

**Contact Information**

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**Areas of Research:**

- Nonlinear analysis: global dynamics, pattern formation, invariant manifolds, coherent structures, homoclinic and heteroclinic phenomena, quasi-periodic solutions and KAM theory.
- Computational mathematics: numerical methods for boundary value problems; dynamics of N-body problems, parabolic PDEs and delay differential equations; efficient high order methods for accurate representation of invariant manifolds; computational Fourier/ Chebyshev/ Taylor analysis and automatic differentiation.
- Computer assisted proof in analysis: existence and quantitative properties of solutions of nonlinear ordinary, partial, and delay differential equations. Global analysis of finite and infinite dimensional dynamical systems and applications to mechanics, mathematical biology, and renormalization theory.

**Education**

- Ph.D. *Mathematics*. University of Texas at Austin. December 2009. Thesis Advisor: Rafael de la Llave.
- B.S. *Mathematics* Lamar University, Beaumont, Texas, 2003.
- B.S. *Electrical Engineering*, Lamar University, Beaumont, Texas, 2003

**Ph.D. Dissertation:**

- “Reliable Computation of Invariant Dynamics for Conservative Discrete Dynamical Systems”

**Employment History**

- Associate Professor (with Tenure), Florida Atlantic University, Department of Mathematical Sciences. August 2019 – Present.
- Assistant Professor, Florida Atlantic University, Department of Mathematical Sciences. August 2014– July 2019.
- Hill Assistant Professor, Rutgers University, Department of Mathematics, September 2011 – July 2014.
- Postdoctoral Associate, Rutgers University, January 2010 – August 2011.
- Assistant Instructor, University of Texas at Austin, August 2008 – December 2009.

**Visiting Appointments**

- Simons CRM Scholar at the Centre de Recherches Mathématiques, April 2019.

**Research Support, Fellowships, and Awards**

- National Science Foundation Grant DMS – 2307987: \$299,717.00 “Fine Structure in Hamiltonian Systems” (July 2023 - June 2026).
- National Science Foundation Grant DMS – 1813501: \$131,975.00 “Validated Computational Methods in Global Analysis and Applications to Celestial Mechanics” (August 2018 – July 2021).
- National Science Foundation Grant DMS – 1318172: \$103,429.00 “Computational Intersection Theory for Infinite Dimensional Dynamical Systems”. (July 2013 – 2016).
- Sloan Foundation Grant “Conference: Llavest: a broad perspective on finite and infinite dimensional dynamical systems (FIDDS-17)” \$20,000 Co-PI with Marian Gidea (May - July 2017).
- Florida Atlantic University Curriculum Grant: \$10,000 awarded August 2016. Co-PI with William Kalies, Necibe Tuncer, Erik Lundberg, and Vincent Naudot.
- AMS-Simmons Travel Grant (Awarded in Summer 2013).
- 2010 Frank Gerth III Dissertation Award, Department of Mathematics, University of Texas at Austin.

**Postdoctoral Fellows Supervised**

- Wai-Ting Lam: *NSF Ascending Postdoctoral Fellowship*, Florida Atlantic University, 2022 - 2025.

**Ph.D. Students Supervised**

- Bishal Dhakal. Successful defense July 2023, Florida Atlantic University. Thesis title: *Solving V.I. Arnold's problem about asymptotic enumeration of Morse functions on the 2-sphere: a combinatorial and analytic approach with computer assisted proofs* (co-supervised with Erik Lundberg). Currently an assistant professor at Arizona State University, Tempe.
- Archana Neupane Timsina. Successful defense June 2022, Florida Atlantic University. Thesis title: *Identifiability Analysis and Optimal Control of Infectious Diseases, Epidemics, and Parameterization Method for (Un)Stable Manifolds of Implicitly Defined Dynamical Systems* (co-supervised with Dr. Necibe Tuncer). Currently a CDC funded postdoctoral fellow at North Carolina State University.
- Emmanuel Fleurantin. Successful defense December 2021, Florida Atlantic University. Thesis title: *Formation, Evolution, and Breakdown of Invariant Tori in Dissipative Systems: From Visualization to Computer Assisted Proofs*. (co-supervised with Dr. Vincent Naudot). Currently an NSF ASCEND postdoctoral fellow with joint affiliation at The University of North Carolina, Chapel Hill and George Mason University in January 2022.
- Maxime Murray. Successful defense July 2021, Florida Atlantic University. Thesis title: *Homoclinic Dynamics in a Spatial Restricted Four Body Problem*. Currently an instructor at FAU.
- Jorge Gonzalez. Successful defense April 2020, Florida Atlantic University (co-supervised with Dr. Necibe Tuncer). Thesis title: *Accurate high order computation of invariant manifolds for long periodic orbits of maps and equilibrium states of PDE*. Currently an NSF postdoctoral fellow at Georgia Institute of Technology.
- Shane Kepley. Successful defense December 2017, Florida Atlantic University (co-supervised with Dr. William Kalies). Thesis title: *The circular restricted four body problem is non-integrable: a computer assisted proof*. Hill Assistant professor at Rutgers University, 2018-2021. Currently a postdoctoral fellow at VU Amsterdam.
- David Blessing. Florida Atlantic University (expected graduation December 2023).
- Noah Corbett, Florida Atlantic University (Current).
- Raya Shimshi, Florida Atlantic University (Current).

- Juan Miranda, Florida Atlantic University (Current).
- Russell Peel, Florida Atlantic University (Current).

### Undergraduate Student Projects

- Florida Atlantic University Summer Undergraduate Research Fellowship (SURF) faculty advisor for Adam Zaidan, Summer 2023.
- Honors thesis supervisor of Dominic Blanco – FAU Honors College. Expected graduation May 2022. Accepted to the Ph.D. program at McGill University.
- NSF LEARN program faculty mentor of Payne Ross.

