Charles Puelz

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(**updated:** April 16, 2019)

Experience

- Assistant Professor/Courant Instructor, September 2018–present
  Courant Institute of Mathematical Sciences, New York University

- Postdoctoral Research Associate, July 2017–August 2018
  Visiting Scholar, August 2018–present
  Department of Mathematics, University of North Carolina, Chapel Hill
  advisor: Boyce Griffith

- Graduate Research Assistant, August 2011–May 2017
  Department of Computational and Applied Mathematics, Rice University
  advisors: Beatrice Riviere, Craig Rusin, Mark Embree

- Undergraduate Research Assistant, Summer 2010
  Department of Mathematics, Massachusetts Institute of Technology
  advisor: Laurent Demanet

- Undergraduate Research Assistant, Summer 2009
  Max Planck Institute for Dynamics and Self–Organization
  advisor: Tsampikos Kottos

Education

- Ph.D. in Computational and Applied Mathematics, Rice University, Houston, TX, May 2017
  title: *Numerical methods and applications for reduced models of blood flow*
  advisors: Beatrice Riviere (Rice) and Craig G. Rusin (Baylor College of Medicine)

- M.A. in Computational and Applied Mathematics, Rice University, Houston, TX, May 2013
  title: *Improved spectral calculations for discrete Schrödinger operators*
  advisor: Mark Embree

- B.A. in Mathematics and B.A. in Physics, Wesleyan University, Middletown, CT, May 2011
  Phi Beta Kappa and honors in mathematics

Journal Papers

1. "A sharp interface method for an immersed viscoelastic solid." C. Puelz and B.E. Griffith. 2019. *submitted.*

2. "A priori error estimates of Adams-Bashforth discontinuous Galerkin methods for scalar nonlinear conservation laws." C. Puelz, B. Rivière. *Journal of Numerical Mathematics*, 26(3), pp. 151–172, 2018.

3. "A computational study of the Fontan circulation with fenestration or hepatic vein exclusion." C. Puelz, S. Acosta, B. Rivière, D. Penny, K. Brady, C.G. Rusin. *Computers in Biology and Medicine*, 89, pp. 405-418, 2017.

4. "Cardiovascular mechanics in the early stages of pulmonary hypertension: a computational study." S. Acosta, C. Puelz, B. Rivière, D. Penny, K. Brady, C.G. Rusin. *Biomechanics and Modeling in Mechanobiology*, 16(6), pp. 2093–2112, 2017.

5. "Convergence of IPDG for coupled time–dependent Navier–Stokes and Darcy equations." N. Chabaane, V. Girault, C. Puelz, B. Rivière. *Journal of Computational and Applied Mathematics*, 324, pp. 25–48, 2017.

6. "Comparison of reduced blood flow models using Runge–Kutta discontinuous Galerkin methods." C. Puelz, S. Čanić, B. Rivière, C.G. Rusin. *Applied Numerical Mathematics*, 115, pp. 114–141, 2017.

7. "Numerical method of characteristics for one–dimensional blood flow." S. Acosta, C. Puelz, B. Rivière, C.G. Rusin, D. Penny. *Journal of Computational Physics*, 294, pp. 96-109, 2015.

8. "Spectral approximation for quasiperiodic Jacobi operators." C. Puelz, M. Embree, J. Fillman. *Integral Equations and Operator Theory*, 82(4), pp. 533-554, 2015.

Conference Abstracts

1. "Mathematical investigation of impact of recirculation in patients receiving tandem extracorporeal membrane oxygenation and therapeutic plasma exchange." C. Puelz, Y.A. Park, J. Marinaro, C.S. Peskin, B.E. Griffith, J.S. Raval. *American Society for Apheresis Annual Meeting 2019*, Portland, OR.

2. "Immersed boundary finite element hyperelastic heart model." C. Puelz, M.A. Smith, S. Rossi, G. Sturgeon, P. Segars, and B. Griffith. *ECCM–ECFD 2018*, Glasgow, Scotland.

