

JOSHUA P. SWANSON

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Curriculum Vitae

RTPC Assistant Professor of Mathematics
University of Southern California
Department of Mathematics

Los Angeles, CA, USA
Office: KAP 438 D

ACADEMIC POSITIONS *University of Southern California*, Los Angeles, CA August 2021 — Present
RTPC NTT Assistant Professor of Mathematics

University of California, San Diego, La Jolla, CA August 2018 — July 2021
Stefan E. Warshawski
Visiting Assistant Professor of Mathematics

EDUCATION *University of Washington*, Seattle, WA September 2012 — June 2018
Ph.D. in Mathematics Thesis: *Major Index Statistics: Cyclic Sieving, Branching Rules, and Asymptotics*.
Adviser: Sara Billey
M.S. in Mathematics September 2012 — June 2015
Harvey Mudd College, Claremont, CA September 2006 — June 2010
B.S. in Math/CS (Joint Major)

AWARDS 2022 **AMS-Simons Travel Grant**
\$5000 award
2019 **Personal prize from Doron Zeilberger**
\$300 award for the proof in “On a theorem of Baxter and Zeilberger via a result of Roselle”
2012—2014 **McKibben and Merner Fellow**
\$10000 University of Washington departmental award for academic excellence

RESEARCH INTERESTS Algebraic combinatorics, analytic combinatorics, combinatorial representation theory, symmetric functions, complex reflection groups, Coxeter groups, major index statistics, tableaux combinatorics, dynamical algebraic combinatorics, invariant theory, cyclic sieving, {classical, super, diagonal} coinvariant algebras, q -analogues, generating function factorizations, free Lie algebras, cumulants, limit laws, local limit theorems, plabic graphs, Stirling numbers

PAPERS 19. (2022) “ q -Stirling numbers in type B ”.
With Bruce Sagan. 46 pages. arXiv:2205.14078. Submitted.
18. (2022) “Curious cyclic sieving on increasing tableaux”.
With Christian Gaetz, Oliver Pechenik, and Jessica Striker. 9 pages. arXiv:2112.09228.
Published in *Enumer. Combin. Appl.* ECA 2:3 (2022) Article S2R17.

17. (2021) “Tanisaki witness relations for harmonic differential forms”.
29 pages. arXiv:2109.05080. Submitted.
16. (2021) “Harmonic differential forms for pseudo-reflection groups II. Bi-degree bounds”.
With Nolan R. Wallach. 48 pages. arXiv:2109.03407. Submitted.
15. (2022) “The metric space of limit laws of q -hook formulas”.
With Sara C. Billey. 59 pages. arXiv:2010.12701. To appear in *Combinatorial Theory*.
14. (2020) “On the distribution of the major index on standard Young tableaux”.
With Sara C. Billey and Matjaž Konvalinka. arXiv:2005.10341. Talk at FPSAC 2020.
Extended abstract published in *Sém. Lothar. Combin*, 84B (2020), Art. 44, 12 pp.
13. (2021) “Harmonic differential forms for pseudo-reflection groups I. Semi-invariants”.
With Nolan R. Wallach. 30 pages. arXiv:2001.06076. Published in *J. Combin. Theory Ser. A* 182 (2021), Paper No. 105474.
12. (2019) “Thrall’s problem: cyclic sieving, necklaces, and branching rules”.
With Connor Ahlbach. Talk at FPSAC 2019. Extended abstract published in *Sém. Lothar. Combin*, 82B (2019), Art. 37, 12 pp.
11. (2020) “Existence and hardness of conveyor belts”.
With Molly Baird, Sara C. Billey, Erik D. Demaine, Martin L. Demaine, David Eppstein, Sándor Fekete, Graham Gordon, Sean Griffin, Joseph S. B. Mitchell. 21 pages.
arXiv:1908.07668. Published in *Electron. J. Combin.* 27 (2020), no 4. Paper 4.25.
10. (2019) “Alternating super-polynomials and super-coinvariants of finite reflection groups”.
18 pages. arXiv:1908.00196. Superseded by joint work with Nolan Wallach, *Harmonic differential forms for pseudo-reflection groups I. Semi-invariants*.
9. (2020) “Asymptotic normality of the major index on standard tableaux”.
With Sara C. Billey and Matjaž Konvalinka. 28 pages. arXiv:1905.00975. Published in *Adv. in Appl. Math.* 113 (2020), 101972.
8. (2022) “On a Theorem of Baxter and Zeilberger via a Result of Roselle”.
9 pages. arXiv:1902.06724. Published in *Ann. Comb.* (2022).
7. (2020) “Tableau posets and the fake degrees of coinvariant algebras”.
With Sara C. Billey and Matjaž Konvalinka. 45 pages. arXiv:1809.07386. Published in *Advances in Mathematics* 371 (2020).
6. (2018) “Cyclic sieving, necklaces, and branching rules related to Thrall’s problem”.
With Connor Ahlbach. 38 pages. arXiv:1808.06043. Published in *Electron. J. Combin.* 25 (2018), no. 4, Paper 4.42.
5. (2018) “Major Index Statistics: Cyclic Sieving, Branching Rules, and Asymptotics”.
206 pages. Ph.D. Thesis at the University of Washington under Sara Billey. ISBN 978-0438-52242-8.
4. (2018) “Refined cyclic sieving on words for the major index statistic”.
With Connor Ahlbach. 24 pages. arXiv:1706.08631. Published in *European J. Combin.* 73 (2018), 37-60.
3. (2018) “On the Existence of Tableaux with Given Modular Major Index”.
20 pages. arXiv:1701.04963. Published in *Algebraic Combinatorics* Volume 1 (2018), no. 1 pp. 3-21.
2. (2017) “Refined cyclic sieving”.
With Connor Ahlbach. Poster presentation at FPSAC 2017. Extended abstract published in *Sém. Lothar. Combin*, 78B (2017), Art. 48, 12 pp.
1. (2017) “Standard tableaux and modular major index”.
Poster presentation at FPSAC 2017. Extended abstract published in *Sém. Lothar. Combin*, 78B (2017), Art. 50, 9 pp.

