Andrew Kruse Gillette

agillette@math.arizona.edu

http://math.arizona.edu/~agillette/
much more information at my website

Employment

Assistant Professor, Department of Mathematics, **University of Arizona** 2013–present

Member, Program in Applied Mathematics, **University of Arizona** 2014–present

Postdoctoral Scholar in Mathematics **University of California, San Diego** 2011–2013
advisor: Dr. Michael Holst, Chancellor's Associates Endowed Chair VIII

Education

Ph.D. in Mathematics, **University of Texas at Austin** 2011
advisor: Dr. Chandrajit Bajaj, Computational Applied Mathematics Chair in Visualization

B.A. in Mathematics, summa cum laude, **Amherst College** 2004
advisor: Dr. Robert Benedetto, Department of Mathematics

Research Interests

Finite element methods; computational geometry and topology; scientific and high performance computing; applications to cardiac modeling; simulations for gravitational wave science; mathematics of visualization and data science.

Grants and Awards

Interdisciplinary Link Student Team Award, University of Arizona, $17,593, (co-PI: Sam Gralla) 2018

NSF Computational Math Award, DMS-1522289, $224,998, single PI 2015–2018

NSF Conference Award, DMS-1542183, $25,000, co-PI (PI: Chunmei Wang, Georgia Tech) 2015

AMS-Simons Travel Grant, $4000, single PI 2012–2014

Refereed Journal Publications

(19). A. Gillette, T. Kloefkorn, V. Sanders, *Computational Serendipity and Tensor Product Finite Element Differential Forms*, Submitted. Preprint: arXiv:1806.00031, 2018.

(18). A. Gillette, K. Hu, S. Zhang, *Nonstandard finite element de Rham complexes on cubical meshes*, Submitted. Preprint: arXiv:1804.04390, 2018.

17. A. Gillette, T. Kloefkorn, *Trimmed serendipity finite element differential forms*, Mathematics of Computation, 88:316. pp. 583–606, 2019.

16. A. Gillette, C. Gross, K. Plackowski, *Numerical studies of serendipity and tensor product elements for eigenvalue problems*, Involve, a journal of Mathematics, 11:4, pp. 661–678, 2018.

15. A. Gillette, M. Holst, Y. Zhu, *Finite element exterior calculus for evolution problems*, ICMSEC Journal of Computational Mathematics, 35:2, pp. 187–212, 2017.

14. A. Gillette, *Serendipity and tensor product affine pyramid finite elements*, SMAI Journal of Computational Mathematics, 2, pp. 215–228, 2016.

13. A. Gillette, A. Rand, C. Bajaj, *Construction of scalar and vector finite element families on polygonal and polyhedral meshes*, Computational Methods in Applied Mathematics, 16:4, pp. 667–683, 2016.

12. M. Floater, A. Gillette, *Nodal bases for the serendipity family of finite elements*, Foundations of Computational Mathematics, 17:4, pp. 879–893, 2016.

11. A. Gillette, A. Rand, *Interpolation error estimates for harmonic coordinates on polytopes*, ESAIM: Mathematical Modelling and Numerical Analysis, 50:3, pp. 651–676, 2016.

Refereed Journal Publications (continued)

10. S. Christiansen, A. Gillette, *Constructions of some minimal finite element systems*, ESAIM: Mathematical Modelling and Numerical Analysis, 50:3, pp. 833–850, 2016.
9. K. Vincent, M. Gonzales, A. Gillette, C. Villongco, S. Pezzuto, J. Omens, M. Holst, A.D. McCulloch, *High-order interpolation methods for cardiac monodomain simulations*, Frontiers in Physiology, 6:217, 2015.
8. M. Floater, A. Gillette, N. Sukumar, *Gradient bounds for Wachspress coordinates on polytopes*, SIAM Journal on Numerical Analysis, 52:1, pp. 515–532, 2014.
7. P. Kekenes-Huskey, A. Gillette, J.A. McCammon, *Predicting the influence of long-range molecular interactions on macroscopic-scale diffusion by homogenization of the Smoluchowski equation*, Journal of Chemical Physics, 140:17, article 174106, 2014.
6. P. Kekenes-Huskey, T. Liao, A. Gillette, J. Hake, Y. Zhang, A. Michailova, A.D. McCulloch, J.A. McCammon, *Molecular and sub cellular-scale modeling of nucleotide diffusion in the cardiac myofilament lattice*, Biophysical Journal, 105:9, pp. 2130–2140, 2013.
5. P. Kekenes-Huskey, A. Gillette, J. Hake, J. McCammon, *Finite element estimation of protein-ligand association rates with post-encounter effects: Applications to calcium binding in Troponin C and SERCA*, Computational Science and Discovery, 5:1, pp. 1–20, 2012.
4. A. Rand, A. Gillette, C. Bajaj, *Quadratic serendipity finite elements on polygons using generalized barycentric coordinates*, Mathematics of Computation, 83:290, pp. 2691–2716, 2014.
3. A. Rand, A. Gillette, C. Bajaj, *Interpolation error estimates for mean value coordinates*, Advances in Computational Mathematics, 39:2, pp. 327–347, 2013.
2. A. Gillette, A. Rand, C. Bajaj, *Error estimates for generalized barycentric interpolation*, Advances in Computational Mathematics, 37:3, pp. 417–439, 2012.
1. A. Gillette, C. Bajaj, *Dual formulations of mixed finite element methods*, Computer Aided Design, 43:10, pp. 1213–1221, 2010.