Theses and Technical Reports

1. *Numerical methods and applications for reduced models of blood flow*, PhD Thesis, Rice University, 2017.

2. *Improved spectral calculations for discrete Schrödinger operators*, Masters Thesis, Rice University, 2013.

3. "Visualizing the Pareto Surface." B. Hosseini, G. Liu, C. Puelz, S. Tracht, M. Smilovic. *IMA Preprint Series* 2401, 2012.

Funding

- AMS MRC Microconference on Parameter Estimation, August 9, 2018. $5,350.
  co-organized with Renee Brady, Ben Randall, and Mette Olufsen.

Computer Skills

- Computer Languages: FORTRAN, C, C^{++}

- Tools: SVN, Emacs, Git, Eclipse, netbeans, MATLAB

- Experience with: Python

Honors and Awards

- Alan Weiser Memorial Travel Award, Rice CAAM department, April 2016.

- National Library of Medicine training fellowship through the Gulf Coast Consortia
  for the Quantitative Biomedical Sciences, awarded 2014, renewed 2015 and 2016.

- Honorable Mention in the National Science Foundation GRFP competition, April 2013.

- SIAM Student Chapter Certificate of Recognition, April 2013.

- Rae Shortt Prize, Wesleyan math department, April 2010.

- Robertson Math Award, Wesleyan math department, April 2009.

Teaching and Mentoring

Course	Date	Institution	Role
MATH 252: Numerical Analysis	Spring 2019	NYU	Instructor
MATH 395: Modeling and Sim. in Sci., Eng., and Econ.	Fall 2018	NYU	Co Instructor
CAAM 336: Differential Equations in Science and Eng.	Spring 2015	Rice	Teaching Assistant
CAAM 335: Matrix Analysis	Fall 2014	Rice	Teaching Assistant
CAAM 335: Matrix Analysis	Fall 2013	Rice	Teaching Assistant
CAAM 335: Matrix Analysis	Spring 2013	Rice	Lab Instructor
CAAM 210: Intro to Eng. Computation	Fall 2012	Rice	Rice Learning Assistant

- Mentor for undergraduate researcher Lynn Jin, with Charlie Peskin. Lynn is working on a zero dimensional pulsatile model for the fenestrated Fontan physiology which includes pulsatile oxygen–transport dynamics. September 2018–present.

- Mentor for post–undergraduate researcher Margaret Anne Smith, with Boyce Griffith. Margaret Anne is working on developing a model of the human heart. She has been learning about computer aided design, meshing, solid mechanics, version control software and Matlab scripting. August 2017–August 2018.

- Lab instructor for matrix analysis lab, Rice University, Spring 2013.
  Organized experiments for students interested in exploring linear algebra concepts within a hands–on setting. Students enrolled in this lab while concurrently taking a sophmore/junior level linear algebra course.

- Rice Learning assistant (RLA), Rice University, Fall 2012.
  Held a weekly interactive lab section for students. We worked through Matlab implementations of concepts introduced in the lecture portion of the class. This position included a pedagogy course which brought RLAs together for a discussion about effective pedagogical strategies for conveying course content.

- Teaching Assistant, Tutor, and Grader, Wesleyan University, Spring 2008–Spring 2011.

Service

- Session chair for contributed presentation session titled "Applications in CSE," SIAM CSE, 2019.

- Reviewer for: *Numerical Methods for Partial Differential Equations*, *Journal of Theoretical Biology*, *Journal of Fluids and Structures*.

- Co–organizer of Applied Math/Applied Math Lab seminar in the Courant Institute, 2018–2019.

- Co–organizer of AMS microconference on parameter estimation in physiological models. August 9, 2018.

- Co–organizer of minisymposium at the 42nd SIAM Southeastern Atlantic Section Conference titled "Cardiovascular Modeling and Simulation." March 9–11, 2018.

- Co–organizer of the Applied Mathematics Colloquium in the UNC–CH Mathematics Department, 2017–2018.

- Co–organizer of an AMS minisymposium at the Joint Mathematics Meeting. Minisymposium titled "Mathematics in Physiology and Medicine." January 5, 2017.

