Oskar Henriksson

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Mathematical interests

Applied and computational aspects of algebraic geometry, with emphasis on numerical, toric, and tropical techniques in the study of parametric polynomial models appearing in biology and statistics.

Education and employment

Postdoc, Max Planck Institute of Molecular Cell Biology and Genetics, Dresden. **September 2025 –**
Mentor: Aida Maraj.

Ph.D. in Mathematics, University of Copenhagen. **January 2022 – August 2025**
Advisor: Elisenda Feliu. PhD award date: March 11, 2025.
Thesis title: *On the generic geometry of parametrized polynomial systems in biology and statistics.*

Research assistant, Aalto University, Espoo. Mentor: Kaie Kubjas. **August–December 2021**

Research assistant, University of Copenhagen. Mentor: Elisenda Feliu. **March–June 2021**

M.Sc. in Mathematics, University of Copenhagen. **September 2018 – January 2021**

B.Sc. in Mathematics, Lund University. **September 2013 – August 2018**

Longer research visits

University of Wisconsin–Madison. Host: Jose Rodriguez. **September–October 2024**

Institute for Mathematical and Statistical Innovation, Chicago. **October 2023**
The *Varieties from Statistics* apprenticeship. Mentor: Bernd Sturmfels.

Peer-reviewed papers

6. **The generic geometry of steady state varieties** with Elisenda Feliu, Beatriz Pascual-Escudero.
   To appear in *SIAM Journal on Applied Algebra and Geometry* (2026).
5. **Moment varieties of the inverse Gaussian and gamma distributions are nondefective**
   with Kristian Ranestad, Lisa Seccia, Teresa Yu. *Journal of Symbolic Computation* **132** (2026).
4. **Maximum likelihood estimation of log-affine models using detailed-balanced reaction networks**
   with Carlos Améndola, Jose I. Rodriguez, Polly Y. Yu. *Journal of Mathematical Biology* **91**, 34 (2025).
3. **Generic consistency and nondegeneracy of vertically parametrized systems**
   with Elisenda Feliu, Beatriz Pascual Escudero. *Journal of Algebra* **677** (2025).
2. **Moment varieties from inverse Gaussian and gamma distributions**
   with Lisa Seccia, Teresa Yu. *Algebraic Statistics*, **15**, 2 (2024).
1. **3D genome reconstruction from partially phased Hi-C data**
   with Diego Cifuentes, Jan Draisma, Annachiara Korchmaros, Kaie Kubjas.
   Bulletin of Mathematical Biology, **86**, 33 (2024).

Preprints

5. **Root bounds of vertical systems using tropical geometry**
   with Elisenda Feliu, Paul Helminck, Yue Ren, Benjamin Schröter, Máté Telek [2605.07645]
4. **Elimination Without Eliminating: Computing Complements of Real Hypersurfaces Using Pseudo-Witness Sets**
   with Paul Breiding, John Cobb, Aviva Englander, Nayda Farnsworth, Jonathan Hauenstein, David Johnson, Jordy Lopez Garcia, Deepak Mundayur [2601.04383].
3. **A flux-based approach for analyzing the disguised toric locus of reaction networks**
   with Balázs Boros, Gheorghe Craciun, Jiaxin Jin, Diego Rojas La Luz [2510.03621].

2. **Toric invariance of vertically parametrized systems** with Elisenda Feliu [2411.15134].

1. **A tropical method for solving parametrized polynomial systems** with Paul Helminck, Yue Ren [2409.13288].

