Benjamin P. Russo

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Education/Employment

Postdoctoral Research Associate Current
Oak Ridge National Laboratory - Data Analysis and Machine Learning

Assistant Professor (tenure track) September 2018 - August 2021
Farmingdale State College SUNY

Visiting Assistant Professor August 2016 - August 2018
University of Connecticut

Ph.D in Mathematics May 2016
University of Florida, Advisor: Scott McCullough

M.S. in Mathematics May 2012
University of Florida

B.S. in Mathematics and Physics May 2010
University of Florida

Research Interests

Machine learning, data compression, data analysis, system identification, surrogate modeling, dynamical systems, functional analysis, operator theory, matrix analysis, applied functional analysis, reproducing kernel Hilbert spaces, quantum information theory, quantum probability theory.

Publications

Fault Detection via Occupation Kernel Principal Component Analysis
IEEE Control Systems Letters, Vol 7. 2023, with Zachary Morrison, Yingzhao Lian, Rushikesh Kamalapurkar.

Time-dependent SOLPS-ITER simulations of the tokamak plasma boundary for model predictive control using SINDy
Nuclear Fusion, Volume 63, Number 4, 2023, with J.D. Lore, S. De Pascuale, P. Laiu, J.-S. Park, J.M. Park, S.L. Brunton, J.N. Kutz, and A.A. Kaptanoglu.

The Occupation Kernel Method for Nonlinear System Identification
Accepted for publication, 2023, with Joel Rosenfeld, Rushikesh Kamalapurkar, and Taylor T Johnson.

Bayesian inversion and the Tomita–Takesaki modular group
*The Quarterly Journal of Mathematics,*Volume 74, Issue 3, 2023, with Luca Giorgetti, Arthur J. Parzygnat, Alessio Ranallo.

Non-commutative disintegrations: existence and uniqueness in finite dimensions
Journal of Noncommutative Geometry, Vol. 17, No. 3, pp. 899–955, 2023, with Arthur Parzygnat.

Spectra for Toeplitz Operators Associated with a Constrained Subalgebra
Integral Equations and Operator Theory, Volume 94, Issue 2, 2022, with Christopher Felder and Douglas Pfeffer.

A non-commutative Bayes' Theorem
Linear Algebra and its Applications, Volume 644, 28–94, 2022, with Arthur Parzygnat.

Liouville operators over the Hardy space
Journal of Mathematical Analysis and Applications, Volume 508, Issue 2, 2021, with Joel Rosenfeld.

Motion Tomography via Occupation Kernels
Journal of Computational Dynamics, Volume 9, Issue 1, 27–45, 2021, with Rushikesh Kamalapurkar, Dongsik Chang, and Joel Rosenfeld.

Occupation Kernels and Densely Defined Liouville Operators for System Identification
2019 IEEE Conference on Decision and Control Proceedings, with Joel Rosenfeld, Rushikesh Kamalapurkar, and Taylor T Johnson.

The Mittag Leffler Reproducing Kernel Hilbert Spaces of Entire and Analytic Functions
Journal of Mathematical Analysis and Applications, Volume 463, Issue 2, 576–592, 2018, with Joel Rosenfeld and Warren Dixon.

Lifting Commuting 3-Isometric Tuples
Operators and Matrices, Volume 11, no. 2, 397–433, 2017.

The 3-isometric Lifting Theorem
Integral Equations and Operator Theory, Volume 84, no. 1, 69–87, 2016, with Scott McCullough.

In Submission

Streaming Compression of Scientific Data via weak-SINDy
with M. Paul Laiu, and Richard Archibald

Convergence of weak-SINDy Surrogate Models
with M. Paul Laiu

Theoretical Foundations for Higher Order Dynamic Mode Decomposition
with Joel Rosenfeld and Rushikesh Kamalapurkar

Occupation Kernel Hilbert Spaces for Fractional Order Liouville Operators and Dynamic Mode Decomposition
with Joel Rosenfeld and Xiuying Li

Programming Languages

Python – Fluent, **MATLAB** – Intermediate, **LaTeX** – Fluent.