- Speaker at "Rice Summer Math Days," a summer program for high school students interested in studying mathematics, June 2015.

- SIAM student chapter president, Rice University, 2012–2013.

Presentations

1. "A review of Taylor's 1953 paper on dispersion of a solute in fluid and related applications."
   joint with Ondrej Maxian (Courant).
   Courant Modeling and Simulation Group Seminar, March 2019.

2. "Hyperelastic immersed boundary finite element model of the human heart."
   SIAM CSE, Spokane, WA, 2019.

3. "A sharp interface method for an immersed viscoelastic solid."
   WONAPDE 2019, Universidad de Concepción, Concepción, Chile, January 23, 2019.

4. "Hyperelastic immersed boundary finite element model of a human heart."
   WONAPDE 2019, Universidad de Concepción, Concepción, Chile, January 23, 2019.

5. "Computer model of the human heart."
   CAAM Graduate Seminar, Rice University, Houston, TX, January 16, 2019.

6. "Computer modeling of the human heart."
   Courant Instructor Day, CIMS, New York, NY, October 12, 2018.

7. "A one–dimensional vessel network model for the Fontan circulation."
   Biomath/Comp. Biology Colloquium, CIMS, New York, NY, October 2, 2018.

8. "Construction of a hyperelastic immersed boundary model of the human heart."
   Biomath/Comp. Biology Colloquium, CIMS, New York, NY, September 18, 2018.

9. "A hyperelastic immersed boundary model of the human heart."
   SIAM Life Sciences, Minneapolis, MN, 2018.

10. "Reduced model for the Fontan circulation."
    SIAM Life Sciences, Minneapolis, MN, 2018.

11. "Immersed boundary finite element hyperelastic heart model."
    ECCM–ECFD, Glasgow, UK, June 2018.

12. "Computational modeling of Fontan hemodynamics"
    North Carolina State University Biomathematics Seminar, Raleigh, NC, April 2018.

13. "Discretizations of 1D blood flow models and an application to the Fontan physiology"
    Virginia Tech Numerical Analysis Seminar, Blacksburg, VA, November 1, 2017.

14. "One dimensional vessel network models for studying abnormal physiologies"
    UNC Department of Mathematics Applied Mathematics Colloquium, Chapel Hill, NC, September 2017.

15. "Numerical methods for blood flow"
    Rice CAAM department graduate colloquium, Houston, TX, March 2017.

16. "Reduced models for blood flow"
    Finite Element Rodeo, University of Houston, Houston, TX, March 2017.

17. "One–dimensional blood flow models: analysis and applications"
    SIAM Life Sciences, Boston, MA, July 2016.

18. "Discontinuous Galerkin discretizations of one–dimensional blood flow models"
    Finite Element Rodeo, Texas A&M University, College Station, TX, March 2016.

19. "Numerical methods for reduced blood flow models"
    National Institute of Standards and Technology, Gaithersburg, MD, June 2015.

20. "Discontinuous Galerkin methods for reduced blood flow models"
    Finite Element Rodeo, Southern Methodist University, Dallas, TX, May 2015.

21. "An $O(N^2)$ eigenvalue algorithm for period–N Jacobi operators"
    Joint Mathematics Meeting, San Antonio, TX, January 2015.

22. "Spectra of Schrödinger operators via transfer matrices"
    Rice CAAM department graduate colloquium, Houston, TX, January 2014.

23. "Electrical networks and Polya's theorem"
    Rice CAAM department graduate colloquium, Houston, TX, January 2012.

24. "Random walks and electrical networks"
    Wesleyan math department senior honors presentation, Wesleyan University, Middletown, CT, April 2011.

25. "Oil drilling and mathematics"
    Wesleyan math department undergraduate colloquium, Middletown, CT, February 2011.

Posters

1. "Heart Modeling with the Immersed Boundary Finite Element Method."
   with Margaret Anne Smith, Simone Rossi, and Boyce Griffith.
   SIAM Annual Meeting, Portland, OR, July 2018.

