neural networks for dimension reduction and reduced-order modeling", Applied Mathematics group, Texas Tech University, Lubbock. (50 min; Sep 30, 2021).

· A. Gruber, Seminar talk, "Optimal quasiconformal mappings with prescribed boundary" (virtual), Probability, Geometry, and Mathematical Physics group, Texas Tech University, Lubbock. (50 min; April 7, 2021).

· A. Gruber, Seminar talk, "Geometric flows via finite element methods" (virtual), Elasticity group, Texas Tech University, Lubbock. (50 min; Dec 2, 2020.)

· A. Gruber, Paper presentation, 18th International Conference of Numerical Analysis and Applied Mathematics (virtual), Sep 17-23, 2020, "Quaternionic remeshing during surface evolution", Rhodes, Greece. (30 min; Sep 17, 2020.)

· A. Gruber, Paper presentation, 18th International Conference of Numerical Analysis and Applied Mathematics (virtual), Sep 17-23, 2020, "Willmore-stable minimal surfaces", Rhodes, Greece. (30 min; Sep 17, 2020.)

· A. Gruber, Seminar talk, "Variational Aspects of Curvature Functionals", Elasticity group, Texas Tech University, Lubbock. (50 min; Sep 2, 2020.)

· A. Gruber, Seminar talk, "Computing stationary solutions to p-Willmore flow", Applied Mathematics group, Texas Tech University. (50 min; April 22, 2020.)

· A. Gruber, Seminar talk, "A conformally-adjusted Willmore flow of closed surfaces", Applied Mathematics group, Texas Tech University, Lubbock. (50 min; May 8, 2019.)

· A. Gruber, Seminar talk, "Curvature functionals and p-Willmore energy", Analysis group, Texas Tech University, Lubbock. (50 min; April 29, 2019.)

· A. Gruber, Seminar talk, "Active Manifolds: A geometric approach to dimension reduction for sensitivity analysis", ORNL Computational and Applied Mathematics group, Oak Ridge, Tennessee. (50 min; August 1, 2018.)

Editorial and Reviewing Experience

· Organizer, session #54, "Elastic curves and surfaces with applications and numerical representations", 18th International Conference of Numerical Analysis and Applied Mathematics, Sep 17-23, 2020.

· Reviewed for: J. Comput. Phys. (JCP), Comput. Methods Appl. Mech. Eng. (CMAME), Electron. J. Stat. (EJS).

Other Service

· Panel Member, Early Career Panel, TTU Association of Women in Mathematics, Apr. 21, 2022 (virtual).

· Ph.D. thesis committee member, Madusha Atampalage, "Topics of Minimal Surfaces and Applications", defended Apr. 2021 (graduated Aug. 2021), Texas Tech University.

TECHNICAL SKILLS

Courses Taught as Primary Instructor

· Advanced Calculus I (TTU Math 4350)
· Foundations of Algebra I (TTU Math 3360)
· Higher Mathematics II (PDEs) for Scientists and Engineers (TTU Math 3351)
· Higher Mathematics I (ODEs) for Scientists and Engineers (TTU Math 3350)
· Introduction to Critical Reasoning and Proof (TTU Math 3310)
· Calculus III with Applications (TTU Math 2450)
· Calculus II with Applications (TTU Math 1452)
· College Algebra (TTU Math 1320)
· Intro. to Data Analytics (10-hour short course self-developed for TTUCR)

Computer Languages and Technologies

· Python (expert).
· C++ (experienced).
· Wolfram Mathematica (some experience), MathWorks MATLAB (experienced).
· MacOS/Unix, Numpy/Scipy, PyTorch, Blender, ParaView, Adobe Illustrator, LaTeX.

Laboratory Experience

· Chromatography: TLC, HPLC, GC, column.
· Deposition: CSS, PL.
· Acid/base titration; chemical distillation/recrystalization.
· Bomb calorimetry; lithography; Hall voltage measurement.
· Class 1000 cleanroom experience.

OTHER AWARDS AND HONORS

- Nominated for TTU Outstanding Dissertation award, 2020.
- SIAM Graduate Scholarship, TTU chapter, 2018–2019, $600.
- Gordon Fuller Graduate Scholarship, TTU Mathematics Department, 2018–2019, $825.
- Travel stipend, John H. Barrett memorial lectures on mean curvature flow, University of Tennessee at Knoxville, 5/2018, $600.
- Patrick L. Odell Graduate Scholarship, TTU Mathematics Department, 2016–2017, $350.
- Proven Achievers Transfer Scholarship, Texas Tech University, 2014–2016, $6,500/yr.
- Leland F. and Helen Schubert Honors Scholarship, Ohio Wesleyan University, 2011–2014, $35,000/yr.
- Music Performance Merit Scholarship, Ohio Wesleyan University, 2011–2014, $7,500/yr.
- CRC Press Chemistry Achievement Award, Ohio Wesleyan University, 2012.