Ryan Tully-Doyle

Department of Mathematics
Cal Poly, SLO
1 Grand Ave
San Luis Obispo, CA
U.S.A.

Cell: 858-922-6052
email: rtullydo@calpoly.edu
URL: https://rtullydo.github.io/

Research areas: functional analysis, several complex variables, free noncommutative analysis, operator analysis

Additional interests: undergraduate mathematical programming, mathematical modeling

Education

2015* PhD in Mathematics, University of California, San Diego
Dissertation: "On the representation and behavior of certain classes of holomorphic functions in several variables"
Advisor: Jim Agler
(*medical leave 2006-2012)

2001 BS in Mathematics, *magna cum laude*, California Polytechnic State University, San Luis Obispo

Professional appointments

2020- Assistant Professor, California Polytechnic State University, San Luis Obispo, Department of Mathematics

2019-2020 Assistant Dean, College of Arts and Sciences, University of New Haven

2017-2020 Assistant Professor, University of New Haven, Department of Mathematics and Physics

2015-2017 Assistant Professor, Hampton University, Department of Mathematics

Publications

Refereed journal articles

2023 1. Induced Stinespring factorization and the Wittstock support theorem. (with J. E. Pascoe). To appear in:*Results in Mathematics*. arXiv:2204.02963

2022 2. The royal road to automatic noncommutative real analyticity, monotonicity, and convexity. (with J. E. Pascoe). To appear in *Adv. Math.* arXiv:1907.05875

2022 3. Iteration of low-degree rational inner skew-products on $\mathbb{T}^2$. (with A. Sola). To appear. *Ann. Polon. Math.*.

2022 4. Monotonicity of the principal pivot transform (with J. E. Pascoe). To appear. *Lin. Alg. Appl.*

2022 5. Analytic continuation of concrete realizations and the McCarthy champagne conjecture. (with K. Bickel and J. E. Pascoe). *Int. Math. Res. Not.* 2022. DOI

2021 6. Automatic real analyticity and a regal proof of a commutative multivariate Löwner theorem. (with J. E. Pascoe). *Proc. Amer. Math. Soc.* 2021 **149** 2019-2024, arxiv:1912.10356

2021 7. A controlled tangential Julia-Carathéodory theory via averaged Julia quotients. (with J. E. Pascoe and M. Sargent), *Anal. PDE.*, 2021 **14**(6) 1773-1795 arXiv:1809.09208

2019 8. Representation of free Herglotz functions (with J. E. Pascoe and B. Passer), *Ind. Univ. J. Math* 2019 **69** 1199-1215, arXiv:1607.00407

2019 9. Cauchy transforms arising from homomorphic conditional expectations parametrize free Pick functions (with J. E. Pascoe), *J. Math. Anal. App.*, **472**(2) 1487-1498 arXiv:1607.06737

2017 10. Free functions with symmetry (with J. E. Pascoe, D. Cushing), *Math. Z.* 2017, DOI.

2017 11. Free Pick functions: representations, asymptotic behavior and matrix monotonicity in several noncommuting variables (with J. E. Pascoe), *J. Func. Anal.*, 2017 **273**(1) 283 - 328, arXiv:1309.1791

2017 12. Analytic functions on the bidisk at boundary singularities via Hilbert space methods, *Oper. Matrices*, 2017 **11**(1) 55-70 arXiv:1607.01413

2016 13. Convex entire noncommutative functions are polynomials of degree two or less (with J.W. Helton, J. E. Pascoe, and V. Vinnikov), *Integral Equations Operator Theory*, 2016 **86**(2) 151-163 arXiv:1501.06000

2016 14. Nevanlinna Representations in Several Variables (with J. Agler, N.J. Young), *J. Func. Anal.* 2016 **270**, arXiv:1203.2261

2012 15. Boundary Behavior of Analytic Functions of Two Variables via Generalized Models (with J. Agler, N.J. Young), *Indag. Math.* 2012 **23** 995-1027, arXiv:1203.6589.

