

Edmilson Roque dos Santos

Current position: Research Associate at the DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
CLARKSON CENTER FOR COMPLEX SYSTEMS SCIENCE
CLARKSON UNIVERSITY

Research interests: Dynamical Systems, ergodic theory, synchronization, sparse recovery methods.

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🌐 <https://github.com/edmilson-roque-santos>

PROFESSIONAL APPOINTMENTS

Research Associate

CLARKSON CENTER FOR COMPLEX SYSTEMS SCIENCE

Feb 2023 – present

CLARKSON UNIVERSITY.

NSF-NIH CRCNS: *Functional Brain Networks with Tensioned Stability for Optimal Processing*

EDUCATION

PhD. in Applied Mathematics

Feb 2018 – Jan 2024

ICMC-USP AND IMPERIAL COLLEGE LONDON (PARTIALLY SUPPORTED BY ROYAL SOCIETY).

Project Title: *Reconstruction of Complex Networks from Data*

Supervisor: Prof. Dr. Tiago Pereira

Co-Supervisor: Prof. Dr. Sebastian van Strien

MSc. in Physics

Feb. 2016 – Feb. 2018

IFSC-USP

Thesis title: *Discontinuous transitions to collective dynamics in star motifs of coupled oscillators*

Supervisor: Prof. Dr. Tiago Pereira

Co-Supervisor: Dr. Jaap Eldering

Bachelor in Physics

Feb. 2012 – Dec. 2015

IFSC-USP

Undergraduate research title: *Models in Explosive Synchronization*

Supervisor: Prof. Dr. Francisco Aparecido Rodrigues

PUBLICATIONS

PREPRINTS AND IN PREPARATION

1. Yuanzhao Zhang, Edmilson Roque dos Santos, and Sean P. Cornelius. “How more data can hurt: Instability and regularization in next-generation reservoir computing”. In preparation.
2. Tiago Pereira, Edmilson Roque dos Santos, Sebastian van Strien. “Robust reconstruction of sparse network dynamics”. <https://arxiv.org/abs/2308.06433> (2023). Under review in Nonlinearity.
3. Edmilson Roque dos Santos, Sebastian van Strien, and Tiago Pereira. “Ergodic Basis Pursuit induces Divide-and-Conquer Network Reconstruction”. In preparation.

JOURNAL PUBLICATIONS

1. Anil Kumar, Edmilson Roque dos Santos, Paul J. Laurienti, and Erik Boltt. “Symmetry breaker governs synchrony patterns in neuronal inspired networks”. *Chaos* 34, 113115 (2024). <https://doi.org/10.1063/5.0209865>
2. Erik Boltt, Jeremie Fish, Anil Kumar, Edmilson Roque dos Santos, and Paul J. Laurienti. “Fractal Basins as a Mechanism for the Nimble Brain”. *Sci Rep* 13, 20860 (2023). <https://doi.org/10.1038/s41598-023-45664-5>.

3. Juliano Genari, Guilherme T. Goedert, Sérgio H.A. Lira, Krerley Oliveira, Adriano Barbosa, et al. "Quantifying protocols for safe school activities". PLoS ONE 17(9): e0273425 (2022). <https://doi.org/10.1371/journal.pone.0273425>
4. Marcel Novaes, Edmilson Roque dos Santos, Tiago Pereira. "Recovering sparse networks: Basis adaptation and stability under extensions". Physica D: Nonlinear Phenomena 424 132895, (2021). <https://doi.org/10.1016/j.physd.2021.132895>
5. Jaap Eldering, Jeroen Lamb, Tiago Pereira, Edmilson Roque dos Santos. "Chimera states through invariant manifold theory". Nonlinearity 34-5344, (2021). <https://dx.doi.org/10.1088/1361-6544/ac0613>

GRANTS AND HONORS

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|-------------|---|
| 2018 - 2022 | Doctoral Scholarship: The São Paulo Research Foundation, FAPESP. |
| 2016 - 2018 | Grant: Coordination for the Improvement of Higher Education Personnel, CAPES. |
| 2015 | Garfields Medal: Best Oral Presentation in Symposium of Mathematics to the Undergraduate course (SiM 2015) at ICMC-USP. |
| July 2015 | Research internship at PIK under the supervision of Prof. Jurgen Kurths - The São Paulo Research Foundation, FAPESP. |
| 2014 - 2015 | Undergraduate Scientific Initiation Scholarship: The São Paulo Research Foundation, FAPESP. |

