

# COLLEEN ROBICHAUX

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## RESEARCH INTERESTS

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Algebraic combinatorics, Schubert calculus

## EDUCATION

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**Ph.D. Mathematics**, University of Illinois at Urbana-Champaign, completed June 2022

Advisor: Alexander Yong

Honors: NSF Graduate Research Fellow, Irving Reiner Memorial Award in Algebra 2020

**M.S. Mathematics**, University of Illinois at Urbana-Champaign, completed May 2018

Honors: GAANN Fellow

**B.S. Mathematics, concentration in Secondary Education**, Louisiana State University, completed May 2016

Honors: Summa Cum Laude, University Medalist, Astronaut Scholar

## EMPLOYMENT

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Hedrick Assistant Adjunct Professor, University California, Los Angeles, 2022-2025

Mentors: Igor Pak and Pavel Galashin

## PUBLICATIONS AND PREPRINTS

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1. (with Jenna Rajchgot, Anna Weigandt) *Castelnuovo-Mumford regularity of ladder determinantal varieties and patches of Grassmannian Schubert varieties*, preprint, arXiv:2202.03995.
2. *Shifted edge labeled tableaux and localizations*, preprint, arXiv:2111.02971.
3. (with Harshit Yadav, Alexander Yong) *Equivariant cohomology, Schubert calculus, and edge labeled tableaux*, in Facets of Algebraic Geometry: A Volume in Honour of William Fulton's 80th Birthday, Vol. 2, Cambridge University Press, London Mathematical Society Lecture Note Series, 284–335.
4. (with Anshul Adve, Alexander Yong) *An efficient algorithm for deciding vanishing of Schubert polynomial coefficients*, Advances in Mathematics, Vol. 383 (2021)
5. (with Jenna Rajchgot, Yi Ren, Avery St. Dizier, Anna Weigandt) *Degrees of symmetric Grothendieck polynomials and Castelnuovo-Mumford regularity*, Proceedings of the American Mathematical Society, 149 (2021) no. 4, 1405–1416.
6. (with Harshit Yadav, Alexander Yong) *The  $A \cdot B \cdot C \cdot D$ s of Schubert calculus*, Séminaire Lotharingien de Combinatoire B85a (2020), 12 pp.
7. (with Anshul Adve, Alexander Yong) *Complexity, Combinatorial Positivity, and Newton Polytopes*, The 31st International Conference on Formal Power Series and Algebraic Combinatorics, Ljubljana, Slovenia (FPSAC 2019), appearing in Séminaire Lotharingien de Combinatoire 82B (2019), Article #52, 12pp.
8. (with Anshul Adve, Alexander Yong) *Vanishing of Littlewood-Richardson polynomials is in P*, Computational Complexity, Vol. 28(2) (2019), 241–257.

9. (with Christian Gaetz, Michelle Mastrianni, Rebecca Patrias, Hailee Peck, David Schwein, Ka Yu Tam) *K-Knuth Equivalence for Increasing Tableaux*, Electronic Journal of Combinatorics, Vol. 23(1) (2016), P1.40.

