

# THOMAS KINDRED

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## PROFESSIONAL EXPERIENCE

<b>Wake Forest University</b>	Visiting Assistant Professor	July 2024-Present
<b>Wake Forest University</b>	Teacher-Scholar Postdoctoral Fellow	July 2021-June 2024
<b>University of Nebraska-Lincoln</b>	Postdoctoral Faculty Fellow	August 2018-May 2021

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## EDUCATION

<b>University of Iowa</b> , Iowa City, IA	Ph.D. May 2018
<b>Major:</b> Mathematics: geometric topology	M.S. December 2014
<b>Advisor:</b> Dr. Charlie Frohman	
<b>Williams College</b> , Williamstown, MA	B.A. June 2007
<b>Major:</b> Mathematics	Highest Honors
<b>Advisor:</b> Dr. Colin Adams	

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## RESEARCH INTERESTS

Geometric topology in 3 and 4 dimensions, especially knot theory via linear algebra and spanning surfaces and solids; applications to the sciences; computing; quantum topology; computational geometry

**Postdoctoral advisors:** Dr. Mark Brittenham, Dr. Hugh Howards, Dr. Alex Zupan

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## ADVISING EXPERIENCE

<b>Teacher-Scholar Postdoc. Fellow &amp; Visiting Asst. Professor</b> , Wake Forest Univ. <i>Winston-Salem, NC</i>	July 2021-present
<ul style="list-style-type: none"><li>• Senior Thesis: applied knot theory in statistical mechanics (advisor F24-present)</li><li>• Senior Thesis: Gauss codes and crosscap numbers (co-advisor S23-present)</li><li>• Master's Thesis: linear algebra via spanning surfaces (co-advisor S23-S24)</li><li>• Master's Thesis: Khovanov homology (co-advisor F21-S23)</li></ul>	

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## PUBLICATIONS AND PREPRINTS

15. *Average crosscap number of a 2-bridge knot* (with M. Cohen, A. Lowrance, P. Shanahan, and C. Van Cott), preprint, 26 pp.
14. *Kink-equivalence of matrices, spanning surfaces, 4-manifolds, and quadratic forms* (with H. Howards, W. F. Moore, and J. Tolbert), preprint, 19 pp.
13. *How essential is a spanning surface?*, submitted, 42 pp. [arXiv](#)
12. *The virtual flying theorem*, submitted, 27 pp. [arXiv](#)
11. *End-essential spanning surfaces for links in thickened surfaces*, submitted, 15 pp. [arXiv](#)
10. *Primeness of alternating virtual links*, submitted, 32 pp. [arXiv](#)
9. *A geometric proof of the flying theorem*, submitted, 51 pp. [arXiv](#)
8. *A simple proof of the Crowell-Murasugi theorem*, Alg. Geom. Topol. 24 (2024), no. 5, 2779-86. [link](#)

7. *Efficient multisections of odd-dimensional tori*, Alg. Geom. Topol. 23 (2023), no. 9, 3997-4056. [link](#)
  6. *Nonorientable spanning surfaces for knots*, Chapter 23 of the Concise Encyclopedia of Knot Theory (2021), 197-203.
  5. *Crosscap numbers of alternating knots via unknotting splices*, Internat. J. Math. 31 (2020), no. 7, 2050057, 30 pp. [link](#)
  4. *Alternating links have representativity 2*, Alg. Geom. Topol. 18 (2018), no. 6, 3339-3362. [link](#)
  3. *Plumbing essential states in Khovanov homology*, New York J. Math. 24 (2018), 588-610. [link](#)
  2. *Heegaard diagrams corresponding to Turaev surfaces* (with C. Armond and N. Druivenga), J. Knot Theory Ramifications 24 (2015), no. 4, 1550026, 14 pp. [link](#)
  1. *A classification of spanning surfaces for alternating links* (with C. Adams), Alg. Geom. Topol. 13 (2013), no. 5, 2967-3007. [link](#)
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## TEACHING EXPERIENCE