Refereed Conference Proceedings

7. A. Gillette, *Hermite and Bernstein style basis functions for cubic serendipity spaces on squares and cubes*, Proc. Approximation Theory XIV: San Antonio 2013, Springer, pp. 103–121, 2014.
6. A. Gillette, C. Bajaj, *A generalization for stable mixed finite elements*, Proc. ACM Symposium on Solid and Physical Modeling, Association for Computing Machinery, pp. 41–50., 2010.
5. C. Bajaj, A. Gillette, Q. Zhang, *Stable mesh decimation*, Proc. SIAM/ACM Joint Conf. on Geometric and Physical Modeling, Association for Computing Machinery, pp. 277–282., 2009.
4. C. Bajaj, A. Gillette, S. Goswami, B. Kwon, J. Rivera, *Complementary space for enhanced uncertainty and dynamics visualization*, chapter in 'Topological Methods in Data Analysis and Visualization: Theory, Algorithms and Applications,' Springer-Verlag, pp. 217–228., 2009.
3. C. Bajaj, A. Gillette, S. Goswami, *Topology based selection and curation of level sets*, chapter in 'Topology-Based Methods in Visualization,' Springer-Verlag, pp. 45–58, 2009.
2. C. Bajaj, A. Gillette, *Quality meshing of a forest of branching structures*, Proc. 17th International Meshing Roundtable, Springer-Verlag, pp. 433–449, 2008.
1. S. Goswami, A. Gillette, C. Bajaj, *Efficient Delaunay mesh generation from sampled scalar functions*, Proc. 16th International Meshing Roundtable, Springer-Verlag, pp. 495–511, 2007.

Other Publications

5. A. Gillette, T. Kloefkorn, *Counting Dots on Tetrahedra and Cubes: Accelerating computation by identifying patterns*, MTCircular (newsletter about Math Teachers Circles), American Institute of Mathematics, to appear, 2019.
4. A. Gillette, A. Rand, *Shape quality for generalized barycentric interpolation,* chapter in 'Generalized Barycentric Coordinates in Computer Graphics and Computational Mechanics', K. Hormann, N. Sukumar, editors, CRC Press, 2017.
3. A. Gillette, *Serendipity methods: Using mathematics to accelerate computation*, UA Mathematics Newsletter (for public audience), Fall 2014.
2. A. Gillette, *Stability of dual discretization methods for partial differential equations*, UT Austin Digital Repository, PhD Dissertation, 2011.
1. A. Gillette, *Notes on Discrete Exterior Calculus*, Technical Report, UT Austin, 2009.

Recent Poster Presentations

4. A. Gillette, T. Kloefkorn, *Trimmed Serendipity Finite Elements*, SIAM Conference on Computational Science and Engineering, 2017.
3. A. Gillette, *Serendipity and tensor product pyramid finite elements*, Advances in Mathematics of Finite Elements (Ivo Babuska 90th Birthday Conference), 2016.

2b. A. Gillette, A. Rand, *What is a good linear finite element... on a generic polytope?*, Advanced Numerical Methods in the Mathematical Sciences (Workshop at Texas A&M), 2015.

2a. A. Gillette, A. Rand, *What is a good linear finite element... on a generic polytope?*, SIAM Conference on Computational Science and Engineering, 2015.

1. A. Gillette, M. Floater, *Nodal basis functions for serendipity finite elements*, ICERM Workshop: Robust Discretization and Fast Solvers for Computable Multi-Physics Models, 2014.