Research talks

28. **An invitation to algebraic reaction network theory**. Introductory tutorial for *Chemical Reaction Networks in Hawai'i 2026*, University of Hawai'i at Mānoa (May 17, 2026).
27. **Computing discriminant complements using pseudo-witness sets**. *Workshop on Real Applied Algebra* at the University of Copenhagen (March 24, 2026).
26. **The polyhedral structure of the disguised toric locus**. *The Mathematics of Reaction Networks seminar*, online (February 12, 2026).
25. **Toric invariance of steady state systems**. *Workshop on Formal Reaction Kinetics* at the Bolyai Institute in Szeged (January 8, 2026).
24. **Exploring the parameter space of polynomial systems using pseudo-witness sets**. *The Mathematics Seminar* at the Center for Systems Biology Dresden (October 23, 2025).
23. **Secant nondefectivity of moment varieties: curves, surfaces and beyond**. *Algebraic Methods in Parameter Identifiability and Submodel Selection* at SIAM AG25, UW Madison (July 8, 2025).
22. **Tropical root bounds: case studies from chemistry, rigidity and physics**. *The Applied CATS seminar* at KTH Stockholm (June 10, 2025).
21. **Algebraic and dynamical aspects of designing Birch-point-estimating reaction networks**. *The Formal Reaction Kinetics seminar*, online (March 25, 2025).
20. **The dynamics of Birch point estimating reaction networks**. *Algebraic Statistics 2025*, TU Munich (March 24, 2025).
19. **The numerical algebraic geometry of steady state equations**. *Numerical (Nonlinear) Algebra in the Real World*, MPI-CBG Dresden (February 5, 2025).
18. **Moment identifiability of mixture distributions: the gamma and inverse Gaussian case**. *Applied Algebra Seminar*, University of Wisconsin–Madison (October 17, 2024).
17. **The generic geometry of steady state varieties**. *The Formal Reaction Kinetics seminar*, online (September 24, 2024).
16. **Nondegeneracy, robustness and multistationarity in reaction network theory**. *Computer Algebra Applications in the Life Sciences* at ICMS 2024, Durham University (July 23, 2024).
15. **Generalized polyhedral homotopies with tropical geometry**. *Symbolic-Numeric Methods in Algebraic Geometry* at ICMS 2024, Durham University (July 22, 2024).
14. **Robustness and multistationarity conditions for interaction networks with nondegenerate steady states**. *Annual Meeting of the Society for Mathematical Biology* at Konkuk University, Seoul (July 1, 2024).
13. **The positive algebraic geometry of vertically parametrized systems**. *Positive Solutions of Polynomial Systems Arising from Real-life Applications* at BIRS-IMAG (May 21, 2024).
12. **Tropical root bounds and generalized polyhedral start systems in OSCAR**. Software demo at the *Grad Student Meeting in Applied Algebra and Combinatorics* in Berlin (April 10, 2024).
11. **Secant varieties in statistics: identifiability of mixture distributions**. *Applied Algebra and Geometry Seminar*, University of Copenhagen (March 8, 2024).
10. **Finding *all* steady states with tropical geometry**. *The Mathematics of Reaction Networks seminar*, online (November 30, 2023).
9. **Moment varieties of classical distributions**. *Varieties from Statistics*, IMSI (October 2, 2023).
8. **Generic dimension and optimal start systems in reaction network theory**. *Seminar on Nonlinear Algebra* at MPI MiS Leipzig (September 7, 2023).
7. **Generic dimension of varieties arising in reaction network theory and 3D genome reconstruction**. *Computer Algebra Applications in the Life Sciences* at ACA 2023 (July 20, 2023).
6. **Improved steady state bounds with tropical and toric methods**. *New Approaches to Analyzing Biological Interaction Networks* at SIAM AG23 (July 13, 2023).

5. **The tropical geometry of parametric polynomial systems**. *Queer and Trans Mathematicians in Combinatorics* in London (July 6, 2023).
4. **Detecting and precluding toricity in reaction network theory**. 28th Nordic Congress of Mathematicians in Helsinki (August 19, 2022).
3. **Detecting and precluding toricity in reaction network theory**. *Computer Algebra Applications in the Life Sciences* at ACA22 in Gebze-Istanbul (August 15, 2022).
2. **Geometric perspectives on the steady states of reaction networks**. *Statistics, Algebra, and Geometry Seminar* at Aalto University (November 11, 2021).
1. **Toricity in reaction network theory**. *Algebraic-Geometric Methods for Reaction Networks* at SIAM AG21 (August 19, 2021).