Papers in submission and preprints

2021 1. Averaged mixed Julia-Fatou type theory with applications to spectral foliation. (with J. E. Pascoe). *In revision.* arXiv:2108:08830

2023 2. Matrix convex verbatim enumeration functions are graphical. (with J. E. Pascoe) *In submission.* arXiv:2401.06932

2025 3. Pick Functions as Cauchy Transforms of Graphs. (with L. Adlin, G. Thai, S. Tiscareno) *in preparation* arXiv:2410.10695

Open texts and courses

2021 1. *Mathematical Software* (in Mathematica). Course page

2020 2. *Hilbert spaces: a sequel to linear algebra.* link. pretext. (work in progress)

2020 3. *Differential Equations.* link. interactive xml/pretext/sage.

2019 4. *Mathematical Cryptography.* link. interactive xml/pretext/python. (work in progress)

2019 5. *Numerical Analysis.* link. interactive xml/pretext/octave. (work in progress)

Other Publications

Published

2021 1. Fingermark Ridge Drift: influencing factors of a not-so-rare aging phenomenon. **R. Tully-Doyle**, et al. *J. Forensic Sci.* In press.

2020 2. First Year Students' Experience in a Cyber World Course - An Evaluation. F. Breitinger, **R. Tully-Doyle**, K. Przyborski, L. Beck, R. Harichandran. *Education and Information Technologies.* 2020. Online.

2019 3. A sample study on friction skin ridges: visual differences between latent and inked fingerprints for time of deposition estimations. J. Alracaz-Fossoul, **R. Tully-Doyle**, et al. *J. Forensic Sci.* In press. link

2019 4. A survey on smartphone user's security choices, awareness and education. F. Breitinger, **R. Tully-Doyle**, and C. Hassenfeldt. *Computers and Security.* In press. link

In submission

2021 1. Solving for time: visual cues to reliably determine the age of latent fingerprints. J. Alracaz-Fossoul, **R. Tully-Doyle**

Grants and Awards

Grants

2024-25 *CSU Assigned Time for Exceptional Levels of Service to Students* to implement a seminar program for senior and graduate mathematics students, focused on application to PhD programs and introducing PhD level mathematics. Award: 4 WTU.

2021-2024 NSF DMS Analysis 2055098. "Representations of analytic functions in several variables and applications". Amount: $112,341.00

2019 Fields Institute Travel Grant: $2000

2019 University of New Haven RF Grant: $2000

2018 University of New Haven Summer Research Grant. Amount: $3250.

Awards

2023 Math Department Faculty of the Year, chosen by mathematics majors

2019 Nominated for Award for Teaching Excellence, University of New Haven.

2019 Linear Algebra Association Early Career Speaker, ILAS 2019, Rio de Jinero - $500.

2015 "Super Teacher", Hampton University. Best teacher in Mathematics Department as chosen by Hampton University mathematics majors.

2012 Research Assistantship, University of California, San Diego.

2001 Charles J. Hanks Award, California Polytechnic University, San Luis Obispo. Awarded annually to the most outstanding undergraduate mathematics student.

1999 Ralph E. Weston Memorial Award, California Polytechnic University, San Luis Obispo. Awarded annually to the best Putnam Exam result at the university.

1997-2001 Meritorious, Mathematical Competition in Modeling, California Polytechnic University, San Luis Obispo

Conferences and presentations

Research talks

2024 Southeastern Analysis Meeting, plenary talk, University of Florida, March 2024.

2024 Joint Mathematical Meetings, two invited talks, San Francisco, January 2024.

2023 Southeastern Analysis Meeting, semi-plenary talk, Clemson University, March 2023.

2022 "Realization of matrix monotone and matrix convex functions", International Symposium on Mathematical Theory of Networks and Systems, invited talk, Bayreuth, GR, Sep. 2022.

2022 ""Realizations, completely positive maps, and Wittstock decomposition", International Workshop in Operator Theory and Applications, invited talk, Krakow PL, Sep. 2022

2022 "Realizations, completely positive maps, and Wittstock decomposition", Workshop in Operator Theory. Invited talk, Chapman University, Orange CA. June 2022.

2022 "Dynamics of rational inner skew products", Joint Mathematical Meetings. invited talk. ILAS Special Session, Seattle WA, Jan 2022.

