

Dan Knopf

Contact Information

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Professional History

Higher education.

- PhD in Mathematics (1999) University of Wisconsin-Milwaukee.
(Supervisor: Kevin McLeod. Mentor: Bennett Chow.)
- BA in Mathematics (1993) University of Wisconsin-Milwaukee.

Academic positions.

- Associate Dean for Graduate Education, College of Natural Sciences, The University of Texas at Austin (2014–24).
- Professor, Department of Mathematics, The University of Texas at Austin (2014–).
- Graduate Advisor, Department of Mathematics, The University of Texas at Austin (2009–14).
- Associate Professor, The University of Texas at Austin (2008–2014).
- Research Professorship, Mathematical Sciences Research Institute (MSRI), *Geometric Evolution Equations and Related Topics* (2006–2007).
- Assistant Professor, The University of Texas at Austin (2004–08).
- Visiting Assistant Professor, The University of Iowa (2002–04).
- VIGRE Van Vleck Visiting Assistant Professor, University of Wisconsin Madison (1999–2002).

Awards, honors, and professional development

Research grants and training grants.

- PI, Simons Foundation Collaboration Grant, *Dynamics of Ricci flow singularity formation and recovery*, 2019–24, \$42,000.
- PI, NSF grant: *Profiling singularities of geometric PDE*, 2012–16, \$160,679 (DMS-1205270).
- Co-PI with Dan Freed and Alan Reid, NSF grant: *RTG: Unified Training in Geometry and Topology*, 2012–18, \$2,499,126 (DMS-1148490).
- Graduate School Diversity Mentoring Fellowship, University of Texas, 2011–12.
- Frank E. Gerth III Faculty Fellowship, University of Texas, 2009–2021.
- PI, NSF CAREER award: *Investigating Ricci flow singularity formation*, 2006–2012, \$400,000 (DMS-0545984).
- PI, NSF grant: *Singularity models for Ricci flow*, 2005–08, \$108,000 (DMS-0505920).

- Summer Research Assignment, University of Texas, 2005.
- PI, NSF grant: *Behavior of the Ricci flow and related curvature flows*, 2002–06, \$80,000 (DMS-0202796, DMS-0328233, DMS-0511184).
- University of Wisconsin-Milwaukee Dissertation Fellowship, 1996–98.
- Office of Naval Research Graduate Fellowship, 1993–96.

Teaching awards.

- College of Natural Sciences Teaching Excellence Award, 2012.
- John R. Durbin Teaching Excellence Award in Mathematics, 2012.
- Services for Students with Disabilities Appreciation Award, Office of the Dean of Students, 2006.

Professional development.

- CIMER (Center for the Improvement of Mentored Experiences in Research) Facilitator Training, 2024.
- University of Texas Executive Management and Leadership Program, 2018.

Research and Scholarship

Areas of scholarship.

- Geometric analysis: applications of nonlinear PDE to differential geometry.
- Geometric evolution equations: heat flows applied to geometric objects.
- Ricci flow and its applications, including low-dimensional topology.

Research papers.

- Local singularities of compact multiply warped product Ricci flow solutions. Coauthors: James Isenberg, Zilu Ma, and Nataša Šešum. *Submitted*. ([arxiv:2502.08500](https://arxiv.org/abs/2502.08500)).
- Asymptotic behavior of unstable perturbations of the Fubini–Study metric in Ricci flow. Coauthors: David Garfinkle, James Isenberg, and Haotian Wu. *Submitted*. ([arxiv:2403.06427v1](https://arxiv.org/abs/2403.06427v1)).
- A numerical stability analysis of mean curvature flow of noncompact hypersurfaces with Type-II curvature blowup: II. Coauthors: David Garfinkle, James Isenberg, and Haotian Wu. *Exp. Math.* (2023) (DOI: 10.1080/10586458.2023.2201958)
- Ricci solitons, conical singularities, and nonuniqueness. Coauthor: Sigurd Angenent. *Geom. Funct. Anal. (GAFA)* **32** (2022), no. 3, 411–489. (DOI: 10.1007/s00039-022-00601-y)
- Singularity formation of complete Ricci flow solutions. Coauthors: Timothy Carson, James Isenberg, and Nataša Šešum. *Adv. Math.* **403** (2022) 108326.
- A numerical stability analysis of mean curvature flow of noncompact hypersurfaces with Type-II curvature blowup. Coauthors: David Garfinkle, James Isenberg, and Haotian Wu. *Nonlinearity* **34** (2021), no. 9, 6539–6560. (DOI: 10.1088/1361-6544/ac15a9)
- Non-Kähler Ricci flow singularities modeled on Kähler–Ricci solitons. Coauthors: James Isenberg and Nataša Šešum. *Pure Appl. Math. Q.* **15** (2019), no. 1, 749–784.