## SEMINAR AND CONFERENCE TALKS

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- K-orbit determinantal ideals. Women in Commutative Algebra and Algebraic Geometry Workshop, Fields Institute, Zoom. (February 5, 2022)
- Castelnuovo-Mumford regularity of ladder determinantal ideals via Grothendieck polynomials. CAAC, Fields Institute, Zoom. (January 21, 2022)
- Castelnuovo-Mumford regularity of ladder determinantal ideals via Grothendieck polynomials. Algebra Seminar, Syracuse University, Zoom. (December 10, 2021)
- Castelnuovo-Mumford regularity of ladder determinantal ideals via Grothendieck polynomials. Combinatorics and Geometry of Moduli Spaces session, CMS Winter Meeting 2021, Zoom. (December 6, 2021)
- Castelnuovo-Mumford regularity of ladder determinantal ideals via Grothendieck polynomials. Discrete Geometry and Combinatorics Seminar, Cornell University, Ithaca NY. (November 8, 2021)
- CM regularity and Kazhdan-Lusztig varieties. Algebra and Discrete Math Seminar, University of California, Davis, Davis CA. (September 27, 2021)
- Degrees of Grothendieck Polynomials and CM Regularity. Graduate Online Combinatorics Colloquium, Zoom. (September 15, 2021)
- The A·B·C·Ds of Schubert calculus. IMPANGA 20 Contributed talk, Banach Center, Zoom. (July 15, 2021)
- CM regularity and Kazhdan-Lusztig varieties. Recent Developments in Gröbner Geometry session, CMS Summer Meeting 2021, Zoom. (June 9, 2021)
- An Efficient Algorithm for Deciding the Vanishing of Schubert Polynomial Coefficients. Combinatorics and Geometry Seminar and Pre-Seminar, University of Washington, Zoom. (April 28, 2021)
- CM regularity and Kazhdan-Lusztig varieties. Algebraic Geometry/Commutative Algebra Seminar, University of Notre Dame, Zoom. (April 8, 2021)
- An Efficient Algorithm for Deciding the Vanishing of Schubert Polynomial Coefficients. Algebraic (and enumerative) combinatorics seminar, University of Waterloo, Zoom. (March 25, 2021)
- Equivariant cohomology, Schubert calculus, and Edge labeled tableaux. Spring Eastern Sectional Meeting, Recent Advances in Schubert Calculus and Related Topics, III, Brown University, Zoom. (March 20, 2021)
- An Efficient Algorithm for Deciding the Vanishing of Schubert Polynomial Coefficients. Discrete Mathematics Seminar, University of British Columbia, Zoom. (March 9, 2021)
- Littlewood-Richardson coefficients and the Hermitian Eigenvalue Problem. AWM Graduate Student Colloquium, University of Illinois at Urbana-Champaign, Zoom. (February 24, 2021)
- Matrix Schubert varieties and CM regularity. Introductory Workshop: Combinatorial Algebraic Geometry Lightning Talks, ICERM, Zoom. (February 17, 2021)
- Computing degrees of Grothendieck polynomials. UBC-UIUC Combinatorics Meeting, Zoom. (January 19, 2021)

- An Efficient Algorithm for Deciding the Vanishing of Schubert Polynomial Coefficients. Enumerative Combinatorics session, CMS Winter Meeting 2020, Zoom. (December 5, 2020)
- An Efficient Algorithm for Deciding the Vanishing of Schubert Polynomial Coefficients. Combinatorics Seminar, University of Florida, Zoom. (November 10, 2020)
- Schubert Polynomials and Computational Complexity. Theory of Computation Seminar, University of Illinois at Urbana-Champaign, Zoom. (October 28, 2020)
- The A·B·C·Ds of Schubert calculus. Western Sectional Meeting, Combinatorics of Reduced Decompositions of Elements of Coxeter Groups and Related Topics, California State University, Fresno, Fresno CA. (May 2, 2020 – cancelled)
- Equivariant cohomology, Schubert calculus, and Edge labeled tableaux. Spring Eastern Sectional Meeting, Recent Advances in Schubert Calculus and Related Topics, II, Tufts University, Medford, MA. (March 21, 2020 – cancelled)
- The A·B·C·Ds of Schubert calculus. AMS Spring Southeastern Sectional Meeting, Combinatorics Related to Geometry and Representation Theory, IV, University of Virginia, Charlottesville, VA. (March 15, 2020 – cancelled)
- Degree of Grothendieck polynomials and Castelnuovo-Mumford regularity. AWM Mini Symposium, University of Illinois at Urbana-Champaign, Urbana, IL. (February 8, 2020)
- Degree of Grothendieck polynomials and Castelnuovo-Mumford regularity. Combinatorial Algebraic Geometry session, CMS Winter Meeting 2019, Toronto, ON. (December 8, 2019)
- Degree of Grothendieck polynomials and Castelnuovo-Mumford regularity. Algebra, Geometry, and Combinatorics Seminar, University of Illinois at Urbana-Champaign, Urbana, IL. (November 21, 2019)
- Schubert Polynomials and Computational Complexity. Undergraduate Seminar, University of Illinois at Urbana-Champaign, Urbana, IL. (October 25, 2019)
- Schubert Polynomials and Computational Complexity. New Facets of Algebraic Geometry Contributed talk, University of Michigan, Ann Arbor, MI. (October 18, 2019)
- A conversation about Algebraic Combinatorics and Computational Complexity. GROW 2019 Plenary Talk, University of Illinois at Urbana-Champaign, Urbana, IL. (October 6, 2019) (joint with Alexander Yong)
- Complexity, Combinatorial Positivity, and Newton Polytopes. Combinatorics Seminar, Washington University in St. Louis, St. Louis, MO. (April 12, 2019)
- Complexity, Combinatorial Positivity, and Newton Polytopes. Graduate Student Combinatorics Conference, University of Pennsylvania, Philadelphia, PA. (April 6, 2019)
- Complexity and Combinatorial Positivity. AWM Mini Symposium, University of Illinois at Urbana-Champaign, Urbana, IL. (February 9, 2019)
- Complexity, Combinatorial Positivity, and Newton Polytopes. Algebra, Geometry, and Combinatorics Seminar, University of Illinois at Urbana-Champaign, Urbana, IL. (March 28, 2019)
- Vanishing of Littlewood-Richardson polynomials is in P. Workshop on Representation Theory, Combinatorics, and Geometry Contributed Talk, University of Virginia, Charlottesville, VA. (October 20, 2018)
- Vanishing of Littlewood-Richardson polynomials is in P. Algebra, Geometry, and Combinatorics Seminar, University of Illinois at Urbana-Champaign, Urbana, IL. (November 15, 2017)

