

Curriculum Vitae
David Bachman

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CURRENT POSITION

Professor, *Pitzer College* 2013-present

PREVIOUS EMPLOYMENT

Associate Professor, *Pitzer College* AY 2008-2013
Assistant Professor, *Pitzer College* AY 2004-08
Assistant Professor, *California Polytechnic State University at San Luis Obispo* AY 2002-04
Research Assistant Professor, *The University of Illinois at Chicago* AY 2000-02
Assistant Professor, *Portland State University* AY 1999-2000

EDUCATION

Ph.D., Mathematics, *The University of Texas at Austin* May 1999
Dissertation: *A Piecewise-Linear Theory of Minimal Surfaces of Non-Zero Index*
Advisor: C. McA. Gordon
B.S., Mathematics, *State University of New York at Binghamton* June 1993

RESEARCH INTERESTS

Knot theory and 3-Manifold Topology: *normal and almost normal surfaces, Heegaard splittings, thin position, Dehn surgery, contact structures.*
Geometry: *hyperbolic geometry, minimal surfaces, surface modeling.*
Computer Science: *discrete differential geometry, machine learning*

GRANTS AND AWARDS

Pitzer College, *Scholar in Residence* Fall 2020
NSF Research Grant (PI, DMS-1207804), “Applications of Topologically Minimal Surfaces” 2012-15
NSF Research Grant (PI, DMS-0906151), “Topologically Minimal Surfaces in 3-Manifolds” 2009-12
Math Circle mini-grant (PI) 2010-11
Support for the “Gateway to Exploring the Mathematical Sciences Program.”
MAA Tensor-SUMMA Grant (PI) 2010-11
Support for the “Gateway to Exploring the Mathematical Sciences Program.”
State Faculty Support Grant, *California Polytechnic State University, San Luis Obispo* Winter 2003
Outstanding Teaching Award nomination, *Portland State University* June 2000
Continuing Fellowship, *University of Texas at Austin* Spring 1999, Fall 1998
David Bruton Jr. Graduate Fellowship, *University of Texas at Austin* Fall 1997, Summer 1995

PUBLICATIONS

Books

1. “Grasshopper: Visual Scripting for Rhinoceros 3D,” Industrial Press (2017).
2. “A Geometric Approach to Differential Forms,” Birkhäuser, Boston (1st edition, 2006; 2nd edition, 2012).
3. “Advanced Calculus DeMYSTiFieD,” McGraw-Hill (2007).