- Dynamic instability of $\mathbb{C}\mathbb{P}^N$ under Ricci flow. Coauthor: Nataša Šešum. *J. Geom. Anal.* **29** (2019), no. 1, 902–916. (DOI:10.1007/s12220-018-0022-6)
- Sphere bundles with 1/4-pinchd fiberwise metrics. Coauthors: Thomas Farrell, Zhou Gang, and Pedro Ontaneda. *Trans. Amer. Math. Soc.* **369** (2017), no. 9, 6613–6630. (<http://dx.doi.org/10.1090/tran/6993>)
- Ricci flow neckpinches without rotational symmetry. Coauthors: James Isenberg and Nataša Šešum. *Comm. Partial Differential Equations* **41** (2016), no. 12, 1860–1894. (DOI:10.1080/03605302.2016.1233982)
- Universality in mean curvature flow neckpinches. Coauthor: Zhou Gang. *Duke Math. J.* **164** (2015), no. 12, 2341–2406.
- Neckpinch dynamics of asymmetric surfaces evolving by mean curvature flow. Coauthors: Zhou Gang and Israel Michael Sigal. *Mem. Amer. Math. Soc.* **253** (2018), no. 1210, 1–78.
- Degenerate neckpinches in Ricci flow. Coauthors: Sigurd Angenent and James Isenberg. *J. Reine Angew. Math. (Crelle)* **709** (2015), 81–117.
- Minimally invasive surgery for Ricci flow singularities. Coauthors: Sigurd Angenent and M. Cristina Caputo. *J. Reine Angew. Math. (Crelle)* **672** (2012), 39–87.
- Formal matched asymptotics for degenerate Ricci flow neckpinches. Coauthors: Sigurd Angenent and James Isenberg. *Nonlinearity* **24** (2011), 2265–2280.
- Cross curvature flow on a negatively curved solid torus. Coauthors: Jason DeBlois and Andrea Young. *Algebr. Geom. Topol.* **10** (2010), 343–372.
- Convergence and stability of locally \mathbb{R}^N -invariant solutions of Ricci flow. *J. Geom. Anal.* **19** (2009), no. 4, 817–846.
- Estimating the trace-free Ricci tensor in Ricci flow. *Proc. Amer. Math. Soc.* **137** (2009), no. 9, 3099–3103.
- Asymptotic stability of the cross curvature flow at a hyperbolic metric. Coauthor: Andrea Young. *Proc. Amer. Math. Soc.* **137** (2009), no. 2, 699–709.
- Local monotonicity and mean value formulas for evolving Riemannian manifolds. Coauthors: Klaus Ecker, Lei Ni, and Peter Topping. *J. Reine Angew. Math. (Crelle)* **616** (2008), 89–130.
- Precise asymptotics of the Ricci flow neckpinch. Coauthor: Sigurd Angenent. *Comm. Anal. Geom.* **15** (2007), no. 4, 773–844.
- Linear stability of homogeneous Ricci solitons. Coauthors: Christine Guenther and James Isenberg. *Int. Math. Res. Not.* (2006), Art. ID 96253, (DOI: 10.1155/IMRN/2006/96253), 30 pp.
- Positivity of Ricci curvature under the Kähler–Ricci flow. *Commun. Contemp. Math.* **8** (2006), no. 1, 123–133.
- An example of neckpinching for Ricci flow on \mathcal{S}^{n+1} . Coauthor: Sigurd Angenent. *Math. Res. Lett.* **11** (2004), no. 4, 493–518.
- Rotationally symmetric shrinking and expanding gradient Kähler–Ricci solitons. Coauthors: Mikhail Feldman and Tom Ilmanen. *J. Differential Geom.* **65** (2003), no. 2, 169–209.

