

Simon Rubinstein-Salzedo

Curriculum Vitae

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Education

- 2012 **PhD Mathematics**, *Stanford University*,
Thesis: Controlling Ramification in Number Fields, Advisor: Akshay Venkatesh.
- 2007 **BS Mathematics**, *College of Creative Studies, UC Santa Barbara*,
Thesis: Finitistic Dimensions of Monomial Algebras, Advisor: Birge Huisgen-Zimmermann.
Minor in Music

Academic Jobs

- 2015– **Euler Circle**, *Director*.
- 2013–2015 **Stanford University**, *Postdoctoral Fellow*, Department of Statistics.
- 2012–2013 **Dartmouth College**, *Visiting Assistant Professor*, Department of Mathematics.

Non-Academic Jobs

- 2014–2020 **EventForte, Inc.**, *Senior Mathematician*.

Papers

- “The asymmetric Colonel Blotto game.” Preprint at <https://arxiv.org/abs/1708.07916>. (With Y. Zhu.)
- “Riemannian curvature: a surrogate metric of convergence for Hamiltonian Monte Carlo.” Submitted. (With S. Holmes and C. Seiler.)
- “Curvature and concentration of Hamiltonian Monte Carlo in high dimensions.” Submitted. Preprint at <http://arxiv.org/abs/1407.1114>. (With S. Holmes and C. Seiler.)
- “Inscribed triangles of Jordan curves in \mathbb{R}^n .” Submitted. Preprint at <https://arxiv.org/abs/2102.03953>. (With A. Gupta.)
- “RSK-complete cycle decompositions.” To appear in *Australasian Journal of Combinatorics*. Preprint at <https://arxiv.org/abs/2301.07216>. (With A. Goel.)
- “Memgames.” To appear in *Games of No Chance 6*. Preprint at <https://arxiv.org/abs/1912.10517>. (With U. Larsson and A. Siegel.)
- “ \mathcal{P} -play in candy nim.” To appear in *Games of No Chance 6*. Preprint at <https://arxiv.org/abs/1805.07019>. (With N. Mani, R. Nelakanti, and A. Tholen.)
- “Cyclotomic coincidences.” *Experimental Mathematics* **31** no. 2, 2022, pp. 596–505. (With C. Pomerance.)
- “Diophantine tuples over \mathbb{Z}_p .” *Acta Arithmetica* **197**, 2021, pp. 331–351. (With N. Mani.)
- “Stability for take-away games.” *Journal of Integer Sequences* **23** no. 2, 2020. (With S. Sarkar.)
- “Reduction of dynatomic curves.” *Ergodic Theory and Dynamical Systems* **39** no. 10, 2019. (With J. Doyle, H. Krieger, A. Obus, R. Pries, and L. West.)
- “Understanding significance tests from a non-mixing Markov chain for partisan gerrymandering claims.” *Statistics and Public Policy* **6** no. 1, 2019, pp. 44–49. (With W. Tam Cho.)
- “Global Fibonacci nim.” *International Journal of Game Theory* **47** no. 2, 2018, pp. 595–611. (With U. Larsson.)
- “Finite ramification for pre-image fields of PCF morphisms.” *Mathematical Research Letters* **24** no. 6, 2017, pp. 1633–1647. (With A. Bridy, P. Ingram, R. Jones, J. Juul, A. Levy, M. Manes, and J. Silverman.)
- “Could Euler have conjectured the prime number theorem?” *Mathematics Magazine* **90** no. 5, 2017, pp. 355–359.
- “Noncrossing partitions, toggles, and homomesies.” *Electronic Journal of Combinatorics* **23**, issue 3 #52. (With D. Einstein, M. Farber, E. Gunawan, M. Joseph, M. Macauley, and J. Propp.)
- “Grundy values of Fibonacci nim.” *International Journal of Game Theory* **45**, no. 3, 2016, pp. 617–625. (With U. Larsson.)
- “Noncrossing partitions, toggles, & homomesy.” *Discrete Mathematics and Theoretical Computer Science* proceedings of FPSAC 2016, 419–430. (With D. Einstein, M. Farber, E. Gunawan, M. Joseph, M. Macauley, and J. Propp.)
- “ N -division points of hypocycloids.” *Arnold Mathematical Journal* **2**, no. 2, 2016, pp. 149–158. (With N. Mani.)
- “Identities for field extensions generalizing the Ohno-Nakagawa relations.” *Compositio Mathematica* **151**, no. 11, 2015, pp.

