

Simon Rubinstein-Salzedo

simon@eulercircle.com
<http://www.simonrs.com/>
<http://www.eulercircle.com/>

Current position

Director and mathematics teacher at Euler Circle.

Education

2012	PhD Mathematics, Stanford University. Thesis: “Controlling ramification in number fields,” advisor Akshay Venkatesh.
2007	BS Mathematics, Minor Music, College of Creative Studies, University of California, Santa Barbara. Thesis: “Finitistic dimensions of monomial algebras,” advisor Birge Huisgen-Zimmermann.

Academic positions held

2013–2015	Stanford University, Department of Statistics. Postdoctoral fellow
2012–2013	Dartmouth College, Department of Mathematics. Visiting assistant professor

Research interests

Number theory, combinatorics, probability theory, combinatorial game theory

Papers

1. “Diophantine tuples over \mathbb{Z}_p .” In preparation. (With N. Mani.)
2. “Memgames.” In preparation. (With U. Larsson and A. Siegel.)
3. “A hands-on approach to origamis and origami curves.” In preparation.
4. “A stability result for take-away games.” Submitted. Preprint at <https://arxiv.org/abs/1809.07749>. (With S. Sarkar.)
5. “ \mathcal{P} -play in candy nim.” Submitted. Preprint at <https://arxiv.org/abs/1805.07019>. (With N. Mani, R. Nelakanti, and A. Tholen.)
6. “On Markov chains and redistricting.” Submitted. (With W. Tam Cho.)

7. “The asymmetric Colonel Blotto game.” Submitted. Preprint at <https://arxiv.org/abs/1708.07916>. (With Y. Zhu.)
8. “Riemannian curvature: a surrogate metric of convergence for Hamiltonian Monte Carlo.” Submitted. (With S. Holmes and C. Seiler.)
9. “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.)
10. “Reduction of dynatomic curves.” To appear in *Ergodic Theory and Dynamical Systems*. Preprint at <https://arxiv.org/abs/1703.04172>. (With J. Doyle, H. Krieger, A. Obus, R. Pries, and L. West.)
11. “Global Fibonacci nim.” *International Journal of Game Theory* **47** no. 2, 2018, pp. 595–611. (With U. Larsson.)
12. “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.)
13. “Could Euler have conjectured the prime number theorem?” *Mathematics Magazine* **90** no. 5, 2017, pp. 355–359.
14. “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.)
15. “Grundy values of Fibonacci nim.” *International Journal of Game Theory* **45**, no. 3, 2016, pp. 617–625. (With U. Larsson.)
16. “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.)
17. “ N -division points of hypocycloids.” *Arnold Mathematical Journal* **2**, no. 2, 2016, pp. 149–158. (With N. Mani.)
18. “Identities for field extensions generalizing the Ohno-Nakagawa relations.” *Compositio Mathematica* **151**, no. 11, 2015, pp. 2059–2075. (With H. Cohen and F. Thorne.)
19. “Positive curvature and Hamiltonian Monte Carlo.” *Advances in Neural Information Processing Systems* (NIPS) **27**, 2014. (With S. Holmes and C. Seiler.)
20. “Analysis on surreal numbers.” *Journal of Logic and Analysis* **6**, no. 5, 2014, pp. 1–39. (With A. A. Swaminathan.)
21. “Invariants for A_4 fields and the Cohen-Lenstra Heuristics.” *International Journal of Number Theory* **10**, no. 5, 2014, pp. 1259–1276.
22. “Period computations for covers of elliptic curves.” *Mathematics of Computation* **83**, no. 289, 2014, pp. 2455–2470.
23. “Covers of elliptic curves with unique, totally ramified branched points.” *Mathematische Nachrichten* **286**, no. 14–15, 2013, pp. 1530–1536.
24. “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.

1. *Cryptography*. Springer Undergraduate Mathematics Series, 2018.
2. *Abstract algebra*. In preparation.
3. *Algebraic topology*. In preparation. (With A. Butscher.)
4. *Combinatorial game theory*. In preparation.
5. *Combinatorics*. In preparation.
6. *Complex analysis*. In preparation.
7. *Mathematics of Euler*. In preparation.
8. *p-adic Analysis*. In preparation.

Teaching

Academic year

2015–	Euler Circle. 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, and p -adic analysis.
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).
2009–2012	Stanford University. Teaching assistant for Math 51 (linear algebra and multivariable calculus), Math 53 (ordinary differential equations).
2007–2012	Stanford University. 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 entirely of my own design.
2006–2007	University of California, Santa Barbara. Instructor for Putnam seminar.
2003–2005	Art of Problem Solving. Taught and designed classes to help advanced middle-school and high-school students win mathematics competitions.