**Teacher-Scholar Postdoc. Fellow & Visiting Asst. Professor**, Wake Forest Univ.      July 2021-present  
*Winston-Salem, NC*

- Topology: knot theory & spanning surfaces, computing and applications (S24)
- Introduction to Linear Algebra and Differential Equations (F23, S24)
- Topics in Topology: the linear algebra of curves and surfaces in space (S23)
- Topology: continuity, connectedness, compactness; graduate course (F22)
- Discrete Mathematics: logic, sets, functions, graphs, proofs (F22, S23, F23)
- Calculus with Analytic Geometry I (F21, S22, F24)

**Postdoctoral Faculty Fellow**, University of Nebraska-Lincoln      August 2018-May 2021  
*Lincoln, NE*

- Topics in Topology: knot theory via spanning surfaces; flipped classroom (S21)
- Linear Algebra (F18, F19, F20)
- Discrete & Finite Math: graphs & combinatorics, proofs; inquiry-based (F20)
- Topology II: fundamental groups, covering spaces, homology; qual course (S20)
- Introduction to Modern Algebra: a “rings first” proofs course (S19, F19)

**Instructor, Teaching Assistant, and Tutor**, University of Iowa      Fall 2012-May 2018  
*Iowa City, IA*

- Topics in Topology: substitute professor for six weeks post-defense (S18)
- Engineering Math 2: vector calculus with Mathematica (F13, S14, S15, S18)
- Calculus 2 (F17)
- Elementary Functions: precalculus with trig (S17, instructor of record)
- College Algebra (F16, instructor of record)
- Grad topology: general topology, homotopy theory, smooth manifolds (F15-S16)
- Summer prep course for qualifying exam in topology (2015, 2016)
- Engineering Math 1: single-variable calculus (F14)
- Introduction to Undergraduate Research (S13)
- Mathematics for the Biological Sciences (F12)
- Math Tutorial Lab: college algebra through linear algebra (F12-S18)

**Math and Physics Teacher**, Potts Camp High School

August 2009-May 2012

*Potts Camp, MS*

- Taught geometry, algebra 2, and trigonometry/precalculus each year
- Also taught calculus first year, physics second year, and both third year
- Volunteered as assistant baseball coach each spring
- Certified through the Mississippi Teacher Corps

**Math Teacher**, The Charles School

November 2008-May 2009

*Columbus, OH*

- Taught remedial pre-algebra and fundamentals of math to 9<sup>th</sup>-graders

**Teaching Assistant and Grader**, Williams College

September 2004-May 2007

*Williamstown, MA*

- Graded homework and held office hours for discrete math and real analysis

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### SELECTED HONORS & AWARDS

Wake Forest University Thank A Teacher letter recipient	2023, 2024
MAA Project NExT Fellow	2019
UNL Parents' Recognition Award for Contribution to Students	2019
Bor-Luh Lin Thesis Award	2018
University of Iowa Thank-A-Teacher letter recipient	2016
Catherine Wegner Outstanding Teaching Assistant Award Winner	2015

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### INVITED AND CONTRIBUTED TALKS

<i>Kink-equivalence of matrices, spanning surfaces, 4-manifolds, and quadratic forms</i> AMS Sectional Meeting, Special Session	Albany, NY October 2024
<i>Naive kink equivalence of surfaces and matrices</i> Undergraduate Knot Theory Conference V	Seattle, WA July 2024
<i>Naive blowup-equivalence of 4-manifolds</i> Trisectors Workshop	Lincoln, NE June 2024
<i>Link diagrams determined by checkerboard surfaces</i> AMS Sectional Meeting, Special Session	Buffalo, NY September 2023
<i>The flying theorem and geography problem for alternating links in thickened surfaces</i> University of Nebraska-Lincoln Seminar on Groups, Semigroups, & Topology	Virtual November 2021
<i>A simple proof of the Crowell-Murasugi Theorem</i> AMS Sectional Meeting, Special Session	Virtual October 2021
<i>Definite surfaces, plumbing, and Tait's conjectures</i> Caltech Geometry and Topology Seminar	Virtual May 2021
<i>Definite surfaces and Murasugi sums: new geometric proofs of two classical theorems</i> UC Davis Geometry/Topology Seminar	Virtual May 2021
<i>Replumbing definite surfaces: the geometric content of the flying theorem</i> MIT Geometry and Topology Seminar	Virtual April 2021