### Service and Memberships

- Member of Editorial Board (Associate Editor) for *SIAM Journal on Applied Dynamical Systems*.
- Member of the International Advisory Editors Board for *Communications in Nonlinear Science and Numerical Simulations*.
- Member of the American Mathematical Society and the Society for Industrial and Applied Mathematics.
- National Science Foundation review panels.
- Faculty Associate for the Spring 2019 Fulbright Scholarship of Maciej Capinski (AGH University, Krakow, Poland) - Proposal entitled “Diffusion in Celestial Mechanics”. Professor Capinski spent Spring 2019 at FAU supported by the fellowship.
- External member of Ph.D. committee of Jonathan Jaquette: *Counting and discounting slowly oscillating periodic solutions to Wright’s equation*. Rutgers University. (Successful defense Spring 2018).  
Member Ph.D. committee of Bikram Bhusal: *Stability analysis and parameter estimation of a stochastic logistic growth model with multiplicative alpha-stable Levy noise*, Department of Mathematical Sciences, Florida Atlantic University. (Successful defense August, 2022).  
Member Ph.D. committee of Jessica Khera: *Lonesum Matrices and Acyclic Orientations: Enumeration and Asymptotics*, Department of Mathematical Sciences, Florida Atlantic University. (Successful defense March, 2021).  
Member Ph.D. committee of Vaishakh Krishnan: *Statistical Modeling of Ship Airwakes Including the Feasibility of Applying Machine Learning*. Department of Electrical Engineering, Florida Atlantic University. (Successful defense December, 2020).  
Member Ph.D. committee of Cory Ball: *The Change Point Problem for*

*Two Classes of Stochastic Processes.* Department of Mathematical Sciences, Florida Atlantic University. (Successful defense April 2020).

Member Ph.D. committee of Hasala Senpathy Karunaratne Gallolu Kankana-malage: *Output stability analysis for nonlinear systems with time delays.* Department of Mathematical Sciences, Florida Atlantic University. (Successful defense June, 2017).

Member Ph.D. committee of Vermont Rutherford: *Negligible Variation, Change of Variables, and a Smooth Analog of the Hobby-Rice Theorem.* Department of Mathematical Sciences, Florida Atlantic University. (Successful defense March, 2016).

Member Ph.D. committee of Stepan M. Grigoriev: *General Monotonicity, interpolation of operators, and applications.* Department of Mathematics, Florida Atlantic University. (Successful defense October, 2014)

- Referee for Annals of Mathematics, Journal of Differential Equations, SIAM Journal on Applied Dynamical Systems, Nonlinearity, Nonlinear Differential Equations and Applications, Communications in Nonlinear Science and Numerical Simulations, Journal of Computational Dynamics, and others.
- Member of the Florida Atlantic University Quality Enhancement Program Development Committee.
- Affiliate Faculty Member of the Florida Atlantic University Peace, Justice, and Human Rights Initiative, and member of the research committee.
- Member of the Department of Mathematical Sciences undergraduate committee on curriculum, and on the engineering curriculum committee.
- Chair of the Department of Mathematical Sciences Learning Community: active learning in the Calculus II curriculum at FAU. (Fall 2018, Spring 2019).

### Book Chapters/Encyclopedia Articles/Special Issues

- Editor (with Maciej Capinski, AGH University, Krakow, Poland) a special issue of Communications in Nonlinear Science and Numerical Simulations entitled *Computer Assisted Proofs in Dynamical Systems*. The issue contains 19 original research articles in the area.
- “Validated numerics for equilibria of analytic vector fields: invariant manifolds and connecting orbits.” – chapter two of the book *Rigorous Numerics in Dynamics*, AMS Proceedings of Symposia in Applied Mathematics, Volume 74. J.B. van den Berg and J.P. Lessard Editors. This volume is based on lectures delivered at the 2016 AMS Short Course “Rigorous Numerics in Dynamics”, held January 4-5, 2016, in Seattle, Washington.
- “Computational Proofs in Dynamics” with K. Mischaikow. Invited Submission to Encyclopedia of Applied and Computational Mathematics. Editor B. Engquist. Springer-Verlag Berlin Heidelberg, 2015.

**Refereed Journal Articles**

1. “Weighted Birkhoff averages and the parameterization method,” with David Blessing. (Submitted).  
<https://arxiv.org/abs/2306.16597> <https://arxiv.org/pdf/2304.00318.pdf>
2. “Computer assisted proof of homoclinic chaos in the spatial equilateral restricted four body problem,” with Maxime Murray. (Submitted)  
<https://arxiv.org/pdf/2212.00930.pdf>
3. “State dependent delay maps: numerical algorithms and dynamics of projections,” with Francis Motta and Vincent Naudot. (Submitted).  
<https://arxiv.org/pdf/2211.09914.pdf>
4. “Numerical computation of transverse homoclinic orbits for periodic solutions of delay differential equations,” with Olivier Hénot, and J.P. Lessard. (To appear in SIAM Journal on Applied Dynamical Systems).
5. “Validated numerical approximation of stable manifolds for parabolic partial differential equations,” with J.B. ven den Berg and Jonathan Jaquette (to appear in the Journal of Dynamics and Differential Equations).  
<https://arxiv.org/abs/2111.06391>
6. “Persistence of periodic orbits under state-dependent delay perturbations: computer-assisted proofs,” with Jiaqi Yang, Joan Gimeno, and J.P. Lessard. Vol. 22. Issue 3 (2023)
7. “Computer assisted proofs for transverse collision and near collision orbits in the restricted three body problem,” with Shane Kepley and Maciej Capiński. Journal of Differential Equations. Vol. 366, No. 5 (2023), 132-191.  
<https://arxiv.org/abs/2205.03922>
8. “Finite element approximation of invariant manifolds by the parameterization method,” with Jorge Gonzalez and Necibe Tuncer. Partial Differential Equations and Applications. Volume 3, Number 75 (2022).  
<https://arxiv.org/abs/2203.03115>
9. “Parameterized stable/unstable manifolds for periodic solutions of implicitly defined dynamical systems,” with Archana Neupane Timsina. Chaos, Solitons and Fractals. Volume 161 (2022).
10. “Parameterization of unstable manifolds for DDEs: formal series solutions and validated error bounds,” with Olivier Hénot and J.P. Lessard. Journal of Dynamics and Differential Equations, 34, 1285-1324 (2022).  
<https://doi.org/10.1007/s10884-021-10002-8>