Summer teaching

2014–2017	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.

Other teaching experience

2017	Palo Alto Unified School District. Taught a 12-hour probability workshop for high-school teachers.
2015–2017	San Francisco Bay Area ARML Team. Coached the 2015, 2016, and 2017 national champion A1 teams.
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)

Talks

Research talks

2018.05	FRAGMENT Seminar at Colorado State University. “Dessins d’enfants and origamis.”
2018.04	CMC³ Recreational Math Conference. “Take-away games.”
2017.12	West Coast Number Theory. “Stability for take-away games.”
2016.12	West Coast Number Theory. “Reduction of dynamomic curves.”
2016.01	Joint Mathematics Meeting. “Analysis on surreal numbers.”
2015.12	West Coast Number Theory. “PCF morphisms and ramification.”
2015.08	Games at Dalhousie. “Multi-pile Fibonacci nim.”
2015.06	Carl Pomerance 70th Birthday Conference. “Relations between counts of D_ℓ and F_ℓ fields.”
2015.04	UCSB Colloquium. “Dessins d’enfants and origamis.”
2015.01	Joint Mathematics Meeting. “Positive curvature and Hamiltonian Monte Carlo.”
2014.12	West Coast Number Theory. “Relations between counts of D_ℓ and F_ℓ fields.”
2014.06	Stanford Statistics Seminar. “Positive curvature and Hamiltonian Monte Carlo.”
2012.12	CMS Winter Meeting. “The Cohen-Lenstra Heuristics and roots of unity.”
2012.10	Dartmouth Colloquium. “Dessins d’enfants and origamis.”
2012.10	Dartmouth Number Theory Seminar. “Branched covers of algebraic curves.”
2012.09	Québec-Maine Number Theory Conference. “Explicit branched covers of elliptic curves.”
2012.06	Thesis Defense. “Branched covers of elliptic curves.”
2011.06	AIM Workshop on the Cohen-Lenstra Heuristics. “The Cohen-Lenstra Heuristics and roots of unity.”

Expository talks for mathematicians

- 2014.07 **Stanford Undergraduate Research Institute in Mathematics Speaker Series.** “Algebraic number theory by picture.”
- 2012.05 **Student Algebraic Geometry Seminar.** “Fundamental groups in characteristic p .”
- 2012.05 **Area Exam.** “Lifting invariants.”
- 2012.02 **Stanford Graduate Student Colloquium.** “Global arithmetic dynamics.”
- 2011.12 **Student Algebraic Geometry Seminar.** “Humbert surfaces.”
- 2011.03 **Stanford Graduate Student Colloquium.** “Lexicographic codes.”
- 2011.02 **Student Algebraic Geometry Seminar.** “Tschirnhaus transformations.”
- 2010.11 **Student Algebraic Geometry Seminar.** “The distribution of class groups of function fields.”
- 2010.02 **Student Algebraic Geometry Seminar.** “The Beilinson Conjecture for curves.”
- 2009.10 **Stanford Undergraduate Mathematical Organization.** “Integer partitions.”
- 2009.10 **Student Algebraic Geometry Seminar.** “Rigid p -adic geometry and Berkovich spaces.”
- 2009.04 **Stanford Graduate Student Colloquium.** “Preperiodic points of dynamical systems.”
- 2008.11 **Stanford Undergraduate Mathematical Organization.** “Combinatorial games.”
- 2007.11 **Stanford Graduate Student Colloquium.** “Error-correcting codes and the game of nim.”
- 2007.01 **UCSB Math Club.** “Consequences of the abc Conjecture.”
- 2006.10 **UCSB Seminar on Operator Algebras and Functional Analysis.** “A prelude to Pick-Nevanlinna interpolation.”