Mentoring

Periodic Cycles on the Riemann Sphere under Möbius Transformations
with Farmingdale undergraduate Anthony Ercolano

StOKeDMD: Streaming Occupation Kernel Dynamic Mode Decomposition
Efrain Gonzalez – USF Graduate Student and GEM Fellow

Dissertation Committee
Himanshu Singh – USF Mathematics

Dissertation Committee
John Kyei – USF Mathematics

Grant Proposals

National Science Foundation – Software and Hardware Foundations – $500,000 unfunded
Data Driven Verification of Cyber Physical Systems with Joel Rosenfeld and Taylor T. Johnson.

Laboratory Directed Research and Development – AI initiative – $250,000 unfunded
Sparse Neural Network Identification of Nonlinear Dynamics with Konstantine Pieper.

Laboratory Directed Research and Development – AI initiative – $228,000 unfunded
Machine Learning-Assisted Discovery of Special Functions with Jorge Ramirez Osorio, Hoang Tran, and Elaine Wong.

Invited Talks/Presentations

AMS Special Session on Operators, Function Spaces, and Models, January 2016
Sub-Jordan Operator Tuples

IWOTA Special Session on Multivariable Operator Theory, July 2016
Sub-Jordan Operator Tuples

Graduate Mathematics Association, University of Florida, February 2016
Dilations and Completely Positive Maps

SIGMA Seminar, University of Connecticut, October 2016
Dilations and Completely Positive Maps

AMS Sectional Meeting Special Session, Indiana University, April 2017
A Generalization of the Fock Space

AMS Special Session on Operators on Function Spaces – JMM, January 2018
A Generalization of the Fock Space

AMS Special Session, University of Delaware, September 2018
C^*-algebras and the Category of Stochastic Maps

WINRS Special Session, University of Virginia, September 2018
Fractional Derivatives and the Segal Bargmann Space

AMS Special Session on Multivariable Operator Theory – JMM, January 2019
C^*-algebras and the Category of Stochastic Maps

IWOTA Special Session on Free-Analysis and Free Probability, July 2019,
C^*-algebras and the Category of Stochastic Maps

AMS Special Session on Recent Progress in Operator Theory, November 2019,

Occupation Kernels and Liouville Operators

American Control Conference Workshop, June 2020
Motion Tomography via Occupation Kernels

Mathematics in Computation Seminar, ORNL, June 2021
Embedding Non-Linear Systems Data into a Reproducing Kernel Hilbert space

Marquette University Mathematics Colloquium, April 2022
System Identification Techniques

JMM Special Session on the Interplay of Matrix Analysis and Operator Theory, April 2022
Applications of Reproducing Kernels to Dynamical Systems in the Sciences

University of Tennessee - Analysis Seminar, May 2022
Spectra for Toeplitz Operators Associated with a Constrained Subalgebra

University of South Florida Mathematics Colloquium, May 2022
System Identification Techniques

International Symposium on Mathematical Theory of Networks and Systems, September 2022
Kernelized Active Subspaces

SIAM Conference on the Mathematics of Data Science, September 2022
Data Driven System Identification and Surrogate Modeling

Contributed Talks/Presentations

Graduate Mathematics Association, University of Florida September 2014
My Love/Hate Relationship with the Cantor Set

Southeastern Analysis Meeting, University of Georgia March 2015
The Equivalence of Lifting and Factorization for 3-Isometric Tuples

Great Plains Operator Theory Symposium, Purdue University May 2016
The Equivalence of Lifting and Factorization for 3-Isometric Tuples

Southeastern Analysis Meeting, University of South Florida March 2016
Multivariate Lifting Theorems with an Application

Southeastern Analysis Meeting, University of Tennessee March 2017
A Generalization of the Fock Space

