Joel A. Rosenfeld

http://www.thelearningdock.org/

University of South Florida
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Current Position

University of South Florida **Department of Mathematics and Statistics**
Assistant Professor (Tenure Track) (2019-present)

Employment/Education

Education/Training

Vanderbilt University	Electrical Engineering and Computer Science The Verification and Validation for Intelligent and Trustworthy Autonomy Laboratory (VeriVital) Postdoctoral Researcher (2017-2018)
University of Florida	Mechanical and Aerospace Engineering Nonlinear Controls and Robotics (NCR) Laboratory Postdoctoral Researcher (2013-2017)
University of Florida	Mathematics Ph.D. (2013)
University of Florida	M.S. (2010), B.S. (2008)

Previous Employment

Vanderbilt University	Senior Research Scientist Engineer (EECS)	2018-2019
Vanderbilt University	Postdoctoral Researcher (EECS)	2017-2018
University of Florida	Postdoctoral Researcher (MAE)	2013-2017
University of Florida	Adjunct Lecturer (Mathematics)	Summer 2013
University of Florida	Graduate Teaching Assistant (Mathematics)	2008-2013
Gregory Consulting	Database and Web Programming	2007-2008
The Athena Group, Inc.	Graphic Designer for Ed. Tech. Company	2003-2008

Dissertation

Title:	*Classes of densely defined multiplication and toeplitz operators with applications to extensions of RKHS's*
Adviser:	Dr. Michael T. Jury
Awarded:	May 2013

Research Interests

Machine Learning, Reproducing Kernel Hilbert Spaces, Approximation Theory, Cyber-physical Systems Verification, Fractional Order Partial and Ordinary Differential Equations, Operator Theory and Functional Analysis, Optimal Control Theory, Adaptive Dynamic Programming, Densely Defined Operators, and The History of Mathematics.

Grant Writing Activities

Awarded

- NSF Award ID 2027976, $688,856 (USF Portion: $229,350), "Collaborative Research: Operator theoretic methods for identification and verification of dynamical systems"
  PI: Joel A. Rosenfeld (University of South Florida [Lead Institution])
  Co-PI: Rushikesh Kamalapurkar (Oklahoma State University)
  Co-PI: Taylor T. Johnson (Vanderbilt University)
- AFOSR Award FA9550-20-1-0127, $455,222 (USF Portion: $221,468), "Operator theoretic methods for data-driven control synthesis."
  PI: Rushikesh Kamalapurkar (Oklahoma State University [Lead Institution])
  Co-PI: Joel A. Rosenfeld (University of South Florida)

Other Experience

- ONR, US $406,879, "Mine Counter Measure Path Planning and Optimal Control in Uncertain and Dynamic Maritime Environments." Wrote one of three aims in the 'Project Description' section.
  PI: Warren E. Dixon. Co-PI: Rushikesh Kamalapurkar.
  Duration: 2016 - 2019
- NSF ECCS Award #: 1509516, US $325,543, "Adaptive Dynamic Programming for Uncertain Nonlinear Systems Through Coupling of Nonlinear Analysis & Data-based Learning." Wrote one out of three aims in the 'Project Description' section.
  PI: Warren E. Dixon.
  Duration: 2015 - 2018

Publications

Books

1. R. Kamalapurkar, P. Walters, **J. A. Rosenfeld**, W. E. Dixon, "Reinforcement learning for optimal feedback control: A Lyapunov-based Approach," Springer, 2018.

Published/Accepted Journal Publications

1. **J. A. Rosenfeld**, W. E. Dixon, "Convergence Rate Estimates for the Kernelized Adams Bashforth Moulton Method for Fractional Order Initial Value Problems," Fractional Calculus and Applied Analysis, *Accepted*.
2. P. Deptula, R. A. Licitra, H. Y. Chen, **J. A. Rosenfeld**, and W. E. Dixon "Online Approximate Optimal Local Path-Planner in the Presence of Mobile Avoidance Regions," IEEE Transactions on Robotics, *To Appear*.

3. **J. A. Rosenfeld**, S. A. Rosenfeld, W. E. Dixon, "A Mesh-free Pseudospectral Approach for Estimating the Fractional Laplacian via Radial Basis Functions," Journal of Computational Physics, Volume 390, 1 August 2019, Pages 306-322

4. R. Kamalapurkar, **J. A. Rosenfeld**, A. Parikh, A. R. Teel, W. E. Dixon, "Invariance-like Results for Nonautonomous Switched Systems," IEEE Transactions on Automatic Control, Vol. 64, No. 2, pp. 614-627 (2019).