## POSTER PRESENTATIONS

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- CM regularity and Kazhdan-Lusztig varieties. NCN Combinatorics Klatch, Gather. (August 3, 2021)
- Computational Complexity, Newton Polytopes, and Schubert Polynomials. Algebraic Geometry and Polyhedra, ICERM, Gather. (April 14, 2021)
- CM regularity and Kazhdan-Lusztig varieties. CAAC 2021, Université du Québec à Montréal, Zoom. (January 23, 2021)
- CM regularity and Kazhdan-Lusztig varieties. AlCoVE 2020, Zoom. (June 16, 2020)
- CM regularity and Kazhdan-Lusztig varieties. MAAGC 2020, University of Virginia, Charlottesville, VA. (March 13, 2020 – cancelled)
- CM regularity and Kazhdan-Lusztig varieties. ALGECOM XIX, University of Illinois at Urbana-Champaign, Urbana, IL. (March 7, 2020)
- The A·B·C·Ds of Schubert calculus. ALGECOM XVIII, Washington University in St. Louis, St. Louis, MO. (September 21, 2019)
- Complexity, Combinatorial Positivity, and Newton Polytopes. FPSAC 2019, Ljubljana, Slovenia. (July 1, 2019)
- Complexity, Combinatorial Positivity, and Newton Polytopes. ALGECOM XVII, Loyola University Chicago, Chicago, IL. (May 25, 2019)
- Vanishing of Littlewood-Richardson polynomials is in P. ALGECOM XVI, University of Michigan, Ann Arbor, MI. (March 24, 2018)

## TEACHING

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- ICERM, Teaching Assistant
  - Intro Workshop: Combinatorial Algebraic Geometry (Spring 2021)
- University of Illinois at Urbana-Champaign (UIUC), Teaching Assistant
  - Calculus II, Merit Program (Spring 2018)
    - \* Active Learning, rated “Outstanding” (in the top 10% for the rating of Instructor’s Overall Teaching Effectiveness among UIUC instructors).
  - Calculus I, Merit Program (Fall 2017)
    - \* Active Learning, rated “Outstanding” (in the top 10% for the rating of Instructor’s Overall Teaching Effectiveness among UIUC instructors).
- East Ascension High School, Student Teacher
  - Geometry, Algebra II (Spring 2016)
    - \* Inquiry-based Learning