Poster presentations

2. **Parametric positive toricity of steady state varieties**. *SIAM AG23* (July 10, 2023)
1. **Positive parametric toricity in reaction network theory**. *Workshop on Solving Polynomial Equations and Applications*, CWI Amsterdam (October 6, 2022)

Teaching experience

Algebraic Geometry (M.Sc.), Co-teacher, University of Copenhagen **Spring 2025**

Applied Algebra and Geometry (M.Sc.), Co-teacher, University of Copenhagen **Fall 2023**

Experimental Mathematics (B.Sc., M.Sc.), Teaching Assistant, University of Copenhagen **Fall 2023**

Algebraic Methods for Biochemical Reaction Networks **Summer 2023**

Teaching assistant, MSRI Summer Graduate School at MPI MiS Leipzig

Commutative Algebra (M.Sc.), Teaching Assistant, University of Copenhagen **Spring 2023**

General Topology (B.Sc.), Teaching Assistant, University of Copenhagen **Spring 2022**

Organic Chemistry (B.Sc.), Teaching Assistant, Lund University **Fall 2015, Spring 2014, Fall 2014**

Mentorship

Group mentor for the Dive Into Research @ Dresden REU program **Summer 2026**

MSc thesis: Ignacio González Mantecón (joint supervision with Elisenda Feliu) **Spring 2024**

Title: *Generic nonemptiness and irreducibility of zero loci of vertically parametrized systems.*

Teacher training

Introduction to University Pedagogy (University of Copenhagen, 3 ECTS) **Summer 2023**

Teaching mentorship for early-career scientists (University of Copenhagen) **Spring 2023**

Outreach and expository talks

- **Fantastic (Nondefective) Secant Varieties and Where to Find Them**. *Graduate Algebraic Geometry Seminar* at the University of Wisconsin–Madison (October 2, 2024).
- **Gröbner bases and chemical reaction networks: What role can algebra play in the biochemistry of the future?** Talk for students in Swedish Young Scientists xRays network, online (September 6, 2020).

Organization

Session on Symbolic and Numerical Methods in (Nonlinear) Algebra @ JuliaCon **August 2026**

Joint with Max Horn, Claus Fieker, Alexander Demin, Taylor Brysiewicz, and Paul Breiding

Session on Biological Applications of Computer Algebra at ICMS 2026 **July 2026**

Joint with Joseph Cummings and Marina Garrote-López.

Copenhagen Applied Algebra and Geometry Seminar **Spring 2024**

Grad Student Meeting on Applied Algebra and Combinatorics **April 2023**

Joint with Xiangying Chen, Danai Deligeorgaki, Filip Jonsson Kling, Felix Rydell, and Mariel Supina.

Service

Refereeing **2022–**

MEGA; SIAM Journal on Applied Algebra and Geometry; SIAM Journal on Applied Mathematics; Journal of Symbolic Computation; Journal of Mathematical Chemistry.

Recruitment committee at Lund University **2020–2021**

Student representative in the search committee for two associate professorships in algebra.

Grants and awards

Travel support from European Society for Mathematical and Theoretical Biology **2024**

Conference of the Society for Mathematical Biology 2024 (350 EUR)

Funding for "Grad Student Meeting on Applied Algebra and Combinatorics" **2023**

Compositio Mathematica (3 000 EUR)
Stockholm Mathematics Centre (100 000 SEK)

Student travel award for participation in the SIAM Conferences AG21 and AG23 **2021, 2023**

Languages

Swedish (native speaker), English (fluent), German (intermediate), Danish (intermediate).

Programming languages

Experience with computational algebra work in `Julia`, `Macaulay2`, `Sage`, `Maple` and `Mathematica`.

Experience with numerical analysis in `Python`/`NumPy` and `Matlab`.