<i>The future is a 4-manifold.</i> Wake Forest University Department of Mathematics and Statistics Colloquium	Virtual April 2021
<i>Flying, plumbing, and symmetries of alternating links</i> McMaster University Geometry and Topology Seminar	Virtual January 2021
<i>Symmetries of alternating link exteriors, spatial graphs, and branched surfaces</i> Joint Math Meetings	Virtual January 2021
<i>The geometric content of Tait's conjectures</i> Ohio State CKVK* Seminar	Virtual November 2020
<i>Spanning surfaces: essence, plumbing, and flypes</i> University of Virginia Geometry Seminar	Virtual October 2020
<i>A geometric proof of the flying theorem</i> Oklahoma State Topology Seminar	Virtual September 2020
<i>Symmetric, efficient multisections of odd-dimensional tori</i> Virtual Trisectors Seminar	Virtual August 2020
<i>Splice-un knotting and crosscap numbers</i> Nearly Carbon Neutral Geometry and Topology Conference	Virtual June 2020
<i>Efficient multisections of odd-dimensional tori</i> University of Iowa Topology Seminar	Virtual April 2020
<i>Checkerboards &amp; crosscaps</i> University of Nebraska-Lincoln Seminar on Groups, Semigroups, & Topology	Lincoln, NE March 2018
<i>Checkerboards &amp; crosscaps</i> Boston College Geometry-Topology Seminar	Boston, MA March 2018
<i>Checkerboard plumbings</i> Williams College Faculty Seminar	Williamstown, MA October 2017
<i>Plumbings of checkerboards</i> AMS Sectional Meetings	Buffalo, NY September 2017
<i>Plumbing is a natural operation</i> GEAR Junior Retreat	Stanford, CA August 2017
<i>Alternating links have representativity 2</i> AMS Sectional Meetings	New York, NY May 2017
<i>Plumbing in Khovanov homology</i> AMS Sectional Meetings	Minneapolis, MN October 2016
<i>Khovanov homology detects adequate homogeneous states</i> MAA Mathfest	Columbus, OH August 2016
<i>What is an alternating link?</i> Advances in Quantum Topology	Iowa City, IA April 2016

## SELECTED SEMINAR TALKS AT THE UNIVERSITY OF NEBRASKA-LINCOLN

<i>Stallings' fibration theorem</i>	GST seminar	April 2021
<i>The future is a 4-manifold.</i>	Landscapes seminar	March 2021
<i>Essence of a spanning surface</i>	GST seminar	October 2020
<i>A geometric proof of the flying theorem</i>	GST seminar	October 2020
<i>Orderability, surgery, and double-branched covers</i>	GST seminar	October 2019
<i>Orderability of knot groups of fibered knots</i>	GST seminar	October 2019
<i>Heegaard-Kirby diagrams</i>	4-manifolds reading seminar	October 2019
<i>Heegaard splittings and trisections</i>	4-manifolds reading seminar	September 2019
<i>Diagrams of knotted surfaces in 4-space</i>	4-manifolds reading seminar	June 2019
<i>Crosscap numbers of alternating knots via unknotting splices</i>	GST seminar	April 2019
<i>Plumbings of 4-manifolds (2-part talk)</i>	4-manifolds reading seminar	March 2019
<i>Carving, framing, and canceling</i>	4-manifolds reading seminar	January 2019
<i>Essential slopes of a knot (2-part talk)</i>	GST seminar	September 2018