- A lower bound for the diameter of solutions to the Ricci flow with nonzero $H^1(M^n; \mathbb{R})$. Coauthor: Tom Ilmanen. *Math. Res. Lett.* **10** (2003), no. 2, 161–168.
- Hamilton’s injectivity radius estimate for sequences with almost nonnegative curvature operators. Coauthors: Bennett Chow and Peng Lu. *Comm. Anal. Geom.* **10** (2002), no. 5, 1151–1180.
- Stability of the Ricci flow at Ricci-flat metrics. Coauthors: Christine Guenther and James Isenberg. *Comm. Anal. Geom.* **10** (2002), no. 4, 741–777.
- New Li–Yau–Hamilton inequalities for the Ricci flow via the space-time approach. Coauthor: Bennett Chow. *J. Differential Geom.* **60** (2002), no. 1, 1–51.
- Quasi-convergence of model geometries under the Ricci flow. Coauthor: Kevin McLeod. *Comm. Anal. Geom.* **9** (2001), no. 4, 879–919.
- Quasi-convergence of the Ricci flow. *Comm. Anal. Geom.* **8** (2000), no. 2, 375–391.

Books.

- *The Ricci Flow: Techniques and Applications; Part IV: Long Time Solutions and Related Topics*. Coauthors: Bennett Chow, Sun-Chin Chu, David Glickenstein, Christine Guenther, James Isenberg, Tom Ivey, Peng Lu, Feng Luo, and Lei Ni. Mathematical Surveys and Monographs, Vol. 206. American Mathematical Society, Providence, RI, 2015.
- *The Ricci Flow: Techniques and Applications; Part III: Geometric-Analytic Aspects*. Coauthors: Bennett Chow, Sun-Chin Chu, David Glickenstein, Christine Guenther, James Isenberg, Tom Ivey, Peng Lu, Feng Luo, and Lei Ni. Mathematical Surveys and Monographs, Vol. 163. American Mathematical Society, Providence, RI, 2010.
- *The Ricci Flow: Techniques and Applications; Part II: Analytic Aspects*. Coauthors: Bennett Chow, Sun-Chin Chu, David Glickenstein, Christine Guenther, James Isenberg, Tom Ivey, Peng Lu, Feng Luo, and Lei Ni. Mathematical Surveys and Monographs, Vol. 144. American Mathematical Society, Providence, RI, 2008.
- *The Ricci Flow: Techniques and Applications; Part I: Geometric Aspects*. Coauthors: Bennett Chow, Sun-Chin Chu, David Glickenstein, Christine Guenther, James Isenberg, Tom Ivey, Peng Lu, Feng Luo, and Lei Ni. Mathematical Surveys and Monographs, Vol. 135. American Mathematical Society, Providence, RI, 2007.
- *The Ricci Flow: An Introduction*. Coauthor: Bennett Chow. Mathematical Surveys and Monographs, Vol. 110. American Mathematical Society, Providence, RI, 2004.

Surveys and expository articles.