11. “Computer assisted proof of drift orbits along normally hyperbolic manifolds,” with Maciej Capiński, Jorge Gonzalez, and Jean-Pierre Marco. *Communications in Nonlinear Science and Numerical Simulation*. Volume 106 (2022), Paper No. 105970, 21 pp.  
<https://doi.org/10.1016/j.cnsns.2021.105970>
12. “A rigorous implicit  $C^1$  Chebyshev integrator for delay equations,” with J.P. Lessard. *Journal of Dynamics and Differential Equations*. Volume 33, No. 4, pp. 1959-1988 (2021).  
DOI: <https://doi.org/10.1007/s10884-020-09880-1>
13. “From the Lagrange polygon to the figure eight I: Numerical evidence extending a conjecture of Marchal,” with Renato Calleja, Carlos García-Azpeitia, and J.P. Lessard. *Celestial Mechanics and Dynamical Astronomy*. 133, Num 10 (2021)
14. “Critical homoclinics in a restricted four body problem: numerical continuation and center manifold computations,” with Wouter Hetebrij. *Celestial Mechanics and Dynamical Astronomy*. 133, Num 5 (2021).
15. “Torus knot choreographies in the  $n$ -body problem,” with Renato Calleja, Carlos García-Azpeitia, and J.P. Lessard. *Nonlinearity*. Volume 34, Num 1 (2021).
16. “Homoclinic dynamics in a spatial restricted four body problem: blue skies to Smale horseshoes for vertical Lyapunov families,” with Maxime Murray. *Celestial Mechanics and Dynamical Astronomy*. 132, Num 38 (2020).
17. “Parameterization method for unstable manifolds of standing waves on the line,” with Blake Barker and Jalen Morgan. *SIAM Journal on Applied Dynamical Systems*. Volume 19, No. 3, pp. 1758–1797 (2020).
18. “A functional analytic approach to validated numerics for eigenvalues of delay equations,” with J.P. Lessard. *Journal of Computational Dynamics*. Issue 7(1), pp. 123-158, (2020).
19. “Resonant tori, transport barriers, and chaos in a vector field with a Neimark-Sacker bifurcation,” with Emmanuel Fleurantin. *Communications in Nonlinear Science and Numerical Simulations*, 85, 105226, 29 pp (2020).
20. “Computer assisted proofs of contracting invariant tori for ODEs,” with Maciej Capinski and Emmanuel Fleurantin. *Discrete and Continuous Dynamical Systems*. 40(12), pp. 6681–6707 (2020).
21. “Homoclinic dynamics in a restricted four body problem: transverse connections for the saddle-focus equilibrium solution set,” with Shane Kepley. *Celestial Mechanics and Dynamical Astronomy*, 131:13 (2019).

22. “Spatial periodic orbits in the equilateral circular restricted four body problem: computer assisted proofs of existence,” with Jaime Burgos-Garcia and J.P. Lessard. *Celestial Mechanics and Dynamical Astronomy*, 131:2. (2019)  
<https://doi.org/10.1007/s10569-018-9879-8>.
23. “Validated numerics for continuation and bifurcation of connecting orbits for maps,” with Ronald Adams. *The Qualitative Theory of Dynamical Systems*, Vol 18, Issue 1, pp 107-137. (2019)
24. “Fourier-Taylor Parameterization of Unstable Manifolds for Parabolic Partial Differential Equations: Formalism, Implementation, and Rigorous Validation” with Christian Reinhardt. *Indagationes Mathematicae*, Volume 39, pp. 39-80. (2019)
25. “Chaotic motions in the restricted four body problem via Devaney’s saddle-focus homoclinic tangle theorem,” with Shane Kepley. *The Journal of Differential Equations*, Vol 266, pp. 1709–1755 (2019).
26. “Parameterization of invariant manifold for periodic orbits (II): a-posteriori analysis and computer assisted error bounds” with Roberto Castelli and J.P. Lessard. *The Journal of Dynamics and Differential Equations*, Volume 30, Issue 4, pp.1525-1581 (2018).  
<https://doi.org/10.1007/s10884-017-9609-z>
27. “Analytic continuation of local (un)stable manifolds with rigorous computer assisted error bounds,” with Shane Kepley and William D. Kalies. *SIAM Journal on Applied Dynamical Systems*, Vol 17, No. 1, pp. 157–202 (2018)
28. “Chebyshev-Taylor parameterization of stable/unstable manifolds for periodic orbits: implementation and applications,” with Maxime Murray, *International Journal of Bifurcation and Chaos*, Volume 27, No. 14, 2017.
29. “Parameterization method for unstable manifold of delay differential equations” with Chris Groothedde, *Journal of Computational Dynamics*, Vol 4, Issue 1, 2017.  
<https://doi.org/10.3934/jcd.2017002>
30. “High-order parameterization of stable/unstable manifolds for long periodic orbits of maps. *SIAM Journal on Applied Dynamical Systems*, Volume 16, No. 3, pp. 1748–1795 (2017).
31. “High-order parameterization of (un)stable manifold for hybrid maps: implementation and applications” with Vincent Naudot and Qiuying Lu, *Communications in Nonlinear Science and Numerical Simulations*, Vol 53, 2017, pp. 184 – 201.