CONFERENCES AND INVITED TALKS

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| Oct, 7. 2024 | Applied Math Seminars. University of Ottawa, Canada. <i>Metastability of chimeras states in coupled networks.</i> (Invited talk) |
| July, 8 - 12. 2024 | Fourth Symposium of Machine Learning on Dynamical Systems. Fields Institute, Toronto - Canada <i>Ergodic Basis Pursuit induces exact (and robust) sparse network reconstruction.</i> (Contributed talk) |
| Mar, 20 - 22. 2024 | NERCCS 2024: Seventh Northeast Regional Conference on Complex Systems. Potsdam, NY - USA. <i>Dynamics of synchrony patterns on networks.</i> (Contributed talk) |
| Feb, 5. 2024 | Oberseminar Dynamics. TUM, Munich - Germany. <i>Ergodic Basis Pursuit induces robust reconstruction of sparse network dynamics.</i> (invited talk - online format) |
| Oct, 27. 2023 | C3S2 Seminars. The Clarkson Center for Complex Systems Science, Potsdam, NY - USA. <i>Reconstruction of coupled sparse networks from data.</i> (invited talk) |
| Mar, 22 - 24. 2023 | NERCCS 2023: Sixth Northeast Regional Conference on Complex Systems. <i>Ergodic Basis Pursuit induces robust network reconstruction.</i> (contributed talk) |
| Jan, 9 - 11. 2023 | Dynamics Days US 23. <i>Ergodic basis pursuit induces robust reconstruction of weakly coupled sparse networks.</i> (contributed talk - online format) |
| Dec, 17-18. 2022 | Mathematical Physics Days 2022. <i>Reconstruction of Weakly Coupled Sparse Networks from Data.</i> (invited talk - online format) |
| Sep, 12 - 21. 2022 | Inverse Network Dynamics - NETDAT22. MPI for the Physics of Complex Systems, Dresden - Germany. <i>Ergodic basis pursuit induces robust reconstruction of sparse networks.</i> (contributed talk) |
| Jun, 20 - 23. 2022 | Rényi 100. Hungarian Academy of Sciences, Budapest - Hungary. <i>Ergodic basis pursuit induces robust reconstruction of sparse networks.</i> (poster presentation) |
| May, 6. 2022 | Free University of Berlin (FUB). Berlin - Germany. <i>Ergodic basis pursuit induces robust reconstruction of sparse networks.</i> (presentation) |

- May, 5. 2022 Potsdam Institute for Climate Impact Research (PIK). Potsdam - Germany. *Ergodic basis pursuit induces robust reconstruction of sparse networks.* (presentation)
- May, 5. 2022 Weierstrass Institute for Applied Analysis and Stochastic (WIAS). Berlin - Germany. *Ergodic basis pursuit induces robust reconstruction of sparse networks.* (presentation)
- May, 4. 2022 University of Potsdam. Potsdam - Germany. *Ergodic basis pursuit induces robust reconstruction of sparse networks.* (presentation)
- May, 23 - 27. 2021 SIAM Conference on Applications of Dynamical Systems (DS21). *Ergodicity implies stable reconstruction of sparse network dynamics.* (invited talk - online format)
- April, 29. 2021 Dynamical Systems and Networks Seminars. Courant Institute of Mathematical Sciences, New York - USA. *Chimera states through invariant manifold theory.* (invited talk - online format)
- Oct, 07 - 11. 2019 V Escola Brasileira de Sistemas Dinâmicos. UFMG - Belo Horizonte, MG - Brazil. *Chimera states through invariant manifold theory.* (poster presentation)
- Aug, 26 - Sep, 01. 2018 V Workshop and School on Dynamics, Transport and Control in Complex Networks - ComplexNet. INPE, Cachoeira Paulista, SP - Brazil. *Discontinuous transitions to collective dynamics in star motifs of coupled oscillators.* (poster presentation)
- Jul, 27 - 31. 2015 International Workshop on Dynamics of Coupled Oscillators: 40 years of the Kuramoto Model. MPI for the Physics of Complex Systems, Dresden - Germany. Title: *Influence of frequency distribution on the discontinuous phase transition in networks of Kuramoto oscillators.* (poster presentation)
- Sep, 17 - 19. 2014 Undergraduate Research Project Highlights 22° SIICUSP -The University of São Paulo's International Symposium of Undergraduate Research (SIICUSP) São Paulo - Brazil. Title: *Influence of frequency distribution on the discontinuous phase transition in networks of Kuramoto oscillators.* (poster presentation)
- Oct, 6 - 11. 2014 III Workshop and School on Dynamics, Transport and Control in Complex Networks - ComplexNet. São José dos Campos, SP - Brazil. Title: *Influence of frequency distribution on the discontinuous phase transition in networks of Kuramoto oscillators.* (contributed talk)