Papers

1. “Heegaard Splittings with Boundary and Almost Normal Surfaces,” *Topology and its applications* 116 (2001) 153-184.
2. “Critical Heegaard Surfaces and Index 2 Minimal Surfaces,” *Proceedings of the Conference on Heegaard splittings and Dehn surgeries of 3-manifolds, Kyoto (Japan), July, 2001*.
3. “Critical Heegaard Surfaces,” *Transactions of the American Mathematical Society* 354 (2002), 4015-4042.
4. “Thin position for tangles,” (with S. Schleimer) *Journal of Knot Theory and its Ramifications* 12, No. 1 (2003) 117-122.
5. “A note on Kneser-Haken finiteness,” *Proceedings of the American Mathematical Society* 132 (2004) 899-902.
6. “Large embedded balls and Heegaard genus in negative curvature,” (with D. Cooper and M. White) *Algebraic & Geometric Topology* 4, No. 3 (2004) 31-47.
7. “Distance and bridge position,” (with S. Schleimer) *Pacific Journal of Mathematics*. **219** (2005), no. 2, 221-235.
8. “Surface Bundles versus Heegaard Splittings,” (with S. Schleimer) *Communications in Analysis and Geometry* 13, No. 5 (2005) 1-26.
9. “Sweepouts of amalgamated 3-manifolds,” (with S. Schleimer and E. Sedgwick) *Algebraic & Geometric Topology* 6(2006) 171-194.
10. “Non-isotopic Heegaard splittings of Seifert fibered spaces,” (with R. Derby-Talbot) *Algebraic & Geometric Topology* 6(2006) 351-372.
11. “Degeneration of Heegaard genus, a survey,” (with R. Derby-Talbot), Workshop on Heegaard Splittings, *G & T Monographs* **12** (2007) 1-15.
12. “Connected sums of unstabilized Heegaard splittings are unstabilized,” *Geometry & Topology* 12 (2008), no. 4, 2327-2378.
13. “Topological Index Theory for Surfaces in 3-Manifolds,” *Geometry & Topology* 14 (2010) 585-609.
14. “On the existence of high index topologically minimal surfaces,” (with Jesse Johnson), *Mathematical Research Letters* 17 (2010), no. 3, 389-394.
15. “Stabilizing and Destabilizing Heegaard Splittings of Sufficiently Complicated 3-Manifolds,” *Mathematische Annalen* 355 (2013), no. 2, 697-728.
16. “Almost normal surfaces with boundary,” (with R. Derby-Talbot and E. Sedgwick), *Contemporary Mathematics*, **597** (2013), 177-194.
17. “Surfaces that become isotopic after Dehn filling,” (with R. Derby-Talbot and E. Sedgwick), *Communications in Analysis and Geometry*, **23** (2015) no. 2, 363-376.
18. “Heegaard structure respects complicated JSJ-decompositions,” (with R. Derby-Talbot and E. Sedgwick), *Mathematische Annalen* online (2015), 1-18.
19. “Computing Heegaard Genus is NP-Hard,” (with R. Derby-Talbot and E. Sedgwick), in “A Journey through Discrete Mathematics. A Tribute to Jiří Matoušek” edited by Martin Loeb, Jaroslav Nešetřil and Robin Thomas, Springer (2017).
20. “Visualizing Mathematics with 3D printing (Book Review),” *Journal of Mathematics and the Arts*, **11** (2017) no. 1, 59-61.
21. “Locally Helical Surfaces have Bounded Twisting,” (with R. Derby-Talbot and E. Sedgwick), *Pacific Journal of Mathematics* 292 (2018), no. 2, 257-272.
22. “From the Golden Ratio to Fibonacci Phyllotaxis Spirals,” *Math Horizons* 26 (2018), no. 3, 18-21.
23. “Procedural Organic Modeling,” *ACM SIGGRAPH '19 Educator's Forum* (proceedings). Los Angeles, CA 2019.
24. “Cohomology fractals, Cannon-Thurston maps, and the geodesic flow,” (with M. Goerner, S. Schleimer, and H. Segerman) *Experimental Mathematics* 31 (2022) no. 4, 1047-1085.

Preprints

1. “Cohomology Fractals,” (with S. Schleimer and H. Segerman)

2. “Normalizing Topologically Minimal Surfaces III: Bounded Combinatorics”
3. “Normalizing Topologically Minimal Surfaces II: Disks”
4. “Normalizing Topologically Minimal Surfaces I: Global to Local Index”

In Preparation

1. “Paper Knots,” (with J. Hoste).

PROFESSIONAL EXPERIENCE

Journal Referee

Proceedings of the AMS, Geometry & Topology, Memoirs of the AMS, Topology and its Applications, Experimental Mathematics, Boletín of the Mexican Mathematical Society, Science in China, Series A: Mathematics, Algebraic & Geometric Topology, Journal of Knot Theory and its Ramifications, Transactions of the AMS, Frontiers of Mathematics in China

Reviewer

Zentralblatt MATH, Mathematical Reviews Database, Addison-Wesley Publishing, National Science Foundation, Israel Science Foundation