32. “Fourier-Taylor Approximation of Unstable Manifolds for Compact Maps: Numerical Implementation and Computer Assisted Error Bounds”. J.D. Mireles James, *Foundations of Computational Mathematics*, Vol 17, Issue 6, pp. 1467–1523, 2017.  
<https://doi.org/10.1007/s10208-016-9325-9>
33. “Validated computation of heteroclinic sets” with Maciej Capinski, *SIAM Journal on applied dynamical systems*, Vol 16, Issue 1, pp. 375–409, 2017.
34. “Computer assisted Fourier analysis in sequence spaces of varying regularity” with J.P. Lessard, *SIAM Journal on Mathematical Analysis*, Vol 49, Issue 1, pp. 530 – 561. 2017.
35. “Automatic differentiation for Fourier series and the radii polynomial approach” with Julian Ransford and J.P. Lessard, *Physica D: nonlinear phenomena – special issue on topology in dynamics, differential equations, and data*, Vol. 334, No. 1, November 2016, pp. 174–186.
36. “Connecting orbits for compact infinite dimensional maps: computer assisted proofs of existence” with Rafael de la Llave. *SIAM Journal on Applied Dynamical Systems*, Vol. 15, No. 2 (2016), pp. 1268-1323.
37. “Computing (un)stable manifolds with validated error bounds: non-resonant and resonant spectra” with Christian Reinhardt and J.B. van den Berg. *Journal of Nonlinear Science*, Vol. 26 (2016), pp. 1055-1095.
38. “Parameterization of slow-stable manifolds and their invariant vector bundles: theory and numerical implementation”. J.D. Mireles James and J.B. van den Berg. *Discrete and Continuous Dynamical Systems A*, Vol 36, No. 9 (2016), pp. 4637-4664.
39. “Computation of maximal local (un)stable manifold patches by the parameterization method” with Maxime Breden and J.P. Lessard. *Indagationes Mathematicae*, Vol. 27, Issue 1, January 2016, pp. 340-367.
40. “Rigorous Numerics for Analytic Solutions of Differential Equations: the Radii Polynomial Approach” with Allan Hungria and J.P. Lessard. *Mathematics of Computation*. Volume 85, Number 299, May (2016), pp. 1427 - 1459.
41. “Analytic Enclosure of the Fundamental Matrix Solution” with Roberto Castelli and J.P. Lessard. *Applications of Mathematics*, Vol. 60 (2015), issue 6, pp. 617–636.
42. “Stationary coexistence of hexagons and rolls via rigorous computations” with J.B. van den Berg, A. Deschênes, and J.P. Lessard. *SIAM Journal on Applied Dynamical Systems*, Vol 14, No. 2 (2015), pp. 942–979.

43. “Parameterization of Invariant Manifolds for Periodic Orbits (I): Efficient Numerics Via the Floquet Normal Form” with R. Castelli, and J.P. Lessard. *SIAM Journal on Applied Dynamical Systems*, Vol 14, No. 1 (2015), pp. 132-167.
44. “Polynomial Approximation of One Parameter Families of (Un)Stable Manifolds with Rigorous Computer Assisted Error Bounds.” J.D. Mireles James. *Indagationes Mathematicae*, January 2015, Vol. 26, Issue 1, pp. 225-265
45. “Computer Assisted Error Bounds for Linear Approximation of (Un)Stable Manifolds and Rigorous Validation of Higher Dimensional Transverse Connecting Orbits” J.D. Mireles James. *Communications in Nonlinear Science and Numerical Simulation*, May 2015, Vol. 22, Issues 1–3, pp. 1102-1133.
46. “Computer Assisted Proof of Transverse Saddle-to-Saddle Connecting Orbits for First Order Vector Fields” with J.P. Lessard and C. Reinhardt. *Journal of Dynamics and Differential Equations*. June 2014, Volume 26, Issue 2, pp. 267-313.
47. “Rigorous A-Posteriori Computation of (Un)Stable Manifolds and Connecting Orbits for Analytic Maps” with Konstantin Mischaikow. *SIAM Journal on Applied Dynamical Systems*. Volume 12, Number 2 (2013), pp. 957-1006.
48. “Parameterization of Invariant Manifolds by Reducibility for Volume Preserving and Symplectic Maps” with R. de la Llave. *Discrete and Continuous Dynamical Systems*. Volume 32, Number 12, December 2012. pp. 4321-4360.
49. “Quadratic Volume-Preserving Maps: (Un)stable Manifolds, Hyperbolic Dynamics, and Vortex-Bubble Bifurcations.” J.D. Mireles James. *Journal of Nonlinear Science*. *Journal of Nonlinear Science*, Volume 23, Number 4, 2013, pp. 585-615.
50. “Rigorous Numerics for Symmetric Connecting Orbits: Even Homoclinic of the Gray-Scott Equation” with J.B. van den Berg, J.P. Lessard, and K. Mischaikow, *SIAM Journal on Mathematical Analysis*, Volume 43, Issue 4 (2011), pp. 1557-1594.
51. “Computation of Heteroclinic Arcs with Application to the Volume Preserving Hénon Family.” with Hector Lomelí, *SIAM Journal on Applied Dynamical Systems*, Volume 9, Issue 3 (2010), pp 919-953.
52. “Adaptive Set-Oriented Computation of Topological Horseshoe Factors in Area and Volume Preserving Maps.” J.D. Mireles James *SIAM Journal on Applied Dynamical Systems*, Volume 9, Issue 4. 2010 pp. 1164-1200.

### Courses and Programs Developed/Major Modifications

- **Quality Enhancement Plan: Learning Reimagined.** As part of FAU's SACSCCOC reaffirmation for 2024, the university is required to develop a new Quality Enhancement Plan (QEP). The Provost's Office appointed members for a QEP Topic Selection Committee to steer the process. A total of 10 proposals were generated, with three finalists who developed full proposals and presented their plans to the university community.

