Zachary M. Boyd

Assistant Professor
Department of Mathematics
Brigham Young University
2021 to present

boyd@mathematics.byu.edu
http://math.byu.edu/~zboyd/

Training

- **University of North Carolina at Chapel Hill** *2018–2021*
  Postdoctoral Research Associate
  Advisor: Peter J. Mucha

- **University of California, Los Angeles** *2014–2018*
  Ph.D. Mathematics
  NDSEG Fellow
  Advisor: Andrea L. Bertozzi

- **Brigham Young University** *2008–2014*
  M.S. Mathematics, B.S. Mathematics
  Monson Presidential Scholar
  Advisor: Michael Dorff

Publications

- **Journal Articles**

  9. Kayvan Miri Lavassani*, Zachary M. Boyd*, and Bahar Movahedi, *Ten-tier and multi-scale supply chain network analysis of medical equipment: Random failure and intelligent attack analysis*, Submitted to Int. J. Prod. Res.

  8. Zachary M. Boyd, Nicolas Fraiman, Jeremy L. Marzuola, Peter J. Mucha, Braxton Osting, and Jonathan Weare, *A metric on directed graphs based on hitting probabilities*, SIAM J. Math. Data Sci., 3(2), pp. 467–493.

  7. Zachary M. Boyd, Emma M. Schmidt, Scott D. Ramsey, and Roy S. Baty, *Converging shocks and collapsing cavities in non-ideal materials*, Qu. J. Mech. Appl. Math., 74 (2019), pp. 501–520.

  6. Zachary M. Boyd, Mason A. Porter, and Andrea L. Bertozzi, *Stochastic block models are a discrete surface tension*, J. Nonlinear Sci., 2019.

  5. Zachary M. Boyd, Egil Bae, Xue-Cheng Tai, and Andrea L. Bertozzi, *Simplified energy landscape for modularity using total variation*, SIAM J. Appl. Math., 78 (2018), pp. 2439–2464.

  4. Scott D. Ramsey, Emma M. Schmidt, Zachary M. Boyd, Jennifer F. Lillieholm, and Roy S. Baty, *Converging shock flows for a Mie-Gruneisen equation of state*, Phys. Fluids, 30 (2018), 046101. (Editor's choice article.)

  3. Zachary M. Boyd, Scott D. Ramsey, and Roy S. Baty, *On the existence of self-similar converging shocks for arbitrary equation of state*, Qu. J. Mech. Appl. Math., 70 (2017), pp. 401–417.

  2. Scott D. Ramsey, Zachary M. Boyd, and Sarah Burnett, *Solution of the Noh Problem using the universal symmetry of the gas dynamics equations*, Shock Waves, 27 (2017), pp. 477–485.

1. Zachary M. Boyd, Michael Dorff, Maria Nowak, Matthew Romney, and Magdalena Woloszkiewicz, *Univalency of convolutions of harmonic mappings*, Appl. Math. Comp., 234C (2014), pp. 326–332.

- **Conference Paper**

  1. Jacob D. Moorman, Qinyi Chen, Thomas K. Tu, Zachary M. Boyd, and Andrea L. Bertozzi, *Filtering Methods for Subgraph Matching on Multiplex Networks*, Proc. GTA3 workshop, IEEE Conference on BIG DATA, Seattle, 2018, pp. 3979–3984.

- **Book Chapter—Original Research**

  1. Zachary M. Boyd, Michael Dorff, Rachel Messick, Matthew Romney, and Ryan Viertel, *Harmonic univalent mappings with singular inner function dilatation*, in 60 years of analytic functions in Lublin—In memory of our professors and friends Jan G. Krzyz, Zdislaw Lewandowski and Wojciech Szapiel, Jan Szynal, ed., Monogr. Univ. Econ. Innov. Lublin, Innovatio Press Scientific Publishing House, Lublin, 2013, pp. 191–200.

- **Book Chapter—Survey**

  1. Zachary M. Boyd and Michael Dorff, *Harmonic univalent mappings and minimal graphs*, in Current topics in pure and computational complex analysis, S. Joshi, M. Dorff, and I. Lahiri, eds., Springer, 2014, pp. 21–46.