5. **J. A. Rosenfeld**, R. Kamalapurkar, W. E. Dixon, "The State Following (StaF) Approximation Method," IEEE Transactions on Neural Networks and Learning Systems, Volume 30 (6), 1716-1730, October 2018. (arXiv:1503.04854)

6. **J. A. Rosenfeld**, B. Russo, W. E. Dixon, "Mittag-Leffler Reproducing Kernel Hilbert Spaces of Entire and Analytic Functions," Journal of Mathematical Analysis and Applications, Vol. 463, No. 2, pp. 576-592 (2018).

7. P. Deptula, **J. A. Rosenfeld**, R. Kamalapurkar, W. E. Dixon,"Approximate Dynamic Programming: Combining Regional and Local State Following Approximations," IEEE Transactions on Neural Networks and Learning Systems, Vol. 29, No. 6, pp. 2154-2166 (2018).

8. **J. A. Rosenfeld**, W. E. Dixon, "Approximating the Caputo Fractional Derivative through the Mittag-Leffler Reproducing Kernel Hilbert Space and the Kernelized Adams-Bashforth-Moulton Method," SIAM Journal on Numerical Analysis, Vol. 53, No. 3, pp. 1201-1217 (2017).

9. R. Kamalapurkar, **J. A. Rosenfeld**, and W. E. Dixon, "Efficient model-based reinforcement learning for approximate online optimal control," Automatica, Vol. 74, pp. 247-258 (2016). (arXiv:1502.02609)

10. **J. A. Rosenfeld**, "The Sarason Sub-Symbol and the Recovery of the Symbol of Densely Defined Toeplitz Operators over the Hardy Space," Journal of Mathematical Analysis and Applications 440 (2016), no. 2, pp. 911–921. (arXiv:1503.01537)

11. **J. A. Rosenfeld**, "Introducing the Polylogarithmic Hardy Space," Integral Equations and Operator Theory 83 (2015), no. 4, pp. 589-600. DOI 10.1007/s00020-015-2256-z

12. **J. A. Rosenfeld**, "Densely Defined Multiplication on Several Sobolev Spaces of a Single Variable," Complex Analysis and Operator Theory 9 (2015), no. 6, pp. 1303-1309. DOI 10.1007/s11785-014-0411-1

Published Conference Proceedings (Refereed)

1. **J. A. Rosenfeld**, R. Kamalapurkar, "Dynamic Mode Decomposition with Control Liouville Operators," 24th International Symposium on Mathematical Theory of Networks and Systems (MTNS 2021). *Accepted.*

2. **J. A. Rosenfeld**, R. Kamalapurkar, B. Russo, T. T. Johnson, "Occupation Kernels and Densely Defined Liouville Operators for System Identification," 58th IEEE Conference on Decision and Control, *Accepted.*

3. W. Xiang, D. Tran, **J. A. Rosenfeld**, T. T. Johnson, "Reachable Set Estimation and Verification for a Class of Piecewise Linear Systems with Neural Network Controllers," American Control Conference 2018, *Accepted.*

4. P. Deptula, R. Licitra, **J. A. Rosenfeld**, W. E. Dixon, "Online Approximate Optimal Path-Planner in the Presence of Mobile Avoidance Regions," American Control Conference 2018, *Accepted.*

5. **J. A. Rosenfeld**, R. Kamalapurkar, W. E. Dixon, "State Following (StaF) Kernel Functions for Function Approximation Part I: Theory and Motivation," Proceedings of the American Control Conference, pp. 1217-1222, 2015.
6. R. Kamalapurkar, **J. A. Rosenfeld**, W. E. Dixon, "State Following (StaF) Kernel Functions for Function Approximation Part II: Adaptive Dynamic Programming," Proceedings of the American Control Conference, pp. 521-526, 2015.
7. T. H. Cheng, Z. Kan, **J. A. Rosenfeld**, W. E. Dixon, "Decentralized formation control with connectivity maintenance and collision avoidance under limited and intermittent sensing," Proceedings of the American Control Conference, pp. 3201-3206, 2014.

Journal Publications Under Review

1. X. Li, **J. A. Rosenfeld**, "Fractional Order System Identification with Occupation Kernel Regression," *Under Review.*
2. P. V. Hai, **J. A. Rosenfeld**, "The Gradient descent method from the perspective of fractional calculus," *Under Review.*
3. P. V. Hai, **J. A. Rosenfeld**, "Weighted Composition Operators on the Mittag-Leffler spaces of Entire Functions," *Under Review.*
4. **J. A. Rosenfeld**, R. Kamalapurkar, L. F. Gruss, T. T. Johnson, "Dynamic Mode Decomposition for Continuous Time Systems with the Liouville Operator," *Under Review.*
5. **J. A. Rosenfeld**, B. Russo, R. Kamalapurkar, T. T. Johnson, "The Occupation Kernel Method for Nonlinear System Identification," *Under Review.*
6. **J. A. Rosenfeld**, P. Musau, A. A. Wild, T. T. Johnson, "An Accurate Iterative Reachable Set Over-approximation Method for Nonlinear Continuous Systems," *Under Review.*
7. T. H. Cheng, Z. Kan, **J. A. Rosenfeld**, A. Parikh, and W. E. Dixon, "Network Connectivity and Collision Avoidance Under Intermittent Feedback," *Under Review.*