The proposal selected to be FAU's next QEP topic was the "LeArning Reimagined: Expanding the Learning Assistant (LA) Model across the Curriculum to Transform Teaching through Student-Centered Collaborative Learning" proposal developed by Brittaney Adelman, Ph.D., director of the Math Learning Center, Jennifer Bebergal, Ph.D., associate dean for retention and academic support, and myself. The three of us now serve on the QEP organizing committee for this 10 year, university wide effort. <http://www.math.fau.edu/news/qep-learning-reimagined/index.php>

- M@thHub undergraduate research semester/workshop: organized by Jorge Gonzalez, Emmanuel Fleurantin, Wai-Ting Lam, Molei Tao, and myself. This was a semester long undergraduate program designed to provide students with research driven training in scientific computing and parallel algorithms. The program ran a weekly hybrid online/in person seminar series, and students at George Mason and Georgia Tech universities had weekly meetings with their mentors. The capstone experience was a two day workshop at Georgia Tech where students presented their research and heard talks from experts in computational and applied mathematics.
- Ordinary Differential Equations (Graduate FAU – also ran at Rutgers, McGill, Laval, VU Amsterdam, and Sao Carlos): this course is being developed by Konstantin Mischaikow, J.B. van den Berg, J.P. Lessard, Marcio Gamero and myself. The idea is to discuss theoretical and numerical aspects of the field simultaneously, stressing the constructive nature of the proofs and that these in many cases lead to good algorithms. For example the proof of local existence and uniqueness of solutions to initial value problems is constructive and can be adapted to give validated a-posteriori error bounds numerical approximations. Similarly for the implicit function theorem, periodic orbits, stable/unstable manifolds, and connecting orbits. The course builds to Smale's theorem for the existence of chaotic dynamics where we give both analytical proofs and constructive methods for validating the hypothesis in explicit systems. The course has run twice at FAU with 15-20 students. We are developing lecture notes which will eventually be published as a graduate textbook.
- Numerical Analysis (Graduate FAU): when I arrived at FAU there was no graduate course in numerical analysis on the books and I was asked to develop one. I was involved with every stage of the course proposal,

from writing the syllabus to obtaining university approval to add it to the course catalog. The course ran for the first time in the Fall of 2019 with 12 students under my instruction.

The goal of the course is to introduce students to topics like interpolation, numerical quadrature, solution of linear and nonlinear systems of equations, and numerical methods for initial value and boundary value problems. The topics are organized so that piecewise linear finite element methods for 2D domains can be discussed by the end of the semester, and this goal gives the course its narrative. Throughout, the interplay between good theory and good practice are stressed, especially in the context of existence theory and error analysis. All topics are filtered through the lens of functional analysis on Banach and Hilbert spaces, using analytical tools like the contraction mapping theorem, weak derivatives, Sobolev spaces, and the Lax-Millgram theorem. Student write their own programs after being given some starter programs written by me.

- Introduction to computer assisted proof in nonlinear analysis (undergraduate Rutgers): this was a special topics course taught at Rutgers in the last semester of my time there. The course focused on analytical and computational methods for solving nonlinear equations, including the use of a-posteriori analysis combined with interval arithmetic to formulate computer assisted proofs. The first half of the course focused on finite dimensional problem (systems of  $n$  equations in  $n$  unknowns) while the second half of the course developed Taylor methods for solving ODEs with validated error bounds. The course had about 20 students.
- Matrix Theory (undergraduate FAU): This is a course in linear algebra with a strong computational flavor. The target audience is engineering and science students in their second year of study. I incorporated the use of MatLab assignments and projects into the course syllabus. These modifications have been used by other instructors teaching the course as well.

**Teaching Experience: (Florida Atlantic University)**

- MAA 5228 and 4226: Introductory Analysis I (Ph.D. qualifying course): Fall 2023 (also Fall 2015).
- MAP 3305: Engineering Mathematics I: Fall 2023 (also Summer 2023, Spring 2023, Summer 2022, Spring 2022, Fall 2020, Fall 2018, Spring 2015).
- MAD 2502: Introduction to Computational Mathematics: Spring 2023 (also Fall 2022).
- MAD 6403: Computational Mathematics (Graduate Course): Fall 2022.
- MAC 2312: Calculus-Analytic Geometry II: Summer 2022 (also Spring 2021, Fall 2019, Summer 2017).

- MAA 4200 Modern Analysis: Spring 2022 (also Fall 2020, Fall 2017).
- MAP 6345 Partial Differential Equations (Graduate Course): Fall 2021.
- MAC 2313 Calculus and Analytic Geometry III: Fall 2021 (also Spring 2020, Fall 2018, and Spring 2018).
- MAD 6407: Numerical Analysis (Graduate Course): Fall 2019.
- MAP 6335: Ordinary Differential Equations (Graduate Course): Spring 2019 and 2017.
- MAC 2311 Calculus and Analytic Geometry I: Summer 2018 (sections 2 and 5).
- MAP 2302 Differential Equations I: Spring 2018.
- MAS 2103 (Sections 001 and 002): Matrix Theory: Summer 2017, Fall 2016.
- MAA 5229 and 4227: Introductory Analysis II (Ph.D. qualifying course): Spring 2016.
- MAA 5228 and 4226: Introductory Analysis I (Ph.D. qualifying course): Fall 2015.
- MAC 2311: Calculus and Analytic Geometry I. Fall 2015.
- MAT 6907: Numerical Methods and Applications Summer School: Summer 2015. (Co-organized and co-taught with William Kalies, Erik Lundberg, Vincent Naudot, Necibe Tuncer)
- MAD 3400: Numerical Methods: Fall 2017, Fall 2014.

**Teaching Experience: (Rutgers University)**

- M515 - Graduate Course in Ordinary Differential Equations: Spring 2013. *Course notes developed with M. Gameiro, J.P. Lessard, and K. Mischaikow.*
- M495 – Undergraduate Special Topics Course on Nonlinear Analysis and Computer Assisted Proof: Spring 2014. *Course developed by J.D.M.J.*
- M373 – Numerical Analysis I: Fall 2013.
- M244 – Differential Equations for Engineering and Physics: Fall 2013.
- M312 – Introduction to Mathematical Analysis II; Spring 2013.
- M250 – Introductory Linear Algebra; Fall 2012.
- M 244 – Differential Equations for Engineering and Physics; Fall 2012.