2. "Hyperelastic immersed boundary finite element heart model."
   with Margaret Anne Smith, Simone Rossi, and Boyce Griffith.
   42nd SIAM Southeastern Atlantic Section Conference, University of North Carolina, Chapel Hill, NC, March 2018.

3. "One–dimensional model of blood flow discretized with Runge–Kutta discontinuous Galerkin methods"
   SIAM Life Sciences, Boston, MA, July 2016.

4. "Computational modeling of hypoplastic left heart syndrome for improved decision support"
   NLM Informatics Training Conference, Ohio State University, Columbus, OH, June 2016.

5. "Mathematical modeling of congenital heart defects and abnormal hemodynamic physiologies"
   Sigma Xi (Rice and TMC chapter) holiday event, Houston, TX, December 2015.

6. "Blood flow model for improved decision support"
   AMIA Annual Symposium, San Francisco, CA, November 2015

7. "A closed–loop reduced hemodynamic model for the simulation of blood flow in patients with hypoplastic left heart syndrome"
   25th Keck Annual Research Conference, Bioscience Research Collaborative, Houston, TX, October 2015.

8. "Discontinuous Galerkin methods for reduced blood flow models"
   Advanced Numerical Methods in the Mathematical Sciences conference, Texas A&M University, College Station, TX, May 2015.

9. "Numerical methods for one–dimensional blood flow"
   poster at the Keck Annual Research Conference, Bioscience Research Collaborative, Houston, TX, November 2014.

Conferences and Workshops

- SIAM CSE, Spokane, WA, February 25–March 1, 2019.

- Sixth Chilean Workshop on Numerical Analysis of Partial Differential Equations (WONAPDE), Concepción, Chile, January 21–25, 2019.

- SIAM Life Sciences, Minneapolis, MN, August 6–9, 2018.

- SIAM Annual Meeting, Portland, OR, July 9–13, 2018.

- European Conference on Computational Mechanics/European Conference on Fluid Dynamics (ECCM–ECFD), Glasgow, UK, June 11–15, 2018.

- 42nd SIAM Southeastern Atlantic Section Conference, University of North Carolina, Chapel Hilll, NC, March 9–11, 2018.

- Finite Element Rodeo, University of Houston, Houston, TX, March 3–4, 2017.

- Joint Mathematics Meeting, Atlanta, GA, January 4–7, 2017.

- SIAM Life Sciences, Boston, MA, July 11–14, 2016.

- National Library of Medicine Informatics Training Conference, Ohio State University, Columbus, OH, June 27–28, 2016.

- AMS MRC: Mathematics in Physiology and Medicine, Snowbird Resort, Snowbird, UT, June 19–25, 2016.

- Finite Element Rodeo, Texas A&M University, College Station, TX, March 4–5, 2016.

- AMIA Annual Symposium, San Francisco, CA, November 14–18, 2015.

- 25th Keck Annual Research Conference, Bioscience Research Collaborative, Houston, TX, October 15–16, 2015.

- National Library of Medicine Informatics Training Conference, National Institutes of Health, Bethesda, MD, June 23–24, 2015.

- Advanced Numerical Methods in the Mathematical Sciences, Texas A&M University, College Station, TX, May 4–7, 2015.

- Finite Element Rodeo, Southern Methodist University, Dallas, TX, February 27–28, 2015.

- Joint Mathematics Meeting, San Antonio, TX, January 10–13, 2015.

- National Library of Medicine Informatics Training Conference, University of Pittsburgh, Pittsburgh, PA, June 17–18, 2014.

- 24th Keck Annual Research Conference, Bioscience Research Collaborative, Houston, TX, November 7, 2014.

- Gene Golub SIAM Summer School on Numerical Linear Algebra, Fudan University, Shanghai, China, July 22–August 9, 2013.

- Recent Advances in Harmonic Analysis and Spectral Theory, Texas A&M University, College Station, TX, August 6–10, 2012.

- Mathematical Modeling in Industry XVI, University of Calgary, Calgary, Alberta, July 18–27, 2012.