Conference Publications Under Review

1. **J. A. Rosenfeld**, R. Kamalapurkar, L. F. Gruss, T. T. Johnson, "On Occupation Kernels, Liouville Operators, and Dynamic Mode Decomposition," *Under Review.*
2. **J. A. Rosenfeld**, R. Kamalapurkar, B. P. Russo, "Theoretical Foundations for Higher Order Dynamic Mode Decompositions," *Under Review.*
3. B. P. Russo, R. Kamalapurkar, D. Chang, **J. A. Rosenfeld**, "Motion Tomography via Occupation Kernels," *Under Review.*

Reviewer Activity

- Engineering Computations (1 manuscript)
- International Conference on Physics, Mathematics and Statistics (1 manuscript)
- Applied Mathematics Letters (1 manuscript)
- IEEE Transactions on Automatic Control (2 manuscripts)
- Journal of Mathematical Analysis and Applications (1 manuscript)
- Neurocomputing (1 manuscript)

- New York Journal of Mathematics (1 manuscript)
- Conference on Decision and Control (several manuscripts)
- American Control Conference (several manuscripts)

Technology Centered Skills

Programming

- Working knowledge of C, C++, Java, PHP, and MATLAB programming.
- Working knowledge of MySQL, and PostgreSQL.

Design

- Six years of professional experience using Photoshop, Illustrator, Inkscape, and 3DS Max.
- Expert knowledge in HTML, LaTeX, LyX, CSS, and Javascript.

Workshops

American Control Conference 2020 Workshop [Conducted Virtually via Zoom]
"*Exploring Interplay between Dynamical Systems and Function Spaces: A Unifying Presentation of Dynamics Mode Decomposition and Occupation Measures*"
Co-organized with Dr. Rushikesh Kamalapurkar

Invited Talks

- **2TART Seminar Series**
  Title: "New Hilbert Space methods in Dynamic Mode Decomposition."
  `https://youtu.be/hlcWzJVM6n4`
  June 24, 2020
- **Florida Atlantic University (Mathematics Department)**
  Title: "Interfacing Occupation Kernels with Dynamic Mode Decomposition for the Analysis of Continuous Time Systems."
  November 2019.
- **University of South Florida - Interdisciplinary Data Science Consortium**
  Title: "Interfacing Occupation Kernels with Dynamic Mode Decomposition for the Analysis of Continuous Time Systems."
  October 2019.
- **University of South Florida (Mathematics Department)**
  Title: "Occupation Kernels and Learning in Dynamical Systems."
  May 2019.
- **Vanderbilt University EECS Department**
  Title: "Fractional Order Dynamical Systems and Numerical Methods."
  April 2017.

- **Alachua Astronomy Club (AAC)**
  Title: "On the Shoulders of Giants: Models of the Solar System."
  February 14, 2017.
- **Georgia Tech Analysis Seminar**
  Title: "Fractional Calculus, Reproducing Kernel Hilbert Spaces, and Approximation Theory."
  October 19, 2016.
- **University of South Florida Analysis Seminar**
  Title: "The Sarason Sub-Symbol and Unbounded Toeplitz Operators."
  April 22, 2016.
- **Graduate Mathematics Association (GMA)**
  Title: "An Introduction to Reproducing Kernel Hilbert Spaces and a Few Applications."
  February 5th, 2014.