- M 311 – Introduction to Mathematical Analysis; Spring 2012.
- M423 – Elementary Partial Differential Equations; Fall 2011.
- M300 – Introduction to Mathematical Reasoning; Spring 2011.
- M151 – Calculus I for the Mathematical and Physical Sciences; Fall 2010 and Fall 2011.

**Teaching Experience: (University of Texas at Austin)**

- M408L: Integral Calculus: Fall 2009.
- M316K (two sections):– Foundations of Arithmetic: Fall 2008.
- Teaching assistant for various courses.

**Workshops, Education, and Outreach Presentations**

- Invited presentation “Computational dynamics,” for the participants of the M@thHub undergraduate workshop on Scientific Computing at the Georgia Institute of Technology, December 4th, 2022.
- Radio interview about research in computational mathematics for the “Science Rocks” radio show. November 5th, 2022.  
<https://www.dropbox.com/s/mlrm0seitkyqlze/SRS-110522.mp3?dl=0>
- Invited presentation “Computer assisted proofs for connecting and ejection/collision orbits,” for the free, online workshop *Machine Learning and Computer Assisted Proofs in Celestial Mechanics and Astrodynamics*.  
<https://mlcap2021.wordpress.com/>  
Organized by Christoph Lhotka and Ugo Locatelli from the Department of Mathematics, University of Rome Tor Vergata, June 18th and June 25th, 2021.  
Videos of all lectures are freely available online.
- Invited presentations “Validated numerics in Banach spaces: Taylor methods” and “Parameterization of invariant manifolds,” for the program *Tutorial: A computer-assisted constructive approach to nonlinear dynamical systems* April 1st and 2nd, 2019. Organized by J.P. Lessard, J.B. van den Berg, and Konstantin Mischaikow as part of the program on Topological and Rigorous Computational Methods for High Dimensional Dynamics at the Centre De Recherches Mathématiques in April 2019, Montreal, Canada.
- “Computer assisted proofs in nonlinear dynamics,” was a three day/six lecture graduate short course which J.P. Lessard and I taught at the Instituto de Investigaciones en Matemáticas Aplicadas y en Sistemas, Universidad Nacional Autónoma de México, Mexico City, Mexico, August 1st-3rd, 2018. The lectures were recorded and are freely available at the course page:  
<https://mym.iimas.unam.mx/renato/curso.html>

- Institute for Learning in Retirement Public Lecture Series Spotlight: Science and Environment “Low Energy Transport in Celestial Mechanics” Boca Raton Community Center, Boca Raton, Florida, April 23-rd, 2018.
- Panelist (with J.B. van den Berg and Keith Promislow) for *Hot topic panel session: computer-aided proofs for existence and stability of coherent structures*, 2016 SIAM Conference on Nonlinear Waves and Coherent Structures, Philadelphia, Pennsylvania.
- “Rigorous computation of (un)stable manifolds and connecting orbits”, AMS Short Course on Rigorous Numerics in Dynamical Systems, Joint meeting of the AMS, MAA, and SIAM, Seattle, Washington, January 4-th, 2016.
- “Introduction to Distributions/Generalized Functions and Distributional/Weak Derivatives.” Florida Atlantic University Department of Mathematics Analysis and Applications Workshop: Distributions and Sobolev Spaces, May 4-th, 2015 (Organized with Erik Lundberg).
- “A Prospective on Undergraduate Research in Mathematics.” Invited presentation to the FAU incoming freshman class, University Campus Day, March 27th, 2015.
- “Complex Behavior in Simple Systems.” Florida Atlantic University Undergraduate Math Club, November 14, 2014.
- “Understanding the Mistakes We Make When We Do Numerical Analysis.” Rutgers University Student Chapter of the Mathematical Association of America, October 29, 2013.
- “Computer Assisted Analysis of Periodic Solutions of Ordinary and Partial Differential Equations.” University of Delaware student chapter of SIAM. September 17, 2013.
- “A Little Nonlinear Analysis (with and without computer assistance)” Rutgers University Student Chapter of the Mathematical Association of America, May 1, 2013.
- “Computation of Stable and Unstable Manifolds of Dynamical Systems by Parameterization” George Mason University Department of Mathematics URCM and REU Applied Mathematics Seminar, Fairfax Virginia, July 27, 2010.
- “Dynamical Systems: Wild Behavior in Simple Models of the World” University of Texas Mathematics Department Saturday Morning Math Group, April 17, 2010.