2021 "Monotonicity, Convexity and Realizations of noncommutative functions", Workshop on the noncommutative function theory, plenary talk, Fields Institute, Novem-

ber 2021

2021 "Noncommutative realizations", International Workshop in Operator Theory and Applications, invited talk. Chapman University, August 2021

2020 "Studying analytic functions in two variables", Operator Theory Talks for Early Researchers. invited talk. Online, September 2020

2020 "Boundary Realizations", 2tart Operator Theory Seminar Series and Conference. invited talk. Online conference, University of Florida, June 2020

2020 International Symposium on Mathematical Theory of Networks and Systems, invited talk, Cambridge UK, August 2020

2020 International Workshop on Operator Theory and Applications, invited talk, Lancaster UK, August 2020

2020 "Matrix inequalities and function theory", invited talk, Cal Poly SLO, February 2020

2020 "A regal proof of Löwner's theorem in several commuting variables", Joint Mathematical Meetings, invited talk, AMS Session in Advances in Operator and Function Theory, Denver, January 2020

2019 "A regal proof of Löwner's Theorem in several commuting variables", invited talk, AMS Fall Sectional, University of Florida, November 2019

2019 International Workshop on Operator Theory and Applications, invited talk, Lisbon, Portugal, July 2019

2019 Session on noncommutative function theory, invited, ILAS 2019, Rio de Janeiro, July 2019

2019 "A recent history of Löwner's Theorem", Focus Workshop on Noncommutative Functions, invited, Fields Institute, Toronto, June 2019

2018 "Tangential approach in Fatou-like theorems", AMS Eastern Sectional Meeting, invited, University of Delaware, September 2018

2018 "Escaping non-tangential approach", invited seminar talk, University of Florida, August 2018

2018 "Escaping non-tangential approach", International Workshop on Operator Theory and Applications, invited, China Eastern Normal University, Shanghai, July 2018

2017 "Rational inner functions on the bidisk and the structure of boundary derivatives of Schur functions" AMS Sectional Meeting, Indiana University, April 2017

2017 "Derivatives of holomorphic functions and operator theory", invited talk, University of New Haven, Mar. 2017

2017 Joint Mathematical Meetings, Atlanta, contributed, Jan. 2017

2016 "Representations of Pick functions", International Workshop on Operator Theory and Applications, Washington University, invited, July 2016

2016 Joint Mathematical Meetings, Seattle WA, Jan 2016, AMS Session in Noncommutative Analysis, invited, Jan. 2016

2015 "Representations of functions in the Pick class", Joint Mathematical Meeting, San Antonio, contributed, Jan. 2015

2014 "Boundary behavior of holomorphic functions and Hilbert space geometry", Dif-

ferential Geometry Seminar, Arizona State University, invited, Sept. 2014

2014 "Boundary behavior of Schur functions on the bidisk and generalized models", Function Theory in Several Complex Variables in Relation to Modeling Uncertainty, ICMS, Edinburgh, Scotland, invited, July 2014

2014 "Representations of functions in the Pick class", Great Plains Operator Theory Symposium, Kansas State University, contributed, May 2014

2014 "Boundary behavior of Schur functions on the bidisk and generalized models", contributed talk, Southeastern Analysis Meeting, Clemson University, contributed, March 2014

Conferences and expository talks

2020 2TART OTWIA, August 2020

2018 "Is $1 + 2 + 3 + \ldots = -1/12$?", NES/MAA Sectional, University of New Haven, June 2018

2017 Hilbert Function Spaces, Palazzo Feltrinelli, Gargnano, Italy, May 2017

2016 Virginia Operator Theory and Complex Analysis Meeting, University of Richmond, Oct. 2016

2015 Southeastern Analysis Meeting, Athens GA, March 2015

2014 Joint Math Meetings, Baltimore MD, January 2014

2013 Hilbert Function Spaces, Palazzo Feltrinelli, Gargnano, Italy, May 2013

Department and Seminar talks

2022 "Boundary behavior of analytic functions in two variables", Department Colloquium

2021 "Iterating complex rational functions", Department Colloquium, November 2021

2018 "Is $1 + 2 + 3 + \ldots = -1/12$?", Department Seminar, September 2018

2016 "The structure of derivatives of Schur functions and related operators", Real Analysis Seminar, Hampton University, September 2016

2016 "Free analysis, matrix convexity, and free power series". Research Seminar, Hampton University, October 2015

2013 "Nevanlinna representations of Pick functions in noncommuting variables", Free Analysis Seminar, UC San Diego, La Jolla CA, August 2013

2012 Free Analysis Seminar, UC San Diego, La Jolla CA, September 2012

Professional Development

2022 ACUE Certification on Effective Teaching Practices, online course, 2021-2022.

2019 NEean Fall Forum, New England Educational Assesment Network, The College of the Holy Cross, Worchester MA, November 2019

Graduate advising

2025-2026 Cal Poly. Elijah Guptill.