- **Technical Reports**

  2. Zachary M. Boyd and Joanne Wendelberger, *An integrated approach to parameter learning in infinite dimensional space*, Los Alamos technical report LA-UR-17-28326, 2017.

  1. Zachary M. Boyd, Scott D. Ramsey, and Roy S. Baty, *Symmetries of the Euler compressible flow equations for general equation of state*, Los Alamos technical report LA-UR-15-28034, 2015.

- **Theses and Dissertations**

  2. Zachary M. Boyd. Community detection using total variation and surface tension. PhD dissertation. University of California, Los Angeles, 2018.

  1. Zachary M. Boyd. Convolutions and convex combinations of harmonic mappings of the disk. Master's thesis. Brigham Young Univerity, Provo, 2014.

- **Unpublished Manuscript**

  1. Zachary M. Boyd and Andrea Bertozzi, PageRank Modularity MBO, 2015.

Grants

- LEAPS-MPS: Structure and Dynamics of Global Supply Chain Networks, PI Boyd, 2022-2023.

- UNC Cares Grant: Global Supply Chain of Medical Equipment: Vulnerability Assessment, Emergency Response Tool, and Financial Impact Analysisa, PI Lavassani, partner Boyd, 2020.

Presentations

- **Conferences and workshops**

  22. A metric on directed graph nodes based on hitting probabilities, SIAM Annual Meeting, 2021.

  21. A metric on directed graph nodes based on hitting probabilities, SIAM Conference on Discrete Math, 2021.

  20. A metric on directed graph nodes based on hitting probabilities, SIAM Conference on Applied and Computational Discrete Algorithms, 2021.

  19. Resiliency of Global Medical Equipment Supply Chains, French Regional Conference on Complex Systems, 2021.

  18. A metric on directed graph nodes based on hitting probabilities, French Regional Conference on Complex Systems, 2021.

  17. Resiliency of Global Medical Equipment Supply Chains, Networks, 2021.

  16. (Invited) Resiliency of Global Medical Equipment Supply Chains, SysPlatform, 2021.

  15. Resiliency of Global Medical Equipment Supply Chains, Northeast regional conference on complex systems, 2021. (poster)

  14. (Invited) A metric on directed graph nodes based on hitting probabilities, AMS Southwest Sectional Meeting, 2021.

  13. A metric on directed graph nodes based on hitting probabilities, Complex Networks 2020.

  12. (Invited) Community detection using total variation and surface tension, Theory and Algorithms of Graph-based Learning, IMA, 2020.

  11. A metric on directed graph nodes based on hitting probabilities, NetSci 2020.

  10. SBM is discrete surface tension, CompleNet, 2018. (poster)

  9. SBM is discrete surface tension, BiFi, 2018.

  8. Formulations of community detection in terms of total variation and surface tension, Flows, mappings, and shapes, Isaac Newton Institute, 2017.

  7. (Invited) Modularity as a balanced cut or total variation problem, ISODS, NetSci, Indianapolis, 2017.

  6. Existence of solutions to the Guderley implosion problem in arbitrary media, APS Division of Fluid Dynamics, Portland, 2016.

  5. Self-similarity in an arbitrary flow medium, APS Division of Fluid Dynamics, Boston, 2015.

  4. Convolutions of harmonic maps, BYU Spring Research Conference, 2013.

  3. Harmonic mappings with singular inner function dilatation, International Workshop on Complex Analysis and its Applications. Walchand College of Engineering, 2012.

  2. Harmonic mappings with singular inner function dilatation, AMS Western Sectional Meeting, 2012.

  1. Harmonic mappings with singular inner function dilatation, Brigham Young University, Spring Research Conference, 2012.

- **Seminars, colloquia, and other talks**

  13. Graph structures, control theory, and game theory, BYU IDEA Lab seminar, 2021.

  12. Open problems in networks and data science, BYU graduate student open house, 2021.

  11. Metrics and learning on directed graphs, and some open problems relating to robustness, University of Utah Applied Mathematics Seminar, 2021.