## Organizational Efforts: Conferences, Minisymposia, Special Sessions, Seminars, and Colloquia.

- *Centre de Recherches Mathématiques Seminar on Computer Assisted Mathematical Proof in Nonlinear Analysis CRM CAMP*, co-founder and co-organizer with J.P. Lessard and J.B. van den Berg. This is a weekly online seminar which started in June 2020. Videos of all lectures are freely available online at:  
<http://crm.math.ca/camp-nonlinear/#crm-camp>
- Co-organizer with Ying Hung, Heather Harrington, Maxime Breden, Konstantin Mischaikow, J.P. Lessard, and J.B. van den Berg, of the upcoming thematic special semester at the CRM in Montreal in Fall 2024 entitled “Computational Dynamics - Analysis, Topology and Data”.  
<https://www.crmath.ca/en/activities/#/type/activity/id/3924>
- Co-organizer, with Blake Barker and Emmanuel Fleurantin, of the upcoming AIM workshop “Computer assisted proofs for stability analysis of nonlinear waves”, which will be held from June 5th-9th, 2023. Official announcement is found at:  
<https://aimath.org/workshops/upcoming/compproofstability/>
- *Special Session: Advances in Nonlinear Dynamics*, co-organized with Evelyn Sander. 10th International Congress on Industrial and Applied Mathematics, Waseda University, Tokyo, Japan, August 20th - 25th, 2023.
- *SIAM Conference on Applications of Dynamical Systems (DS21)*: member organizing committee. May 23-27, 2021.
- *Special Session: Advances in computational dynamics*, AMS sectional meeting, March 13-14, Georgia Institute of Technology (online). Co-organized with Jorge Gonzales, Andrey Shilnikov, and Igor Belykh.
- *Connections in Infinite Dimensional Dynamics (20w5145)*, Banff International Research Station in Banff, Alberta. Co-organized with Jan Bouwe van den Berg, Jean-Philippe Lessard, and Konstantin Mischaikow. 21 person workshop the week of May 17-22, 2020.  
<https://www.birs.ca/events/2020/5-day-workshops/20w5145>
- *Minisymposium: Computer Assisted Theorems in Dynamics - Parts I and II*, SIAM Conference on Dynamical Systems, Snowbird, Utah. co-organized with Jan Bouwe Van Den Berg, May 20th, 2019
- *Llavefest: a Broad Perspective on Finite and Infinite Dimensional Dynamical Systems (FIDDS-17)*, member of organizing committee, June 12 to 16, 2017, Universitat de Barcelona, Barcelona, Spain.
- *Dynamics, from theory to computation*: Co-organized with Renato C. Calleja and Arturo Olvera. Dynamics Days Latin America and the Caribbean, October 25 – 26, 2016, Pebula, Mexico.



- *Special Session on Dynamics and Computation*: Co-organized with William D. Kalies and Vincent Naudot, 11-th AIMS International Conference on Dynamical Systems, Differential Equations and Applications, July 1-5, 2016, Orlando, Florida.
- *Special Session on Advances in Computer Assisted Proofs for Dynamical Systems and Differential Equations*: Co-organized with Gianni Arioli, 11-th AIMS International Conference on Dynamical Systems, Differential Equations and Applications, July 1-5, 2016, Orlando, Florida.
- *Colloquium*: Department of Mathematical Sciences, Florida Atlantic University (Spring 2019 - Present. Fall 2015 and Spring 2016).
- *Analysis and Applications Seminar*: Department of Mathematical Sciences, Florida Atlantic University. Co-Organized with Erik Lundberg (Fall 2104 – Present).
- *Minisymposium on Advances in Computer Assisted Proof for Infinite Dimensional Dynamical Systems*: Co-Organized with Christian P. Reinhardt. 2015 SIAM Conference on Applications of Dynamical Systems. Thursday, May 21, 2015, Snowbird, Utah.
- *Applied and Computational Math Seminar*: Rutgers University. Organized by J.D.M.J. Spring 2014. Co-organized with Konstantin Mischaikow Fall 2013.
- *Minisymposium on Rigorous Computations in Dynamical Systems*: organized with Jan Bouwe van den Berg for the Annual Meeting of the Canadian Applied and Industrial Mathematics Society, Quebec City, June 17-18, 2013.
- *Working Dynamical Systems Seminar*: University of Texas at Austin. Organized the seminar in the Fall of 2008. Co organized with Rafael de la Llave from 2006 – 2009.

### Colloquium, Conference, and Seminar Presentations

- “Validated numerics for divergent series via the Borel Transform,” Mini Symposium on Computer-assisted proofs in differential equations, International Congress on Industrial and Applied Mathematics, Waseda University, Tokyo, Japan, August 20th-25th, 2023.
- “Traveling Waves, Stability, and Computer Assisted Proof: a look at the literature and some recent results,” AIM Workshop: *Computer assisted proofs for stability analysis of nonlinear waves*. San Jose, California, June 5th, 2023.
- “Applications of validated error bounds for the DFT to computer assisted proofs in nonlinear analysis,” École Normale Supérieure de Lyon Workshop on Certified and Symbolic-Numeric Computation, ENS de Lyon, Lyon, France, May 22-26th, 2023.

- “A Trefoil Knot in the Lorenz Equations,” SIAM Conference on Applied Dynamical Systems, Mini Symposium on Computer-Assisted Proofs in Dynamics, Portland, Oregon, May 18th, 2023.
- “Divergent series in dynamical systems and computer assisted error bounds,” Seminar on Differential Equations and Related Topics, Faculty of Mathematics and Computer Science, Jagiellonian University, Krakow, Poland, March 17th, 2023.
- “Computing invariant dynamics for delay differential equations,” Katedra Równań Różniczkowych (Department of Differential Equations) Seminar, Akademia Górniczo-Hutnicza (AGH) University, Krakow, Poland, March 14th, 2023.
- “Computer assisted proof of transverse homoclinics at  $L_4$  in the CRTBP,” University of Barcelona-University Polytechnic Catalunya Dynamical Systems Group Seminar, University of Barcelona, Barcelona, Spain, July 14th, 2022.
- “Continuation and Bifurcation of Ejection-Collision Orbits,” Dynamics, Topology and Computations 2022 (DyToComp22), Bedlewo, Poland, June 23-rd, 2022.
- “Computer assisted proof of collision and near collision orbits in the circular restricted three body problem,” International workshop on Reliable Computing and Computer Assisted Proofs (ReCAP), (fully online conference) March 14th, 2022
- “Conjectures, computations, and computer assisted proofs in celestial mechanics,” Seminar on current problems in numerical analysis, Institute of Mathematics, Czech Academy of Sciences, Prague, The Czech Republic, March 11th, 2022.
- “Some long-standing problems in celestial mechanics and their resolution by computer assisted proof,” Katedra Równań Różniczkowych (Department of Differential Equations) Seminar, Akademia Górniczo-Hutnicza (AGH) University, Krakow, Poland, Feb 8th, 2022.
- “Parameterization method for invariant manifolds of vector fields and validated error bounds,” Seminar on Differential Equations and Related Topics, Faculty of Mathematics and Computer Science, Jagiellonian University, Krakow, Poland, February 4th, 2022.
- “Computer assisted proof of transverse homoclinic chaos - a look under the hood,” CDSNS Colloquium, Georgia Institute of Technology, November 19th, 2021.
- “Computer assisted proofs for connecting orbits in infinite dimensions,” SCAN2020, Plenary Talk (online presentation), Szeged, Hungary, September 15th, 2021.