2025-2026 Cal Poly. Allison Watson.

2024-2025 Cal Poly. Stephen Cook. Thesis title: *Topiarism: The Kernel Embedding of Distributions Applied to Modern Portfolio Theory*

2023-2024 Cal Poly. Bella Padavona. Thesis title: *Matrix Approximation and Image Compression*

2021-2022 Cal Poly. Lucas Kerbs. Thesis title: *Searching for Holes in the Matrix Universe, or, the beginnings of algebraic topology in free analysis.*

2022 Cal Poly. Lukas Dakhlia. Thesis title: *A synthesis of classical boundary theorems.*

Undergraduate research advising

2024 Cal Poly. Stephen Cook, Adam Manzke. Aspects of Hilbert spaces in financial models.

2023 Cal Poly. Jeffery Tan. Iteration of matrix-valued functions.

2023-2025 Cal Poly. Mentor of Frost Scholar. Elijah Guptil. Generating functions and algorithms.

2023 Cal Poly. Giovani Thai, Lily Adline, Samuel Tiscareno. Graphs and Nevanlinna representations of analytic Functions. Frost Summer Research.

2022-2023 Cal Poly. Connor Leipelt. Iteration of matrix-valued functions.

2021-2022 Cal Poly. Emeric Battaglia. Senior project in measure theory.

2021 Cal Poly. Justin Hexem and Jackie Driscoll. Frost Summer Research. Iteration of matrix-valued functions.

2019 University of New Haven. Austin Webber. Data analysis and prediction in fantasy football.

2018 University of New Haven. Robert Ruiz. Statistical analysis of fish behavior in changing currents.

2018 University of New Haven. Tyler Balon. Developing an updated curriculum for Mathematical Cryptography course in CS.

2018 University of New Haven. Tyler Balon. Randomness in website URLS.

2018 University of New Haven. Robert Schmicker. A pursuit simulation incorporating randomness with applications in biology.

2018 University of New Haven. Angela Maestropietro. On the numerical range of small matrices.

2016 Hampton University. Danielle Baldwin.

Curriculum Design

2025 Design, teaching, *Early Start Mathematics 120* on-campus version with D. Retsek.

2023 Design, implementation, *Early Start Mathematics 120*, review of precalculus concepts, calculus prep. Wrote and recorded 20+ video lectures, designed assignments, designed course workflow to include Canvas and Gradescope for assessment.

2020 Design, *Pandemic as Societal Mirror* course. Online, interdisciplinary course offered to incoming students. Based on a lecture and conversation series by humanities and science professors. link.

2019 Design and implementation, *Emergent Studies* program. Combination of interdisciplinary self-designed major and two year program providing cohort-based first year experience for undeclared students.

Teaching experience

As instructor

Mathematics for the Liberal Arts
Modern Geometry (x2)

Precalculus
Calculus
Calculus II (x4)
Calculus III (x2)
Vector Calculus (x2)
Advanced Calculus (x2)
Differential Equations (x3)
Linear Analysis II (X2)
Real Analysis (Xx2)
Complex Analysis sequence
Graduate Real Analysis (x2)
Functional Analysis Seminar (x2)
Seminar on the Prime Number Theorem

Discrete Mathematics and Combinatorics (x2)
Abstract Algebra
Linear Algebra (x4)
Advanced Linear Algebra (x2)
Mathematical Cryptography (self-designed course) (x2)

Elementary Statistics

Probability and Statistics for Engineers
Probability and Statistics I (x2)
Probability and Statistics II

Mathematical Modeling
Advanced Mathematical Modeling

Numerical Analysis
Mathematical software/programming - python and Mathematica (x2)

As teaching assistant

Introductory Calculus
Linear Algebra
Vector Calculus
Differential Equations
Complex Analysis
Real Analysis
Introduction to Analysis