## SELECTED SEMINAR TALKS AT THE UNIVERSITY OF IOWA

<i>Checkerboard plumbings</i>	Three minute thesis competition	October 2017
<i>Checkerboard plumbings</i>	GAUSS	October 2017
<i>Quadratic differentials &amp; measured foliations</i>	Topology reading seminar	March 2017
<i>The metric on Teichmuller space</i>	Topology reading seminar	March 2017
<i>Alternating links have representativity 2</i>	Topology seminar	February 2017
<i>Inscribed rectangles &amp; rhombi via Mobius bands</i>	GAUSS	February 2017
<i>Introduction to Teichmuller space</i>	Topology reading seminar	January 2017
<i>Why study hyperbolic geometry?</i>	Student topology seminar	November 2016
<i>Thin triangles imply exponential explosion.</i>	Student topology seminar	November 2016
<i>Surface bundles &amp; the Meyer signature cocycle</i>	Topology reading seminar	October 2016
<i>Plumbing in Khovanov homology</i>	Graduate student seminar	September 2016
<i>Origins and rudiments of hyperbolic geometry</i>	Student topology seminar	September 2016
<i>Geometric structures via gluing of Platonic solids</i>	Topology reading seminar	April 2016
<i>Geometry and topology of 3-manifolds</i>	Topology reading seminar	January 2016

<i>Rational surgery coefficients &amp; the slam dunk move</i>	Topology reading seminar	December 2015
<i>Examples of Dehn surgery on knots</i>	Topology reading seminar	November 2015
<i>Classification of torus bundles and semi-bundles</i>	Topology reading seminar	October 2015
<i>Prime decompositions of 3-manifolds</i>	Topology reading seminar	September 2015
<i>Geometry of alternating links</i>	Topology seminar	March 2015
<i>Invitation to Spivak's <u>Calculus on Manifolds</u>,</i>	Student topology seminar	January 2015
<i>State surfaces in Khovanov homology</i>	Topology seminar	October 2014
<i>The Temperley-Lieb algebra &amp; Jones polynomials</i>	Student topology seminar	April 2014
<i>Geometric &amp; algebraic caps for spanning surfaces</i>	Topology seminar	March 2014
<i>Gromov hyperbolicity</i>	Topology reading seminar	October 2013
<i>Introduction to spanning surfaces</i>	Student topology seminar	September 2012

### SERVICE

- **Referee or reviewer** for Algebraic & Geometric Topology, Illinois Mathematics Journal, International Journal of Mathematics, Journal of Knot Theory and its Ramifications, New York Journal of Mathematics, Osaka Journal of Mathematics, Proceedings A of the Royal Society of Edinburgh, Topology and its Applications.
- **Putnam exam co-coordinator** (F18, F19, F20)
- **Great Plains Alliance co-coordinator**, arranging regional talks by UNL grad students (F18-S21)
- **Evaluator** of UNL undergraduate research proposals (S19, S20)
- **Organizer** or co-chair for the following seminars and events:
  - AMS Special Session on Developments in Knot Theory and Low-Dimensional Topology (F21)
  - Nebraska GST seminar: Groups, Semigroups and Topology (F19)
  - Nebraska 4-manifold reading seminar (F19)
  - Iowa GAUSS: Graduate And Undergraduate Student Seminar (S17-S18)
  - Iowa student topology seminar (S15, F16)
  - Iowa topology reading seminar (F15-S16)
- **Mentor** for younger students and the surrounding community:
  - Volunteered for Math Day at Lucas Elementary School (2017, 2018)
  - Volunteered for Sonia Kovalevsky Day, to encourage high school girls interested in math (2016)
  - Welcomed incoming graduate students in the University of Iowa's Buddy Program (2014-2016)
  - Served as a Williams College Junior Advisor (F05-S06)

- **Advocate** for students, teachers, and colleagues:
  - Member of the Wake Forest Mathematics Equity Committee (2023-2024)
  - Member of the Wake Forest Chapter of the Math Alliance (2021-present)
  - Member of the Wake Forest Mathematics Curriculum Committee (2022-2023, 2024-present)
  - Alternate math delegate to the University of Iowa Graduate Student Senate (2016-2018)
  - Member of the University of Iowa Affordable Housing Task Force (2016)
  - Williams College Olmsted Prize Committee to recognize excellent high school teaching (S06)
  - Student representative on the Williams College Committee on Priorities and Resources (S05-F06)

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**References available upon request**