Conference Participation

- **AMS Southeast Sectional Meeting 2020** - University of Florida
  Contributed Talk: Operator Theoretic connections to the study of Data Science on Nonlinear Dynamical Systems.
  Fall 2019. Gainesville, FL.
- **Southeast Analysis Meeting (SEAM 2019)** - University of Alabama
  Contributed Talk: Incorporating Dynamical Systems into Reproducing Kernel Hilbert Spaces.
  Spring 2019. Tuscaloosa, AL.
- **Joint Mathematics Meetings (JMM 2017)**
  Contributed Talk: *A Mesh-free Approach to Estimating the Fractional Laplacian via Radial Basis Functions.*
  Spring 2017. Atlanta, GA.
- **Neuroscience 2016** - Society for Neuroscience
  Fall 2016. San Diego, CA.
- **The 2016 Gainesville International Number Theory Conference (Alladi 60) In Honor of Krishna Alladi's 60th Birthday** - University of Florida
  Role: *Session Chair.*
  Spring 2016. Gainesville, FL.
- **Southeast Analysis Meeting (SEAM 2016)** - University of South Florida
  Contributed Talk: *The Caputo fractional derivative and the Mittag-Leffler RKHS*
  Spring 2016. Tampa, FL.
- **The Society for Pyschophysiological Research (SPR 2015)**
  Fall 2015. Seattle Westin Hotel. Seattle, WA.
- **American Control Conference (ACC 2015)** - SIAM Member
  Contributed Talk: *State Following (StaF) Kernel Functions for Function Approximation Part I: Theory and Motivation*
  Summer 2015. Palmer House Hilton. Chicago, IL.
- **Southeast Analysis Meeting (SEAM 2015)** - University of Georgia
  Contributed Talk: *A look at the Polylogarithmic Hardy Space*

Spring 2015. Athens, GA.

- **Southeast Analysis Meeting (SEAM 2014)** - Clemson University
  Contributed Talk: *The Sarason Sub-Symbol and Toeplitz Operators*
  Spring 2014. Clemson, SC.
- **Great Plains Operator Theory Symposium (GPOTS 2013)** - UC Berkeley
  Contributed Talk: *Densely Defined Multiplication Operators with Applications to Extensions of RKHS's*
  Spring 2013. Berkeley, CA.
- **Southeast Analysis Meeting (SEAM 2013)** - Virginia Tech
  Contributed Talk: *Densely Defined Multiplication Operators with Applications to Extensions of RKHS's*
  Spring 2013. Blacksburg, VA.
- **Joint Mathematics Meetings (JMM 2013)**
  Spring 2013. San Diego Convention Center. San Diego, CA.
- **Ramanujan 125** - University of Florida
  Fall 2012. Gainesville, FL.
- **Southeast Analysis Meeting (SEAM 2012)** - University of Alabama
  Spring 2012. Tuscaloosa, AL.
- **Southeast Analysis Meeting (SEAM 2011)** - University of Florida
  Spring 2011. Gainesville, FL.
- **Florida Analysis Seminar (FLOAS)** - Florida Southern College
  Spring 2011, Fall 2011, Summer 2012. Lakeland, FL.

Teaching

Instructor of Record

- **Summer 2013** MAC2313 - Calculus 3
- **Summer 2012** MAC2312 - Calculus 2
- **Summer 2011** MAC2311 - Calculus 1
- **Spring 2011** MAC2312 - Calculus 2
- **Fall 2011** MAC1140 - Precalculus
- **Summer 2010** MAC1147 - Precalculus and Trigonometry

Graduate Teaching Assistant

- **Spring 2013** Calculus 1 (2 Sections)
- **Fall 2012**
  MAC2313 - Calculus 3 (2 Sections)
  MGF1106 - Math for Liberal Arts Majors (1 Section)
- **Spring 2012** MAC2312 - Calculus 2 (2 Sections)
- **Fall 2011** MAC2312 - Calculus 2 (3 Sections)
- **Spring 2010** MAC2311 - Calculus 1 (2 Sections)

- **Fall 2009** MAC1105 - College Algebra (3 Sections) (Online with Elluminate)
- **Spring 2009**
  MGF1106 - Math for Liberal Arts Majors (2 Sections)
  MAC1105 - College Algebra (1 Section) (Online with Elluminate)
- **Fall 2008** MAC1147 - Precalculus and Trigonometry (3 Sections)
- **Fall 2007** MAC2311 - Calculus 1 (2 Sections)

Other Duties

- **Calculus 2 Lecture Notes** - I wrote 150 pages of lecture notes for the Summer 2012 class.
- **Edited "Applied Fourier Analysis"** - I helped edit Dr. Tim Olson's forthcoming book on Fourier Analysis.

References

- Dr. Michael T. Jury - *Ph.D. Adviser*
  Associate Professor of Mathematics - University of Florida
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- Dr. Warren E. Dixon - *Postdoctoral Adviser*
  Professor of Mechanical and Aerospace Engineering - University of Florida
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- Dr. Taylor T. Johnson - *Postdoctoral Adviser*
  Assistant Professor of Electrical Engineering and Computer Science - Vanderbilt University
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- Dr. Scott McCullough
  Professor of Mathematics - University of Florida
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- Dr. Rushikesh Kamalapurkar
  Assistant Professor - Oklahoma State University
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- Dr. Kwailee Chui - *Teaching Reference*
  Lecturer - University of Florida
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