  10. A metric on directed graph nodes based on hitting probabilities, Seminar in Network Analysis at Carolina, 2020.

9. The Structure of Complex Networks, Mathematics department colloqium, Brigham Young University, 2019.

8. Stochastic block models are a discrete surface tension, Applied math collective, University of Utah, 2018.

7. Community detection using total variation and surface tension, Mucha group meeting, University of North Carolina at Chapel Chapel Hill, 2018.

6. Formulations of community detection in terms of total variation and surface tension, AI seminar, USC Information Science Institute, 2018.

5. Surface tension dynamics on networks, Brigham Young University dynamical systems seminar, 2017.

4. Community detection by variational methods, National Geospatial Intelligence Agency anticipatory analytics seminar, 2017.

3. Stochastic block model maximum likelihood estimation as a balanced cut or total variation minimization problem, UCLA network science seminar, 2017.

2. Modularity optimization as a balanced cut or total variation minimization problem, UCLA numerical methods seminar, 2017.

1. PageRank Modularity MBO, Hughes Research Labs seminar, 2016.

Other Scholarly Activities

- Faculty affiliate, BYU Record Linking Lab, 2021.

- BYU Committees

  - Advising
  - Online College Algebra

- Participant, "Data Science in the Social and Behavioral Sciences," Statistical and Applied Mathematical Sciences Institute (SAMSI), 2021

- Program committee member, 8th Annual SIAM Workshop on Network Science (NS20), Toronto, 2020

- Organizer, "Networks and dense matrices: applications and theory" minisymposium at SIAM Conference on the Mathematics of Data Science (MDS20), 2020 (canceled due to COVID)

- Consulting expert, Robinson Bradshaw law firm, 2019

- Graduate mentor, UCLA Applied Mathematics Research Experience for Undergraduates

- Volunteer, Engineering Department, FamilySearch research, 2017–2020

- Referee at

  - Proc. Nat. Acad. Sci.
  - SIAM J. Data Sci.
  - SIAM J. Appl. Math.
  - EPJ Data Science
  - Network Neuroscience

- J. Math. Imag. Vis.
- Discrete Cont. Dyn. Sys. Ser. B
- PLOS One
- Qu. J. Mech. Appl. Math.
- Imaging, Vision and Learning Based on Optimization and PDEs (workshop)

- Lecturer, Open Source Macroeconomics Laboratory at the University of Chicago, Summer 2017

- Graduate Research Assistant, Los Alamos National Laboratory, Summers 2015-2017

- Organizer, PDE and machine learning seminar, UCLA, Fall 2015

- Contributor, Foundations of Applied Mathematics, vol. 1, by J. Humphreys, T. J. Jarvis, and Emily Evans, 2017, Springer, Summer 2014

- Contributor, Labs for Foundations of Applied Mathematics. J. Humphreys, & T. J. Jarvis, eds. Available at `https://github.com/Foundations-of-Applied-Mathematics/Labs`

Teaching

- **Instructor**
  Math 320, Algorithm design and optimization, Fall 2021
  Math 564, Mathematical modeling in the life sciences, Winter 2020
  Math 564, Mathematical modeling in the life sciences, Winter 2019
  Math 102, Quantitative reasoning, Spring 2013

- **Teaching assistant**
  Math 134, Systems of differential equations, Spring 2015
  Math 135, Ordinary differential equations, Winter 2015
  Math 33A, Linear algebra and applications, Fall 2014
  Math 112, Calculus II, Fall 2014
  Math 541, Linear analysis, Winter 2014
  Math 371, Group theory, Spring, 2013
  Math 330, Elementary linear algebra, Fall 2013
  Math 221, Careers in math, Winter 2014
  Math 343, Elementary linear algebra, Winter 2013

- **Curriculum development**
  Brigham Young University, online calculus curriculum development assistant, Fall 2013

Student mentoring

- Graduate students: 2

- Undergraduate students: 7

- REU students: 9

Citizenship

United States