- Neckpinching for asymmetric surfaces moving by mean curvature. *Nonlinear Evolution Problems*. Mathematisches Forschungsinstitut Oberwolfach Report No. 26/2012. (DOI: 10.4171/OWR/2012/26)
- An introduction to the Ricci flow neckpinch. *Geometric Evolution Equations*. Edited by Shu-Cheng Chang, Bennett Chow, Sun-Chin Chu, and

- Chang-Shou Lin. Contemporary Mathematics. Vol. 367, 141–148. American Mathematical Society, Providence, RI. 2005. (Refereed.)
- Singularity models for the Ricci flow: an introductory survey. *Variational Problems in Riemannian Geometry: Bubbles, Scans and Geometric Flows*. Edited by Paul Baird, Ahmad El Soufi, Ali Fardoun, and Rachid Regbaoui. Progress in Nonlinear Differential Equations and Their Applications, Vol. 59, 67–80. Birkhäuser, Basel, 2004.
 - An injectivity radius estimate for sequences of solutions to the Ricci flow having almost nonnegative curvature operators. Coauthors: Bennett Chow and Peng Lu. *Proceedings of ICCM 2001*. Edited by Chang-Shou Lin, Lo Yang, and Shing-Tung Yau. New Studies in Advanced Mathematics, Vol. 4, 249–256. International Press, Somerville, MA, 2004.

Invited lectures

National.

- Gauge Theory, Low-Dimensional Topology, and Geometric Analysis Conference, Rutgers University (May 2024).
- XIX Red Raider Mini-Symposium: Differential Geometry and Integrable Systems, Texas Tech University (April 2023).
- Colloquium, Department of Mathematics, University of Houston (October 2022).
- Geometric Analysis Seminar, University of Oregon (February 2022).
- Numerical and Geometric Methods for Ricci-flat Metrics and Flows: Simons Collaboration on Special Holonomy in Geometry, Analysis, and Physics, virtual meeting (May 2021).
- Rutgers Geometric Analysis Conference, virtual meeting (May 2021).
- AMS Sectional Meeting, virtual meeting — formerly at The University of Texas at El Paso (September 2020).
- Arizona State University Colloquium and Geometry Seminar (March 2020).
- Geometry & Topology Seminar, The University of Texas at Dallas (January 2020).
- Keynote Lecture, Jim Isenberg Pacific Coast Gravity Meeting, Utah State University (March 2019).
- Felix Klein Seminar, University of Notre Dame (February 2019).
- 2018 JDG/Lehigh University Geometry and Topology Conference (May, 2018).
- Differential Geometry Seminar, University of California, Irvine (February 2018).
- PDE & Geometric Analysis Seminar, University of Wisconsin-Madison (January 2018).
- Midwest Geometry Conference, Kansas State University (November 2017).
- AMS Sectional Meeting, University of North Texas (September 2017).
- Colloquium, University of Pennsylvania (April 2017).
- Colloquium, The University of Arizona (January 2017).
- Geometry Seminar, Stanford University (September 2015).
- Geometric Analysis and Topology Seminar, Courant Institute, NYU (May 2015).