Expository talks for younger and general audiences

2018.03	San Jose Math Circle. “The pentagonal number theorem.”
2018.02	San Jose Math Circle. “ p -adic numbers.”
2018.01	San Diego Math Circle. “Games and codes.”
2017.11	Stanford Math Circle. “Hilbert’s third problem.”
2017.10	Los Altos High School STEM Week. “Constructible polygons and related questions.”
2017.10	San Jose Math Circle. “Games and codes.”
2017.10	Stanford Math Circle. “The Thue-Morse sequence, part 2.”
2017.09	San Jose Math Circle. “Rectangle tiling problems.”
2017.09	Stanford Math Circle. “The Thue-Morse sequence, part 1.”
2017.06	AwesomeMath Summer Program. “Quadratic reciprocity.”
2017.04	Stanford Math Circle. “Rectangle tiling problems.”
2017.04	Stanford Math Circle. “Chromatic polynomials of graphs.”
2017.01	Stanford Math Circle. “Generating functions and random walks.”
2016.12	Las Positas College. “Games and codes.”
2016.10	Stanford Math Circle. “ p -adic Numbers.”
2016.03	Nueva Math Circle. “Games and codes.”
2016.02	Pleasanton Math Circle. “Games and codes.”
2015.10	Stanford Math Circle. “Complementary equations and related topics.”
2015.10	Stanford Math Circle. “Binary sequences, graphs, and card tricks.”
2015.09	Stanford Math Circle. “Linearity of expectation.”
2015.05	Stanford Math Circle. “Codes and games.”
2015.05	Stanford Math Circle. “Partitions.”
2015.05	Stanford Math Circle. “Promotion on Young Tableaux.”
2014.11	Stanford Math Circle. “Divide and conquer, and the inverse Ackermann function.”
2014.02	Stanford Math Circle. “Binary sequences, graphs, and card tricks.”
2013.12	Stanford Math Circle. “Generating functions and random walks.”
2013.08	SUMaC. “Games and codes.”
2013.05	Hartford High School. “Games and codes.”
2013.03	MoMath BNL Gifted Math Program. “Wishful thinking in mathematics.”
2012.08	SIYP Middle School Math League. “Binary sequences, graphs, and card tricks.”
2012.08	SIYP Singapore. “Behavioral economics, game theory, and rationality.”
2012.08	EPGY Games and Puzzles Class. “Games and codes.”
2012.07	SUMaC. “Wishful thinking in mathematics.”
2012.07	EPGY Game Theory Class. “Combinatorial games.”
2012.03	Stanford Math Circle. “Wishful thinking in mathematics.”
2011.10	Stanford Math Circle. “Mathematical games.”
2011.07	EPGY Number Theory Class. “Combinatorial games.”
2011.07	SUMaC. “Games and codes.”
2010.12	San Jose Math Circle. “Quadratic reciprocity.”

Students mentored

Undergraduate senior theses

2015–2016	Mark Rychnovsky, College of Creative Studies, University of California, Santa Barbara. “Computation of symmetric Belyı maps on surfaces of high genus.”
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High school student research projects

- 2016– **Yifan Zhu**, Shanghai Foreign Language School. Research project on game theory. Finalist in Yau Awards 2017.
- 2016– **Rachana Madhukara**, Canyon Crest Academy. Research project on Markov chains and analytic number theory. 1st place, Greater San Diego Science and Engineering Fair 2017; 1st place and special prize, California State Science Fair 2017; finalist in Siemens Competition 2017.
- 2016– **Arav Karighattam**, Home schooled/UC Davis. Research project on sums of squares in very short intervals.
- 2015– **Sherry Sarkar**, Lynbrook High School. Research project on inverse problems in game theory.
- 2015– **Sohini Kar**, Saratoga High School. Research project on factorization of recurrence relations. 2nd place, Synopsys Silicon Valley Science and Engineering Fair 2017; 2nd place, California State Science Fair 2017; regional finalist in Siemens Competition 2017.
- 2015– **Meera Desai**, Crystal Springs Uplands School. Research project on generalizations of the truel problem and hyperplane arrangements.
- 2015– **Rohan Joshi**, Evergreen Valley High School. Research project on surreal numbers.
- 2015– **Allison Wang**, The Harker School. Research project on the mathematics of Celtic knots.
- 2014 **Ashwath Thirumalai**, The Harker School. Research project on the game of Sylver coinage.
- 2013– **Nitya Mani**, The Harker School. Research project and paper on constructing n -division points on algebraic curves. Grand prize, Synopsys Silicon Valley Science and Engineering Fair 2014 and 2015; 1st place and special prize, California State Science Fair 2014; 3rd place, International Science and Engineering Fair 2015; 1st place, Karl Menger Award 2014 and 2015.
- 2011–2013 **Ashvin Swaminathan**, The Harker School. Research project and paper on analysis on surreal numbers. Regional finalist in Siemens Competition 2012, semi-finalist in Intel Science Talent Search 2013; Morgan Prize 2018.

Professional service

1. Served on PhD thesis committee for Avram Gottschlich, Dartmouth College, 2012.
2. Referee for *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*.
3. Faculty advisor, Dartmouth Chess Club, 2012–2013.