2059–2075. (With H. Cohen and F. Thorne.)

- “Positive curvature and Hamiltonian Monte Carlo.” *Advances in Neural Information Processing Systems (NIPS)* **27**, 2014. (With S. Holmes and C. Seiler.)
- “Analysis on surreal numbers.” *Journal of Logic and Analysis* **6**, no. 5, 2014, pp. 1–39. (With A. A. Swaminathan.)
- “Invariants for A_4 fields and the Cohen–Lenstra Heuristics.” *International Journal of Number Theory* **10**, no. 5, 2014, pp. 1259–1276.
- “Period computations for covers of elliptic curves.” *Mathematics of Computation* **83**, no. 289, 2014, pp. 2455–2470.
- “Covers of elliptic curves with unique, totally ramified branched points.” *Mathematische Nachrichten* **286**, no. 14–15, 2013, pp. 1530–1536.
- “A Hilbert space approach to bounded analytic interpolation.” *Complex Analysis and Operator Theory* **1**, no. 4, 2007, pp. 523–532. (With J. Danciger.)

Books

These are books for advanced high-school students.

- *Transition to proofs*. World Scientific, 2023.
- *Algebraic topology*. Springer, 2021. (With C. Bray and A. Butscher.)
- *Cryptography*. Springer Undergraduate Mathematics Series, 2018.

Grants for Euler Circle

- AMS Epsilon Fund Grant, 2022–2024.

Teaching

Academic Year

- 2015– **Euler Circle**, Director and instructor for classes for advanced high-school students on abstract algebra, cryptography, complex analysis, combinatorial game theory, proofs from the book, algebraic geometry, combinatorics, mathematics of Euler, p -adic analysis, number theory, ergodic theory, analytic number theory, infinite series, Markov chains, generating functions, differential geometry, independent research and paper writing, theory of computation, gems of linear algebra, differential topology, and transition to proofs.
- 2013–2014 **Stanford University**, Teaching fellow for *Thinking Matters 3: breaking codes and finding patterns*.
- 2012–2013 **Dartmouth College**, Instructor for Math 8 (calculus of one and several variables), Math 10 (elementary statistics), Math 11 (multivariable calculus), Math 20 (discrete probability).
- 2007–2012 **Stanford University**, Teaching assistant for Math 51 (linear algebra and multivariable calculus), Math 53 (ordinary differential equations). Course assistant for Math 19 (differential calculus), Math 114 (advanced honors linear algebra), Math 121 (advanced undergraduate abstract algebra), Math 210A,B (graduate algebra), algebra qualifying exam preparation.
- 2007 **University of California, Santa Barbara**, Instructor for Math 10 (combinatorial game theory), a course of my own design.
- 2003–2005 **Art of Problem Solving**, Taught and designed classes to help advanced middle-school and high-school students win mathematics competitions.

Summer Teaching

- 2014–2019 **Stanford University Mathematics Camp**, Instructor for a four-week intensive course on algebraic topology for high-school students.
- 2013 **Education Program for Gifted Youth**, Instructor for a three-week intensive course on cryptography for high-school students.
- 2009–2013 **Stanford University Mathematics Camp**, Teaching assistant: teaching advanced high-school students about abstract algebra, number theory, and algebraic topology.
- 2012 **Stanford Undergraduate Research Institute in Mathematics**, Mentor for number theory group.