- Workshop on Uniqueness in Analysis and Geometry, Massachusetts Institute of Technology (December 2014).
- Mathematical Physics Seminar, Caltech (April 2014).
- Geometry and Topology Seminar, University of Oklahoma (January 2014).
- Applied Math & PDE Seminar, University of California, Davis (November 2013).
- Colloquium, Rutgers University (September 2013).
- Colloquium, University of Pittsburgh (September 2013).
- Research Program in Geometric Analysis, Park City Math Institute (July 2013).
- Differential Geometry Seminar, University of California, Irvine (May 2013).
- Symposium: Perspectives of the Ricci Flow, CUNY (February 2013).
- Analysis & PDE Seminar, Stanford University (November 2012).
- Colloquium, The George Washington University (November 2012).
- Pacific Northwest Geometry Seminar, Oregon State University (November 2011).
- AMS Sectional Meeting, Cornell (September 2011).
- Dean's Speaker Series, Binghamton University (September 2011).
- Geometry-Topology Seminar, Caltech (May 2011).
- Differential Geometry Seminar, University of California, Santa Barbara (March 2011).
- Analysis Seminar, Cornell University (November 2010).
- Pacific Northwest Geometry Seminar, University of Oregon (October 2010).
- AMS Sectional Meeting, University of California, Los Angeles (October 2010).
- Colloquium, University of Texas at Arlington (September 2010).
- Geometry Seminar, Stanford University (May 2010).
- Differential Geometry Seminar, University of California, Irvine (May 2010).
- Calderón–Zygmund Analysis Seminar, University of Chicago (February 2010).
- Colloquium, University of Notre Dame (February 2010).
- Geometric Analysis Seminar, University of Oregon (November 2009).
- AMS Sectional Meeting, Baylor University (October 2009).
- PDE Seminar, The Ohio State University (May, 2009).
- Differential Geometry Seminar, University of California, San Diego (April 2009).
- 41st Texas Geometry and Topology Conference, University of Houston (February 2009).
- Geometric PDE Seminar, Institute for Advanced Study, Princeton (January 2009).
- Colloquium, University of Oregon (January 2009).
- Geometry Seminar, University of Arizona (October 2007).
- Geometric Analysis Seminar, University of Wisconsin-Madison (October 2007).
- Geometry Seminar, Texas A&M University (May 2007).
- Geometry/Topology Seminar, University of California, Davis (April 2007).
- Workshop on Geometric Evolution Equations, MSRI (March 2007).
- Colloquium, University of Massachusetts, Amherst (February 2007).

- Colloquium, University of California, Riverside (February 2007).
- Colloquium, University of Oregon (February 2007).
- Colloquium, University of Illinois at Chicago (January 2007).
- Geometry Seminar, University of Minnesota (December 2006).
- Geometric Analysis Seminar, University of Wisconsin-Madison (November 2006).
- Analysis and Geometry Seminar, University of Rochester (October 2006).
- Geometry and Analysis Seminar, Columbia University (September 2006).
- Colloquium, University of Oklahoma (April 2006).
- 35th Texas Geometry and Topology Conference, University of Houston (February 2006).
- Colloquium, Rice University (February 2006).
- Geometry Seminar, Stanford University (December 2005).
- Workshop on Geometric Analysis and Flows, University of California, San Diego (July 2005).
- AMS Sectional Meeting, University of California, Santa Barbara (April 2005).
- Geometric Analysis Seminar, University of Wisconsin-Madison (December 2004).
- JDG - Lehigh University Geometry and Topology Conference (June 2004).
- Geometry Seminar, University of Michigan, Ann Arbor (March 2004).
- Geometry Seminar, Lehigh University (November 2003).
- Geometry and Analysis Seminar, Columbia University (November 2003).
- Geometric Analysis Seminar, Princeton University (October 2003).
- Geometry-Topology Seminar, SUNY Buffalo (September 2003).
- Topology seminar, University of Illinois at Chicago (April 2003).
- AMS Sectional Meeting, University of Wisconsin-Madison (October 2002).
- Colloquium, University of Oregon (January 2002).
- AMS Sectional Meeting, The Ohio State University (September 2001).
- Institute for Theoretical Science, University of Oregon (January 2001).
- Midwest Geometry Conference 2000, The University of Iowa (November 2000).
- Colloquium, University of Oregon (February 1999).
- International Conference on Nonlinear Partial Differential Equations and Applications, Northwestern University (March 1998).

International.

- Workshop on Ricci flow and related topics, Warwick Mathematics Institute, United Kingdom (March 2023).
- Thematic Program on Geometric Analysis, Fields Institute, Toronto (mini-course and invited lecture, November 2017).
- Flow(ers) and Friends in Frankfurt: a Workshop on Geometric Analysis (March 2015).
- Geometric Analysis and Relativity Conference, The University of Science and Technology of China, Hefei, China (July 2014).
- Colloquium, McMaster University, Ontario, Canada (February 2014).
- Geometry and Analysis Seminar, Imperial College London, United Kingdom (May 2013).