Organizer/Coordinator

Semester Program on “Illustrating Mathematics” <i>Institute for Computational and Experimental Mathematics</i>	Sep-Dec 2019
Southern California Topology Conference in honor of the retirement of Jim Hoste <i>Claremont Colleges Consortium</i>	April 2018
Gateway to Exploring the Mathematical Sciences program (Claremont Math Circle) <i>Claremont Colleges Consortium</i>	AY 2009-11
Southern California Topology Colloquium <i>Claremont Colleges Consortium</i>	March 2011
Southern California Topology Colloquium <i>Claremont Colleges Consortium</i>	February 2010
AMS sectional meeting special session in Topology <i>Claremont McKenna College</i>	May 2008
Geometry, Topology & Dynamical Systems seminar <i>University of Illinois at Chicago</i>	AY 2000-01
Cascade Topology Conference <i>Portland State University</i>	May 2000
Saturday Morning Math Group <i>University of Texas, Dept. of Mathematics</i>	Spring 1996

INVITED CONFERENCE TALKS

AMS Section Meeting, Fresno, CA Title: <i>Discrete Mean curvature for Hyperbolic Surfaces</i>	May 6, 2023
AMS Section Meeting, Riverside, CA Title: <i>Visualizing Cannon-Thurston Maps</i>	November 9, 2019
AMS Section Meeting, Riverside, CA Title: <i>All odd length polygonal knots are strip knots</i>	November 9, 2019
SIGGRAPH Educator Workshop, Los Angeles, CA	July 29, 2019

Title: *Procedural Organic Modeling*

Mathematical Congress of the Americas, Guanajuato, Mexico August 5-9, 2013
 Title: *Normalizing Topologically Minimal surfaces*

Low-dimensional Topology and Geometry in Toulouse ,Toulouse, France June 24-28, 2013
 Title: *Normalizing Topologically Minimal surfaces*

AMS Section Meeting, Ames, IA April 27, 2013
 Title: *Normalizing Topologically Minimal surfaces*

Workshop on Minimal Surfaces, 3-Manifold Topology and Related Topics, Boston, MA April 28, 2013
 Title: *Parallels between Geometrically Minimal and Topologically Minimal surfaces*

46th Spring Topology and Dynamics Conferences (semi-plenary speaker), Mexico City, Mexico
 Title: *Topological, PL, and geometric minimal surfaces* March 22-24, 2012

The 8th East Asian School of Knots and Related Topics (plenary speaker), Daejeon, Korea
 Title: *Topological, PL, and geometric minimal surfaces* January 9-12, 2012

AMS Section Meeting, Iowa City, IA March 20, 2011
 Title: *Normalizing Topologically Minimal Surfaces*

MAA Mathfest, Portland, OR August 7, 2009
 Title: *Convergence of Discrete Poker Models*

Geometric Topology in 3 and 4 Dimensions, in honor of Martin Scharlemann, Davis, CA
 Title: *Topologically Minimal Surface in 3-Manifolds* June 23-26, 2009

Joint AMS/MAA meeting, Washington, DC January 6, 2009
 Title: *Topological Index Theory for Surfaces in 3-Manifolds*

Cascade Topology Conference, Portland, OR November 8-9, 2008
 Title: *Topological Index Theory for Surfaces in 3-Manifolds*

Joint AMS/MAA meeting, San Diego, CA January 9, 2008
 Title: *Counter-examples to the Stabilization Conjecture*

Conference on Heegaard splittings of 3-Manifolds, Haifa, Israel July 10-20, 2005
 Title: *Gordon's Conjecture*

AMS meeting, Santa Barbara, CA April 16-17, 2005
 Title: *Heegaard splittings and connected sums*

Complex of Curves Fest, Caltech January 7-9, 2005
 Title: *Waldhausen's converse*

Joint AMS/MAA meeting, San Diego, CA January 5-9, 2002
 Title: *A machine for constructing almost normal surfaces*

Conference on Heegaard splittings and Dehn surgeries of 3-manifolds, Kyoto, Japan July 5-12, 2001
 Title: *Critical Heegaard Surfaces*

AMS meeting, New York, New York November 4-5, 2000
 Title: *A new class of useful surfaces in 3-manifolds*