VISITING

- Mar - Jun 2022 Imperial College London, London, UK.
PROF. DR. SEBASTIAN VAN STRIEN AND PROF. DR. JEROEN LAMB
- Dec 2019 - Mar 2020 Imperial College London, London, UK.
PROF. DR. SEBASTIAN VAN STRIEN AND PROF. DR. JEROEN LAMB
- Jan - May, 2019 Imperial College London, London, UK.
PROF. DR. SEBASTIAN VAN STRIEN AND PROF. DR. JEROEN LAMB
- Jan - Feb, 2018 Imperial College London, London, UK.
PROF. DR. JEROEN LAMB
- Jul - Aug, 2015 Potsdam Institute for Climate Impact Research - PIK, Potsdam, Germany
PROF. DR. JURGEN KURTHS

ORGANIZING

- NERCCS 2024
CO-ORGANIZATION WITH PROF. DR. CHUNLEI LIANG, PROF. DR. ERIK BOLLT, DR. GOLSHAN MADRAKI, AND DR. JEREMIE FISH
- Mar 20 - 22, 2024
- Dynamical systems research seminars at ICMC-USP
CO-ORGANIZATION WITH DR. ZHENG BIAN
- 2022 - 2023
- Dynamical systems research seminars
ORGANIZATION OF SEMINARS AT IMPERIAL COLLEGE LONDON
- Jun - Jul, 2022

- NetDynamics Seminars between ICMC-USP and Nodds Lab – Dr. Deniz Eroglu’s group from Kadir Has University (KHAS)
 Apr - Dec, 2021 CO-ORGANIZATION WITH DR. ELIF YUNT.
- São Paulo Dynamical Systems days
 Oct 24 - 26, 2018 CO-ORGANIZATION WITH PROF. DR. TIAGO PEREIRA AND PROF. DR. ALI TAHZIBI
- SIFSC 4 - Semana Integrada de Física de São Carlos
 2014 CO-ORGANIZATION WITH UNDERGRADUATE AND GRADUATE STUDENTS FROM IFSC-USP
- SIFSC 3 - Semana Integrada de Física de São Carlos
 2013 CO-ORGANIZATION WITH UNDERGRADUATE AND GRADUATE STUDENTS FROM IFSC-USP

PEER REVIEW

Physical Review Letters; Physical Review E; Physica A: Statistical Mechanics and its Applications; and Physica D: Nonlinear Phenomena

PROGRAMMING LANGUAGES

Advanced *Python*
 Basic *C++*, *Fortran*, *Matlab*, *Julia*, *Mathematica*

TEACHING

- TA for Linear Algebra and Ordinary Differential Equations
 2019 UNIVERSITY OF SÃO PAULO
 Undergraduate Course
- TA for Advanced Laboratory of Physics
 2017 UNIVERSITY OF SÃO PAULO
 Undergraduate Course
- TA for Mathematical Physics
 2017 UNIVERSITY OF SÃO PAULO
 Undergraduate Course

EXTRA ACTIVITIES

- Modcovid19.
 2020 - 2022 Participation in a large collaboration group formed by different Brazilian institutions to model COVID-19 in Brazil, in particular, model validation of COMORBUSS software, which can be accessed in the following link:

<https://comorbuss.org/Home>.
- Judge during the finals in Brazil.
 2014 INTERNATIONAL YOUNG PHYSICISTS TOURNAMENT (IYPT)