Miscellaneous Teaching

- 2015– **San Francisco Bay Area ARML Team**, Coached the 2015, 2016, 2017, 2021, 2022, and 2023 national champion A1 teams.
- 2022 **Nueva Intersession**, Taught a 2-day workshop on cryptography.
- 2017 **Palo Alto Unified School District**, Taught a 12-hour probability workshop for high-school teachers.

- 2010–2017 **Julia Robinson Mathematics Festival**, *Directed mathematical activities for middle-school students*, 1–8 times per year.
- 2008–2012 **Stanford Splash**, *Taught classes for students in grades 7–12 on various topics, including combinatorial games, cryptography, algebraic topology, prisoner puzzles, and chess*, 1–2 times per year.

Selected Students Mentored

Undergraduate Students

- **Nitya Mani**, Stanford University. Research project and paper on Diophantine tuples over \mathbb{Z}_p .
- **Sherry Sarkar**, Georgia Institute of Technology. Research project and paper on stability for take-away games. Presented at JMM 2018.
- **Mark Rychnovsky**, College of Creative Studies, University of California, Santa Barbara. Undergraduate thesis: “Computation of symmetric Belyĭ maps on surfaces of high genus.”

High School Students

- **Ezra Furtado-Tiwari, Agastya Goel, Grace Howard, Neil Kolekar, Eddy Li, Zipeng Lin, Aashir Mehrotra**. Research project on transcendental numbers and automata.
- **Agastya Goel**. Research project and paper on the RSK bijection for permutations.
- **Kishan Jani, Katherine Taylor, and Darren Yao**. Research project on mixing times for random walks on groups.
- **Sarah Fujimori, Jonathan Sy, and Ethan Yang**. Research project on S -universal quadratic forms. Presented at Number Theory Series in Los Angeles 2019.
- **Rajiv Nelakanti and Alex Tholen**. Research project and paper on game theory. Presented at JMM 2018.
- **Yifan Zhu**. Research project and paper on game theory. Finalist in Yau Awards 2017.
- **Rachana Madhukara**. Research project on Markov chains and analytic number theory. First place, Greater San Diego Science and Engineering Fair 2017; first place and special prize, California State Science Fair 2017; finalist in Siemens Competition 2017.
- **Sohini Kar**. Research project on factorization of recurrence relations. Second place, Synopsys Silicon Valley Science and Engineering Fair 2017; second place, California State Science Fair 2017; regional finalist in Siemens Competition 2017.
- **Nitya Mani**. Research project and paper on constructing n -division points on algebraic curves. Grand prize, Synopsys Silicon Valley Science and Engineering Fair 2014 and 2015; first place and special prize, California State Science Fair 2014; third place, International Science and Engineering Fair 2015; first place, Karl Menger Award 2014 and 2015; honorable mention Schafer Prize 2019.
- **Ashvin Swaminathan**. Research project and paper on analysis on surreal numbers. Regional finalist in Siemens Competition 2012, semifinalist in Intel Science Talent Search 2013; Morgan Prize 2018.