Hilbert Function Spaces, Gargnano, Italy May 2017
A Generalization of the Fock Space

UConn Math Club, University of Connecticut October 2017
The Game of Hex

Northeastern Analysis Meeting, University of Albany October 2017
A Generalization of the Fock Space

Southeastern Analysis Meeting, University of Alabama March 2019
C^*-algebras and the Category of Stochastic Maps

Mathematics in Computation Seminar, ORNL, July 2021

Analysis of the use of System Identification Techniques to Generate Surrogate Models

Oak Ridge Postdoctoral Associate Research Symposium, ORNL, May 2023
System Identification and Surrogate Modeling

AI Expo Poster Session, ORNL, Sept 2023
Convergence of weak-SINDy Surrogate Models

Mathematics in Computation Seminar, ORNL, Sept 2023
An Overview of Reproducing Kernel Hilbert Spaces

CCSD Seminar, ORNL, Sept 2023
Reproducing Kernel Hilbert Spaces in Machine Learning

Referee Activity

Operators and Matrices

Annales de l'institut Fourier

Banach Journal of Mathematical Analysis

Czechoslovak Mathematical Journal

Journal of Mathematical Analysis and Applications

23rd Asian Quantum Information Science Conference (AQIS)

Automatica

SIAM Journal on Applied Dynamics (SIADS)

Computational Methods and Function Theory (CMFT)

Autonomous Robots

Complex Analysis and Operator Theory (CAOT)

Teaching Experience

Courses taught at Farmingdale State College SUNY
MTH 107 - Introduction to Mathematical Ideas
MTH 116 - College Algebra
MTH 129 - Pre-Calculus
MTH 130 - Calculus I with Applications
MTH 150 - Calculus I
MTH 151 - Calculus II
MTH 322 - Advanced Mathematical Analysis
MTH 354 - Principles of Real Analysis
MTH 390 - Methods in Operations Research

Courses taught at University of Connecticut
MATH 1070 - Mathematics for Business and Economics
MATH 1131Q - Calculus I
MATH 2210Q - Applied Linear Algebra

MATH 2710 - Transition to Advanced Mathematics
MATH 3210 - Abstract Linear Algebra
MATH 3150 - Analysis I

Courses taught at University of Florida

Instructor:
MGF 1106 - Mathematics for Liberal Arts Majors
MAC 2312 - Analytic Geometry and Calculus II
MAP 2302 - Elementary Differential Equations

AIM Instructor:
MAC 1105 - Basic College Algebra

Online Instructor:
MAC 1147 - Pre-Calculus and Trigonometry

Lecturer:
MAC2313 - Analytic Geometry and Calculus III

Discussion Leader:
MAC 1140 - Pre-calculus Algebra
MAC 1105 - Basic College Algebra
MGF 1106 - Mathematics for Liberal Arts Majors
MAC 2311 - Analytic Geometry and Calculus I
MAC 2312 - Analytic Geometry and Calculus II
MAC 2313 - Analytic Geometry and Calculus III

Course Development

Online Course Development for MAC 2313 (Calc III) at UF	Spring 2015 - Summer 2015
Course Development for MTH 129 (Pre-Calc) at Farmingdale	Spring 2018 - 2021

Department Service

Graduate Mathematics Association Webmaster	Spring 2013 - Fall 2014
Graduate Analysis Seminar Organizer	Fall 2015
Teaching Help Desk	Fall 2015
Graduate Student Mentor	Spring 2016
Hiring Committee	Fall 2018
Hiring Committee	Fall 2019
Head of the Masters Program Development Committee	Spring 2018 - 2021
Seminar Organizer	2021
Undergraduate Seminar Organizer	2021

Grants, Awards, Recognition

Neil White Teaching Award	Spring 2016
Letter of Recognition for Excellence in Teaching	Spring 2017
Provost Professional Development Grant	Summer 2018
People's Choice Award, ORPA Research Symposium - Computational and Statistical Methods	May 2023