- Analysis Seminar, Warwick Mathematics Institute, United Kingdom (May 2013).
- Geometry, Topology, and Analysis Seminar, The University of Sydney, Australia (December 2012).
- Workshop on Nonlinear Evolution Equations, Mathematisches Forschungsinstitut, Oberwolfach, Germany (May 2012).
- Geometric Analysis Seminar, Freie Universität Berlin (May 2012).
- Numerical Ricci Flow in Computer Science, Geometry, and Physics, ICIAM 2011 (International Congress on Industrial and Applied Mathematics), University of British Columbia, Canada (July 2011).
- Colloquium, University of Toronto, Canada (December 2009).
- Conference on Complex and Differential Geometry, Leibniz Universität, Hannover, Germany (September 2009).
- Conference on conformal geometry, Roscoff, France (June 2008).
- Conference on Ricci flow and related topics, Institut Henri Poincaré (IHP), Centre Emile Borel, Paris, France (June 2008).
- Geometric Analysis and Gravitation Seminar, Max Planck Institut für Gravitationsphysik (Albert Einstein Institut), Golm, Germany (March 2008).
- Workshop on Geometric flows and related topics, Warwick Symposium on Low Dimensional Geometry and Topology, Warwick Mathematics Institute, United Kingdom (March 2007).
- Colloquium, University of British Columbia, Canada (January 2007).
- Thirteenth Gökova Geometry/Topology Conference, Turkey (May 2006).
- Conference on Analytic aspects of problems in Riemannian geometry, Université de Bretagne Occidentale, Brest, France (May 2005).
- Workshop on Aspects of Ricci Flow, Mathematisches Forschungsinstitut, Oberwolfach, Germany (May 2005).
- Geometric Analysis and Gravitation Seminar, Max Planck Institut für Gravitationsphysik (Albert Einstein Institut), Golm, Germany (October 2004).
- Workshop on Geometric Evolution Equations, Banff International Research Station for Mathematical Innovation and Discovery, Canada (July 2004).
- Analysis Seminar, University of Warwick, United Kingdom (June 2004).
- Workshop on Geometric Evolution Equations, National Center for Theoretical Sciences, Hsinchu, Taiwan (July 2002).
- Conference on Harmonic Maps, Minimal Surfaces, and Geometric Flows, Université de Bretagne Occidentale, Brest, France (July 2002).
- Canadian Mathematical Society Winter Meeting, Toronto, Canada (December 2001).
- Workshop on Geometric Evolution Equations, National Center for Theoretical Sciences, Hsinchu, Taiwan (July 2001).
- Seminaire de geometrie differentielle, Paris VI, France (June 1997).

Service

Student advising.

- Max Stolarski, 2015–19, PhD (Visiting Assistant Professor, Arizona State University, 2019–22; Zeeman Lecturer, University of Warwick, 2022–25).
- Tim Carson, 2014–18, PhD (Google, 2018–).
- Haotian Wu, 2009–13, PhD (Visiting Assistant Professor, University of Oregon, 2013–16; Lecturer, University of Sydney, 2016–21; Academic Fellow, University of Sydney, 2022–).
- Davi Máximo, 2008–13, PhD (Szegö Assistant Professor, Stanford, 2013–16; Assistant Professor, University of Pennsylvania, 2016–).
- Michael Williams, 2008–11, PhD (RTG Assistant Adjunct Professor UCLA, 2011–15; GumGum, 2015–2020; Whip Media, 2020–22; Senior Applied Scientist, Apple, 2023–).
- Bradley Anderson, 2006–08, MA (American International Group, 2012–18; Two Sigma, 2018–).

Departmental service.

- Lecturer Review Committee, 2012–13.
- Lecturer Hiring Committee, 2010–12.
- Chair, Vaughn Lounge Upgrade Committee, 2010–12.
- Graduate Review Committee, 2008–09.
- Assistant Graduate Adviser, 2008–09.
- Undergraduate Studies Committee, 2007–09.
- Topology Preliminary Exam Committees (various times).