IN PROGRESS

- (2022+) “Web-like graphs for four row standard tableaux”.
With Christian Gaetz, Oliver Pechenik, Stephan Pfannerer-Mittas, and Jessica Striker.
- (2022+) “ q -Stirling numbers for complex reflection groups”.
With Bruce Sagan.
- (2020+) “Schur–Weyl duals of free Lie superalgebras”.
- (2020+) “The dihedral sieving phenomenon”.
- (2020+) “Cyclotomic generating functions”.
With Sara Billey.
- (2019+) “Generalized bivariate γ -positivity”.
With Sheila Sundaram.
- (2019+) “A joint local limit law for inv and maj on permutations”.
- (2018+) “Canonical inclusions and rim hook tableaux”.
- (2017+) “Euler–Mahonian refined cyclic sieving”.
With Connor Ahlbach and Brendon Rhoades.

INVITED
TALKS

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| 2022 Nov | Cornell Discrete Geometry and Combinatorics Seminar |
| 2022 Nov | USC Combinatorics Seminar |
| 2022 Oct | MIT-Harvard-MSR Combinatorics Seminar |
| 2022 Oct | NDSU Mathematics Department Colloquium |
| 2022 Jun | AlCoVE poster presentation |
| 2022 Mar | University of Waterloo Algebraic and Enumerative Combinatorics Seminar |
| 2021 Nov | UCSD Combinatorics Seminar |
| 2021 Oct | UCLA Combinatorics Seminar |
| 2021 Sep | USC Algebra Seminar |
| 2021 Mar | ICERM workshop on Geometry and Combinatorics of Root Systems |
| 2021 Feb | UCSD Graduate Road Map 2021 |
| 2021 Feb | CombinaTexas 2021 |
| 2021 Jan | Michigan State University Combinatorics and Graph Theory Seminar |
| 2020 Dec | University of Ljubljana Discrete Math Seminar |
| 2020 Oct* | BIRS Workshop on Dynamical Algebraic Combinatorics, Banff, Alberta, Canada |
| 2020 Jul | FPSAC 2020 Online (Contributed) |
| 2020 Jun* | SIAM Conference on Discrete Mathematics (DM20) in Portland, Oregon |
| 2020 May* | AMS Spring Western Sectional Meeting at Cal State Fresno: Special Session on Combinatorics Arising from Representations |
| 2019 Nov | SIAM TX/LA Section at SMU, Dallas |
| 2019 Jul | FPSAC 2019, University of Ljubljana, Slovenia (Contributed) |
| 2019 May | Southern California Discrete Math Symposium (Contributed) |
| 2019 Mar | CombinaTexas 2019 at Texas A-M, College Station (Contributed) |
| 2019 Feb | USC Combinatorics Seminar |