Service to the profession

2024 Advisory Board, *Concrete Operators*
2024- Editor of Analysis Area, *Proyecciones Journal of Mathematics*
2024 Organizer, AMS Special Session in operator theory, JMM 2024, San Francisco
2023 Organizer, invited mini-symposium in operator theory, ILAS 2023, Madrid
2022 Member of NSF Division of Mathematical Sciences Panel
2021 Organizer, ILAS Special Session in the interplay between operator theory and matrix analysis, JMM 2022
2020 Organizer, AMS Special Session in Multivariate Operator Theory, JMM 2021
2020- Administrator and Organizer, "Operator Theory Information Network", effort to build retention and connections in the operator theory community.
2018- Referee for *Comp. Anal. Op. Theory*; *Bull. London. Math. Soc.*; *J. Funct. Anal*; *Acta Sci. Math. Sz.*; *J. Math. Anal. Appl.*; *New York J. Math.*; *Proc. Royal Soc. B*; *Comp. Methods Funct. Theory*; *Canada. Math. Bull.*; *Canadian J. Math*; *Concrete Operators*
2018 Local organizer for NES/MAA Sectional, Spring 2018
2016- AMS Math Reviews

University service

Member, Faculty Senate, UNH, 2019-2020
Member, Search Committee, CAS Dean Search, UNH, 2019-2020
Member, Search Committee, CAS Dean Search, UNH, 2018-2019

College service

Emergent Studies Self-Designed Major design group, UNH, 2019-2020
Working group leader, College Mission Statement Blenders, UNH, 2019-2020
Assistant Dean, College of Arts and Sciences, UNH, 2019-2020

Departmental service

- Cal Poly
  - Commencement 2022, 2023, 2024
  - Screening Committee for Hiring in Mathematics, 2023
  - Design and content creation for Early Start Mathematics module, 2023
  - Complex Analysis Semester Conversion committee, 2023
  - Calculus for Data Science committee, Spring 2022-2023
  - Seminar in advanced topics in complex analysis, Spring 2023
  - Seminar in advanced topics in analysis, Winter 2022, Spring 2022
  - Analysis qualifying exam committee, Fall 2021-present
  - Department Web Committee, Fall 2020-present
- University of New Haven
  - Department Awards Committee, Spring 2019 - 2020
  - Curriculum Committee, Fall 2018-2020
  - Mathematics department computer systems administrator, Summer 2018-2020
  - Math and Physics Club Faculty Advisor, Fall 2017
  - Selection Committee, Fall 2017
  - Outreach Committee, Fall 2017
- Hampton University

- Search Committee, Spring 2017
- Mathematics Department Graduate Committee, Spring 2016-Spring 2017
- Data and assessment administrator, Trackdat software, Spring 2015-present
- Mathematics advisor to undergraduate majors, Fall 2015-present
- Course coordinator, Calculus, Spring 2016
- Hampton University Honors Day, Spring 2016, Spring 2017
- Department Research Seminar Organizer, Fall 2015-present
- Quality Enhancement Program Committee, 2015
- Undergraduate Curriculum Committee, 2015
- Mathematics Club Mentor, 2015

Outreach

Cal Poly Open House, April 2023
Cal Poly Polycultural Day, April 2023
University of New Haven Open House, Winter 2019
University of New Haven Accepted Student Day, Spring 2018
University of New Haven Open House activities, Fall 2017
Hampton University Conference on the Black Family, Spring 2016
Hampton University High School Day, Fall 2015, Fall 2016

Languages

English - native
Spanish - can read with dictionary
French - can read with dictionary

Professional memberships

American Mathematical Society
Mathematical Association of America

References

Jim Agler
Department of Mathematics
University of California, San Diego
9500 Gilman Dr.
La Jolla, CA 93093
jagler@san.rr.com
858-245-8467

J. William Helton
Department of Mathematics
University of California, San Diego
9500 Gilman Dr.
La Jolla, CA 93093
helton@math.ucsd.edu
858-405-7881

John McCarthy
Department of Mathematics
Washington University
One Brookings Drive
St. Louis, MO 63130
mccarthy@wustl.edu
314-448-9335

Matthew Griffiths (teaching reference)
Department of Mathematics and Physics
University of New Haven
300 Boston Post Rd.
West Haven, CT 06516
mgriffiths@newhaven.edu
203-932-7255