AMS meeting, Santa Barbara, CA February 12-13, 2000
 Title: *Piecewise-Linear Index 2 minimal surfaces.*

International workshop on Geometry and Topology, Haifa, Israel January 5-12, 1999
 Title: *Minimizing Morse functions transverse to boundaries*

AMS meeting, Winston-Salem, NC Title: <i>Minimizing Morse functions transverse to boundaries</i>	October 9-10, 1998
AMS meeting, Louisville, KY Title: <i>Boundary Heegaard Splittings</i>	March 20-21, 1998
Georgia Topology Conference, Athens, GA Title: <i>Immersed Foliations and Normal Surfaces</i>	July 30-August 3, 1997
Workshop on Low Dimensional Topology and Geometric Group Theory, Canberra, Australia Title: <i>Isotopic Normal Surfaces</i>	June 25-27, 1997
Dehn Surgery Conference, Fayetteville, Arkansas Title: <i>Isotopic Normal Surfaces</i>	April 10-12, 1997
Workshop on Computation and Algorithmic Methods in Three Dimensional Topology, Mathematical Sciences Research Institute, Berkeley, CA Title: <i>Isotopic Normal Surfaces</i>	March 10-14, 1997
Low Dimensional Topology Seminar, Mathematical Sciences Research Institute, Berkeley, CA Title: <i>Isotopic Normal surfaces</i>	December 12, 1996
AMS meeting, Iowa City, IA Title: <i>Recognizing Lens Spaces</i>	March 22-23, 1996

SEMINAR AND COLLOQUIA TALKS

MIT, Yale, Princeton, UC Bekeley, Caltech, Columbia, UCLA, UCSD, UCSB, UC Davis, UC Riverside, University of Melbourne, Rutgers Newark, American Institute of Mathematics, Boston College, UIC, UT Austin, Cal Poly SLO, Portland State University, Kansas State University, U Penn, Claremont, USC, Georgia tech, UGA, Cal State Channel Islands, Cal Poly Pomona, U of Arkansas, Cal State Fullerton, Cal State Long Beach, Oklahoma State.

COURSES TAUGHT

College Algebra, Pre-Calculus, Calculus I-IV, Vector Calculus, Linear Algebra, Differential Equations, Topology I,II, Set Theory, Dynamical Systems, Differential Forms, Graph Theory, Combinatorial Group Theory, Differential Geometry, Combinatorial Game Theory, Mathematics of Cartography, Mathematics of Poker, Mathematics and 3D-Printing, Geometric Modeling, Intro to Computer Science, Machine Learning, Foundations of Data Science in R, Foundations of Data Science in Python

COMMITTEES/SERVICE

Academic Planning Committee	AY 2022-23
Admissions Liaison Committee	AY 2022-23
Academic Planning Committee, chair	AY 2021-22
Facilities & IT Committee	AY 2019-20
Data Science Curricular Coherence Committee	AY 2018-20
Computer Science Task Force	AY 2018-20
Claremont Center for the Mathematical Sciences Executive Committee	AY 2018-20
Campus Life Committee	AY 2015-16
Appointments, Promotion and Tenure Committee	AY 2014-15
Claremont Center for the Mathematical Sciences Executive Committee, Director	AY 2012-14
Academic Planning Committee, chair	AY 2013-14
Academic Planning Committee	AY 2012-13
IT director search committee	Summer 2012
Faculty liaison for external review of Pitzer IT	Fall 2011
Claremont Center for the Mathematical Sciences Executive Committee	AY 2009-14
Faculty Executive Committee, Chair	Fall 2010

Faculty Executive Committee	AY 2009-11
Budget Implementation Committee	AY 2009-10
Personnel Review Committee	Spring 2009
Alumni Board	AY 2007-08, 2008-09
Personnel Review Committee	Spring 2008
Research and Awards Committee	2006-07
Personnel Review Committee	Fall 2005