Talks

Research Talks

- “Let kids learn math!” (Innovative Pedagogy in Geometry and Topology, July 2023.)
- “ S -universal quadratic forms.” (West Coast Number Theory, December 2019.)
- “Diophantine tuples over \mathbb{Z}_p .” (West Coast Number Theory, December 2018, won Lehmer prize for best talk.)
- “Dessins d’enfants and origamis.” (FRAGMENT Seminar, Colorado State University, May 2018; UCSB Colloquium, April 2015; Dartmouth Colloquium, October 2012.)
- “Take-away games.” (CMC³ Recreational Math Conference, Tahoe, April 2018; West Coast Number Theory, December 2017.)
- “Reduction of dynatomic curves.” (West Coast Number Theory, December 2016.)
- “Analysis on surreal numbers.” (Joint Mathematics Meeting, January 2016.)
- “PCF morphisms and ramification.” (West Coast Number Theory, December 2015.)
- “Multi-pile Fibonacci nim.” (Games at Dalhousie, August 2015.)
- “Relations between counts of D_ℓ and F_ℓ fields.” (Carl Pomerance 70th Birthday Conference, June 2015; West Coast Number Theory, December 2014.)
- “Positive curvature and Hamiltonian Monte Carlo.” (Joint Mathematics Meetings, January 2015; Stanford Statistics Seminar, June 2014.)
- “The Cohen–Lenstra heuristics and roots of unity.” (CMS Winter Meeting, December 2012; AIM workshop on the Cohen–Lenstra heuristics, June 2011.)
- “Branched covers of algebraic curves.” (Dartmouth Number Theory Seminar, October 2012; Québec–Maine Number Theory Conference, September 2012.)

Expository Talks for Mathematicians

- “Ordinal sums.” (Capital Games, May 2020.)
- “Algebraic number theory by picture.” (Stanford Undergraduate Research Institute in Mathematics Speaker Series, July 2014.)

- “Fundamental groups in characteristic p .” (Stanford Student Algebraic Geometry Seminar, May 2012.)
- “Global arithmetic dynamics.” (Stanford Graduate Student Colloquium, February 2012.)
- “Humbert surfaces.” (Stanford Student Algebraic Geometry Seminar, December 2011.)
- “Lexicographic codes.” (Stanford Graduate Student Colloquium, March 2011.)
- “Tschirnhaus transformations.” (Stanford Student Algebraic Geometry Seminar, February 2011.)
- “The distribution of class groups of function fields.” (Stanford Student Algebraic Geometry Seminar, November 2010.)
- “The Beilinson conjecture for curves.” (Stanford Student Algebraic Geometry Seminar, February 2010.)
- “Integer partitions.” (Stanford Undergraduate Mathematical Organization, October 2009.)
- “Rigid p -adic geometry and Berkovich spaces.” (Stanford Student Algebraic Geometry Seminar, October 2009.)
- “Preperiodic points of dynamical systems.” (Stanford Graduate Student Colloquium, April 2009.)
- “Combinatorial games.” (Stanford Undergraduate Mathematical Organizations, November 2008.)
- “Error-correcting codes and the game of NIM.” (Stanford Graduate Student Colloquium, November 2007.)
- “Consequences of the abc conjecture. (UCSB Math Club, January 2007.)
- “A prelude to Pick–Nevanlinna interpolation.” (UCSB Seminar on Operator Algebras and Functional Analysis, October 2006.)