Recent Invited Talks

"Structure Preservation in (Trimmed) Serendipity Finite Element Methods" 2018
Canadian Mathematical Society Winter Meeting, Vancouver, Canada

"(Trimmed) Serendipity Finite Element Methods in Theory and Practice" 2018
Louisiana State University Computational Mathematics Seminar, Baton Rouge, LA

"Polynomial Differential Forms for Efficient Finite Element Methods" 2018
Baylor University Mathematics Colloquium, Waco, TX

"From Squares and Cubes to Quads and Hexes: Recent Advances in Finite Elements" 2018
UC San Diego Center for Computational Mathematics Seminar, San Diego, CA

"An Introduction to Trimmed Serendipity Finite Element Spaces" 2018
Joint Mathematics Meetings, San Diego, CA

"A Plethora of Basis Functions for Quadrilaterals and Hexahedra" 2017
European Conference on Numerical Mathematics and Advanced Applications, Voss, Norway.

"Decompositions of (Trimmed) Serendipity Spaces" 2017
European Conference on Numerical Mathematics and Advanced Applications, Voss, Norway.

"A 'Fifth Column' for the Periodic Table of Finite Elements" 2017
Polytopal Element Methods in Mathematics and Engineering, Milan, Italy

"A New Family of Conforming Finite Elements on Cubical Meshes" 2016
University of Pittsburgh Computational Math Seminar, Pittsburgh, PA

"The Serendipity Pyramid Finite Element" 2016
Mathematics of Finite Elements and Applications, Brunel University, England

"Generalized Barycentric Coordinates for Degenerate Geometry in Finite Element Methods" 2016
Mathematics of Finite Elements and Applications, Brunel University, England

Recent Workshop and Mini-symposium Co-organizer

Geometric & Image Data Sciences: Big Data Analysis, Graphics & Visualization 2018
Co-organizer, special workshop celebrating 60th birthday of Chandrajit Bajaj

Polytopal Discretization Methods for Partial Differential Equations 2018
SIAM Annual Meeting, mini-symposium

Polygonal and Polyhedral Discretizations in Computational Mechanics 2018
13th World Congress on Computational Mechanics, mini-symposium

Mathematics of Gravitational Wave Science 2018
Joint Mathematics Meetings, AMS Special Session

Advances in Quadrilateral and Hexahedral Finite Elements (poster collection) 2017
SIAM Computational Science and Engineering

Polytopal Element Methods in Mathematics and Engineering (special workshop) 2015
Co-organizer; 24 speakers and 54 participants, including many non-US researchers.

Professional Service

Reviewer
AMS Mathematical Reviews; Mathematics of Computation; Numerische Mathematik; ICMSEC Journal of Computational Mathematics; SIAM Numerical Analysis; SIAM Scientific Computing; Finite Elements in Analysis and Design; SIGGRAPH; SIGGRAPH Asia; ESAIM: Mathematical Modelling and NumericalAnalysis; Int'l Journal for Numerical Methods in Engineering; Journal of Aerospace Engineering; ACM Transactions on Mathematical Software; Computer Methods in Applied Mechanics and Engineering; Computer Aided Design; Mathematische Zeitschrift; others.

Program Committee Member, Geometric Modeling and Processing 2016, 2017

Guest Editor, Computer Aided Geometric Design Special Issue: GMP2015 2015

Program Co-Chair, 9th International Conference on Geometric Modeling and Processing 2015

Panelist and "ad hoc" Reviewer, National Science Foundation & Department of Energy

Outreach to K-12 Teachers

Instructor, Tucson Math Teachers' Circle Session 2016–2018
Planned and led research-inspired activities for Southern Arizona teachers (annually).

K-12 Alliance Professional Development Institute, Montebello, CA 2007, 2008
Taught week-long activity-based seminar for math teachers of grades 3-9.

Teaching

Nominated for Provost Award for Innovations in Teaching (*to be announced in 2019*)
Inquiry-based learning section of Linear Algebra (supported by internal grant; *spring 2019)*

Course coordinator

Introduction to Linear Algebra (*8 sections*) fall 2018, spring 2019
Exploring and Understanding Data (*6 sections*) spring 2018

Course instructor

Introduction to Linear Algebra fall 2016, 2018–2019
Exploring and Understanding Data (*new UA course*) 2017–2018
Principles of Analysis (*graduate core course*) 2014–2016
Discrete Mathematics in Computer Science spring 2014
Calculus I fall 2013
Vector Calculus (*Lecturer, UC San Diego*) spring 2012
Precalculus (*Instructor, UT Austin*) 2009–2010
Calculus (*Teaching Assistant, UT Austin*) 2005–2007

Membership

AMS, SIAM, Council on Undergraduate Research, Budapest Semesters in Mathematics (alumnus)