Other grant development.

- Contributor to the University of Texas Geometry Group RTG, 2007–11.
- VIGRE committee, Department of Mathematics, The University of Iowa, 2003.
- Design and implementation of the undergraduate research component of the VIGRE program at UW-Madison, 2001–02.

University service.

- Faculty Council, 2014–16.
- Graduate Assembly, 2013–16.
- Chair, Admissions and Enrollment Committee, 2014–16.
- C-12 Responsibilities, Rights, and Welfare of Graduate Student Academic Employees Committee, 2014–16.
- C-10 Recruitment and Retention Committee, 2014–15.
- Panelist, UT Austin Faculty Orientation Seminar, 2009.
- Faculty Fellow Program, Department of Residence Life, 2007–09.
- Panelist, New Faculty Teaching, Learning and Orientation Seminar, 2005.

Other professional service.

- Central Section Program Committee, American Mathematical Society, 2022–24.
- Committee on Professional Ethics (COPE), American Mathematical Society, 2016–19.
- Reviewer for *Acta Math.*, *Amer. J. Math.*, *Comm. Anal. Geom.*, *Duke Math. J.*, *Comm. Partial Differential Equations*, *Invent. Math.*, *J. Amer. Math. Soc.*, *J. Differential Geom.*, *J. Geom. Anal.*, *J. Math. Pures Appl.*, *J. Reine Angew. Math. (Crelle)*, *Math. Ann.*, and many others.

- Organizer, SAGE workshops, 2007–12, University of Texas.
- Co-organizer, 40th Texas Geometry and Topology Conference, 2008.
- Contributor, 34th Texas Geometry and Topology Conference, 2005.
- Co-organizer, Session on Geometric PDE, Midwest Geometry Conference, The University of North Dakota, April 2002.
- Committee on Grading, Mathematics Department, University of Wisconsin-Madison, 2001.

Courses taught

University of Texas at Austin.

- Plan II Mathematics (M310P). *Through the Lens of Mathematics*. Fall 2014, 2015, 2016, 2017, 2018, 2019.
- Differential Equations with Linear Algebra (M427J) *Math Honors*. Spring 2016.
- Advanced Calculus for Applications I (M427K) *Math Honors*. Spring 2012. Spring 2013. Spring 2014.
- Plan II Modes of Reasoning (TC 310). *Optimal Geometry in Nature, Art, and Mathematics*. Spring 2010, Fall 2012.
- Differential and Integral Calculus (M408C). Fall 2006, Fall 2009, Spring 2011.
- Integral Calculus (M408L). Fall 2004.
- Advanced Calculus for Applications I (M427K). Fall 2005, Fall 2008, Fall 2011, Fall 2013.
- Advanced Calculus for Applications I, (M427K) *Engineering Honors*. Spring 2009.
- Matrices and Matrix Calculations (M340L). Spring 2005.
- Curves and Surfaces (M365G). Spring 2009.
- Differential Topology (M382D). Spring 2007, Spring 2008.
- Riemannian Geometry (M392C). Fall 2007, Fall 2010.
- Ricci flow (M392C). Spring 2006.

The University of Iowa.

- Topics in Analysis: Introduction to the Ricci Flow. Spring 2004.
- Fundamental Properties of Spaces and Functions I. Fall 2003.
- Introduction to Abstract Algebra I. Fall 2002.
- Calculus II. Spring 2003, Fall 2003.
- Calculus I. Fall 2002.

University of Wisconsin-Madison.

- Differential Geometry. Spring 2002.
- Introduction to the Theory of Probability. Spring 2001.
- Elementary Matrix and Linear Algebra. Fall 2000.
- Linear Algebra and Differential Equations. Spring 2000.
- Applied Linear Algebra. Fall 1999.

University of Wisconsin-Milwaukee.

- Calculus and Analytic Geometry II. Fall 1998, Spring 1999.