Expository Talks for Younger and General Audiences

- “Tiling rectangles.” (Stanford Math Circle, April 2024; Stanford Math Circle, December 2022; Leland High School Math Club, December 2021; Andrews University, February 2021; NanoMath Fall Math Meet, October 2020; ASDAN Math Tournament, August 2020; Stanford Math Circle, April 2019; San Jose Math Circle, February 2019; San Jose Math Circle, September 2017; Stanford Math Circle, April 2017.)
- “ p -adic numbers.” (Stanford Math Circle, March 2024; Stanford Math Circle, April 2022; San Jose Math Circle, February 2018; Stanford Math Circle, October 2016.)
- “The pentagonal number theorem.” (Stanford Math Circle, December 2023; The Ross Program, July 2023; Stanford Math Circle, May 2023; SFBA ARML Practice, May 2022; Stanford Math Circle, February 2021; FARML, May 2020; San Jose Math Circle, March 2018.)
- “The Thue–Morse sequence.” (Stanford Math Circle, December 2023; Stanford Math Circle, May 2022.)
- “Divide and conquer, and the inverse Ackermann function.” (Stanford Math Circle, October 2023; Stanford Math Circle, May 2022; San Jose Math Circle, October 2019; Stanford Math Circle, May 2019; Stanford Math Circle, November 2014.)
- “Hilbert’s Third Problem.” (Stanford Math Circle, October 2023; San Jose Math Circle, May 2019; Stanford Math Circle, November 2017.)
- “Games and codes.” (Stanford Math Circle, March 2023; Stanford Math Circle, January 2021; San Diego Math Circle, January 2018; San Jose Math Circle, November 2017; Las Positas College, December 2016; Nueva Math Circle, March 2016; Pleasanton Math Circle, February 2016; Stanford Math Circle, May 2015; SUMaC, August 2013; Hartford High School, May 2013; EPGY games and puzzles class, August 2012; SUMaC, July 2011.)
- “Linearity of expectation.” (Stanford Math Circle, December 2022; Stanford Math Circle, May 2022; San Jose Math Circle, April 2019; Stanford Math Circle, April 2019; Stanford Math Circle, September 2015.)
- “Complementary equations and related topics.” (Stanford Math Circle, October 2022; Stanford Math Circle, November 2019; Stanford Math Circle, October 2015.)
- “Generating functions and random walks.” (Stanford, Math Circle, October 2022; San Jose Math Circle, February 2019; Stanford Math Circle, January 2017; Stanford Math Circle, December 2013.)
- “Counting trees.” (Santa Clarita Valley Spring Math Meet, April 2022; NanoMath Fall Math Meet, October 2021.)
- “Inscribed Polygons.” (Los Altos High School STEAM Week, January 2021.)
- “Division points of hypocycloids.” (Homestead High School Math Club, October 2021; Everaise Academy, July 2020.)
- “Take-away games.” (Raising a Mathematician, May 2021; NanoMath Winter Championship, January 2021; SFBA ARML Practice, May 2020; Homestead High School Math Club, February 2019.)
- “Introduction to Markov chains.” (SFBA ARML Practice, April 2021.)
- “Zero-knowledge proofs.” (Davis WiSTEM Mathalon, March 2021.)
- “Factoring tricks.” (SFBA ARML Practice, May 2020.)
- “Cayley’s theorem.” (SFBA ARML Practice, April 2020.)
- “Constructible polygons and related questions.” (Los Altos High School STEM Week, November 2017.)
- “The Thue–Morse sequence, part 2.” (Stanford Math Circle, October 2017.)
- “The Thue–Morse sequence, part 1.” (Stanford Math Circle, September 2017.)
- “Quadratic reciprocity.” (AwesomeMath Summer Program, June 2017; San Jose Math Circle, December 2010.)
- “Chromatic polynomials of graphs.” (Stanford Math Circle, April 2017.)
- “Binary sequences, graphs, and card tricks.” (Stanford Math Circle, October 2015; Stanford Math Circle, February 2014; SIYP Middle School Math League, August 2012.)
- “Partitions.” (Stanford Math Circle, May 2015.)
- “Promotion on Young tableaux.” (Stanford Math Circle, May 2015.)
- “Wishful thinking in mathematics.” (MoMath BNL Gifted Math Program, March 2013; SUMaC, July 2012; Stanford Math

Circle, March 2012.)

- “Behavioral economics, game theory, and rationality.” (SIYP Singapore, August 2012.)
- “Combinatorial games.” (EPGY game theory class, July 2012; Stanford Math Circle, October 2011; EPGY number theory class, July 2011.)

Professional Service

- President, Lemniscate Education, 2024–.
- Served on PhD thesis committee for Avram Gottschlich, Dartmouth College, 2012.
- Referee for *The Ramanujan Journal*, *Fibonacci Quarterly*, *Games of No Chance 5*, *Involve*, *Electronic Journal of Combinatorics*, *Mathematics of Computation*, *INTEGERS*, *Proceedings of the London Mathematical Society*, and *International Journal of Game Theory*.
- Faculty advisor, Dartmouth Chess Club, 2012–2013.