## PROFESSIONAL ACTIVITIES

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- Women in Commutative Algebra and Algebraic Geometry Workshop, Participant (Spring 2022)
- Association of American Universities PhD Initiative Mathematics, Committee Member (2020-2022)
- Illinois Geometry Lab (IGL), Outreach Manager and Leadership Team Member (2017-2022)

- Illinois Geometry Lab (IGL), Undergraduate Outreach Founder and Graduate Mentor (2018-2022)
- University of Illinois Algebra-Geometry-Combinatorics Seminar co-organizer (Fall 2019-2022)
- Referee for Annals of Combinatorics (Fall 2021), Electronic Journal of Combinatorics (Fall 2021), FPSAC 2022 (Fall 2021)
- ICERM Workshop: Combinatorial Algebraic Geometry, Virtual participant. (Spring 2021).
- ICERM Combinatorial Algebraic Geometry Graduate/Postoc Seminar co-organizer (Spring 2021)
- ALGECOM XIX co-organizer (Spring 2020)
- Graduate Research Opportunities for Women (GROW), Plenary Speaker and Graduate Student Panelist (October 2019)
- Nebraska Conference for Undergraduate Women in Mathematics (NCUWM), Invited Graduate Student Panelist (January 2019)
- Sloan University Center of Exemplary Mentoring, Graduate Student Mentor (August 2018-May 2019)
- Illinois Combinatorics Lab for Undergraduate Experiences (ICLUE), Graduate Student Mentor (2017-2018)

## OUTREACH

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- Illinois Geometry Lab (IGL)
  - UIUC Undergraduates: Training of UIUC undergraduate volunteers for IGL Outreach activities (Fall 2018–Spring 2022)
  - Garden Hills Academy: Instructor, Co-Organizer, activity for 2-3 grade children (March 2021)
  - International Prep Academy: Co-Organizer, activity for 2-3 grade children (March 2020)
  - SACNAS and Friends: Instructor and Co-Organizer, activity for Champaign-Urbana 1-8 grade children (February 2020)
  - Julia Robinson Day: Instructor, activity for Champaign-Urbana K-6 grade children (February 2020)
  - Central High School: Co-Organizer, activity for 9-12 grade children (November 2018, February 2020)
  - First Lego League Robotics Competition: Instructor and Co-Organizer, activity for Illinois K-5 grade children (January 2017 (volunteer), 2018 (volunteer), 2019, 2020)
  - Science at the Market: Instructor and Organizer, activity for Champaign-Urbana K-3 grade children (Fall 2016 (volunteer), 2017 (volunteer), 2018, 2019, 2021)
  - Franklin STEAM Academy: Instructor and Co-Organizer, activity for 6-8 grade children (April, August 2019, September 2021)
  - Illini Fest: Instructor, activity for Chicago K-5 grade children (July 2019)
  - Illinois Council of Teachers of Mathematics Math Contest: Instructor and Organizer, activity for Illinois 8-12 grade children (May 2019)
  - Tri-Point High School: Instructor and Organizer, STEM day activity for rural Southern Illinois 10-12 grade children (April 2019)

- Rantoul High School: Instructor and Organizer, activity for 10-11 grade children (March 2018 (volunteer), March 2019)
- Southern Illinois High School: Instructor and Co-Organizer, activity for 9-10 grade children (March 2019)
- Four Color Fest: Instructor, activity for K-6 grade children (November 2017)
- Summer Illinois Mathematics Camp: Guest Speaker (2019, 2021), Volunteer (2020)
- Sonia Math Day: Instructor and Co-Organizer, activity for Champaign-Urbana 9-12 grade children (November 2017, April 2018)
- Girls Engaged in Math and Science (GEMS): Instructor and Co-Organizer, activity for Champaign-Urbana 5-8 grade children (March 2018)
- iSTEM: Instructor, activity for Champaign-Urbana 9-12 grade children (August 2017)