2018 Oct	AMS Fall Western Sectional Meeting at SFSU: Special Session on Combinatorial and Categorical Aspects of Representation Theory
2018 May	University of Washington Combinatorics Seminar
2018 Mar	University of Washington Probability Seminar
2018 Jan	University of Michigan Combinatorics Seminar
2018 Jan	JMM in San Diego: AMS Special Session on Dynamical Algebraic Combinatorics
2017 Nov	AMS Fall Western Sectional Meeting at UC Riverside: Special Session on Combinatorial Representation Theory
2017 Feb	UCSD Combinatorics Seminar
2016 Nov	University of Minnesota Combinatorics Seminar
2015 Mar	University of Washington Combinatorics Seminar

*Postponed or canceled due to COVID-19

TEACHING: **UCSD**

INSTRUCTOR

<i>Calculus III</i>	UCSD, Math 20C 2021 WI, 2020 FA, 2019 FA, 2019 WI
<i>Combinatorics</i>	UCSD, Math 184A 2019 SP
<i>Enumerative Combinatorics</i>	UCSD, Math 184 2020 SP
<i>Introduction to Discrete Mathematics</i>	UCSD, Math 15A 2020 WI
<i>Introductory Probability and Statistics</i>	UCSD, Math 11 2021 WI, 2019 SP
<i>Mathematical Reasoning</i>	UCSD, Math 109 2020 FA, 2020 WI, 2018 FA

USC

<i>Calculus II</i>	USC, Math 126g 2022 SP
<i>Linear Algebra and Differential Equations</i>	USC, Math 225 2021 FA
<i>Probability Theory</i>	USC, Math 407 2022 FA

University of Washington

<i>Calculus with Analytic Geometry III</i>	University of Washington, Math 126 2013 SU
<i>Introduction to Differential Equations</i>	University of Washington, Math 307 2017 SP, 2015 SU
<i>Matrix Algebra with Applications</i>	University of Washington, Math 308 2018 SP, 2017 SU, 2016 FA, 2015 SP

TEACHING: **University of Washington**

TA

<i>Calculus with Analytic Geometry I</i>	University of Washington, Math 124 2014 AU
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<i>Calculus with Analytic Geometry II</i>	University of Washington, Math 125 2015 WI, 2014 WI, 2012 AU
<i>Calculus with Analytic Geometry III</i>	University of Washington, Math 126 2018 WI, 2017 FA, 2014 SP, 2013 AU 2013 SP, 2013 WI
<i>Graduate Algebra</i>	University of Washington, Math 506 2016 SP, 2016 WI, 2015 FA

OTHER
ACTIVITIES

2015—Present	Referee for <i>Adv. Appl. Math.</i> , <i>Ann. Comb.</i> , <i>Algebr. Comb.</i> , <i>Ars Math. Contemp.</i> , <i>B. Lond. Math. Soc.</i> , <i>Combin. Probab. Comput.</i> , <i>Combin. Theory, Discrete Math.</i> , <i>Electron. J. Comb.</i> , <i>Eur. J. Comb.</i> , FPSAC, <i>J. Combin. Theory</i> (Series A), <i>J. Comb.</i> , <i>Mathematical Reviews</i> , <i>Order</i> , <i>zbMATH</i>
2022—Present	FPSAC '23 Organizing Committee member
2006—Present	Wrote and maintain data management software for Mid-American Research Chemical Corp., and provide tech support for several dozen traveling sales representatives
2013—2018	Many informal graduate-level seminar talks at UW. Topics: Hopf monoids, Schubert calculus, the CSP, coinvariant algebras, etc.
2015—2016	Co-organized the University of Washington combinatorics seminar. Led pre-seminar, handled certain speaker logistics, etc.
2016	Organized a graduate student seminar on the $n!$ conjecture. Primary lecturer.
2016	Designed a group-based “Wiki Project” for introductory linear algebra.
2015, 2016	Led UW Math Day sessions on SageMath, Mathematical Magic Tricks
2013—2015	Wrote/edited lecture notes in \LaTeX for graduate-level courses; see web site. Topics: enumerative/algebraic combinatorics, algebraic groups, group cohomology, etc.

COMPUTER
SKILLS

Programming Languages

Expert in: Python, \LaTeX , C#

Familiar with: Java, C, C++, HTML, Haskell

Systems

SageMath, Mathematica, Visual Studio, Linux, MediaWiki, SVN

PERSONAL
INFORMATION

Citizenship: USA