- “Using Birkhoff Averages with the Parameterization Method for Invariant Tori,” SIAM Conference on Dynamical Systems and Applications 2021. Mini Symposium on Computing Quasiperiodic Tori for Hamiltonian Systems: Applications to Celestial Mechanics, May 24th, 2021 (virtual conference).
- “Introduction to validated numerics for analytic functions,” Katedra Równań Różniczkowych (Department of Differential Equations) Seminar, Akademia Górniczo-Hutnicza (AGH) University, Krakow, Poland, May 25-th, 2021 (virtual presentation).
- “Parameterization methods for unstable manifolds of delay differential equations,” AMS Spring Southeastern Sectional Meeting, Special Section on Functional Differential Equations, Theory and Applications, March 13th, 2021 (virtual conference).
- “Boundary value problems for transverse collisions, near collision periodic orbits, and near collision homoclinic orbits in the restricted three body problem,” AMS Spring Southeastern Sectional Meeting, Special Session on Celestial Mechanics and Applied Astrodynamics, March 13th, 2021 (virtual conference).
- “Boundary value problems and transversality in conservative systems: computer assisted proofs of connection and collision orbits,” Centre De Recherches Mathematiques Computer-Assicated Mathematical Proofs in Nonlinear Analysis Seminar (fully online lecture series). March 2nd, 2021. [https://www.youtube.com/watch?v=T6\\_3dbh3qMA&t=12s](https://www.youtube.com/watch?v=T6_3dbh3qMA&t=12s)
- “Validated numerics for Morse indices of delay differential equations,” Uppsalla University, Uppsalla, Sweden, Dynamics and Computations seminar, online, December 11, 2020.
- “Computer assisted existence proofs for collision orbits in the planar circular restricted three body problem,” Jagiellonian University, Krakow, Poland, Computational Mathematics Seminar, online, December 10, 2020.
- “Continuation, bifurcation, and disintegration of homoclinic orbits in a restricted four body problem,” Yesheva University, New York City, New York, Mathematical Physics Seminar, online, June 17th, 2020.
- “Parameterization of unstable manifolds for delay differential equations,” CDSNS Virtual Colloquium – hosted by Georgia Institute of Technology School of Mathematics, online, June 3rd, 2020.
- “Validated numerical methods for delay differential equations,” University of Barcelona and Universitat Politècnica de Catalunya joint Dynamical Systems Group Seminar, Barcelona, Spain, March 4th, 2020.

- “Computational dynamics and applications,” Dynamical Systems Seminar, Department of Mathematics, Cornell University, Ithaca, New York, November 22, 2019.
- “Validated numerics for stable/unstable manifolds of delay differential equations,” Dynamics, Equations, and Applications Conference Celebrating the 100 Year Anniversary of the Akademia Górniczo-Hutnicza University of Science and Technology. September 16th, 2019, Krakow, Poland.
- “The parameterization method, transverse intersections, and computer assisted proof in celestial mechanics,” mini-symposium: Computer assisted proofs in dynamics - Part 1 of 2, Equadiff 2019, July 8th, 2019, Leiden, the Netherlands.
- “Computer Assisted Proofs in Dynamical Systems Theory: The 1980’s to the Present,” mini-symposium: Computer Assisted Theorems in Dynamics - Part of II, 2019 SIAM Conference on Dynamical Systems, Monday, May 20-th, 2019, Snowbird, Utah.
- “Validated numerics for collision dynamics in the circular restricted three body problem,” Workshop: Rigorous Computational Dynamics in Infinite Dimensions, Centre de Recherches Mathématiques, University of Montreal, April 3rd, 2019, Montreal Canada.
- “Blue skies in the four body problem,” Applied Mathematics Seminar, Department of Mathematics and Statistics, McGill University, October 22nd, 2018, Montreal, Canada.
- “Homoclinic phenomena in Hamiltonian systems and applications”, Analysis and Applications Seminar, Department of Mathematics, Rutgers University, April 3rd, 2018.
- “Homoclinic and heteroclinic phenomena associated with saddle-focus equilibria in an equilateral restricted four body problem”, Jagiellonian University, Seminar on Differential Equations and Related Issues, Faculty of Mathematics and Computer Science, January 26, 2018, Krakow, Poland.
- “Numerical computation of invariant manifolds via the parameterization method”, Polish Akademia Górniczo-Hutnicza im. Stanisława Staszica (AGH University), Seminar of the Department of Differential Equations, Faculty of Applied Mathematics, January 23, 2018, Krakow, Poland.
- “Parameterization of invariant manifolds for PDEs”, NSF Workshop: Geometric Analysis of Spatiotemporal Data in Fluid Flows, Georgia Technical University, September 13, 2017.
- “Parameterization of unstable manifolds for parabolic PDEs”, BIRS Workshop: Rigorous Numerics for Infinite Dimensional Nonlinear Dynamics, Banff International Research Station, Banff, Canada, May 8, 2017.

- “Parameterization Method for Invariant Manifolds and Some Infinite Dimensional Applications”, Seminario de Matemáticas, Departamento Académico de Matemáticas, Instituto Tecnológico Autónomo de México, March, 8-th, 2017.
- “Validated computation of local stable/unstable manifolds and applications,” mini-symposium on spectral stability analysis of nonlinear waves and computational proof, SIAM conference on nonlinear waves and coherent structures, August 10-th, 2016, Philadelphia, Pennsylvania.
- “Parameterization method for unstable manifolds of scalar delay equations,” the 11th AIMS conference on dynamical systems, differential equations, and applications, Orlando, Florida, July 2nd, 2016.
- “Introduction to computational proofs for dynamics in PDEs: methods and history”, Lorentz center workshop on computational proofs for dynamics in PDEs, June 6th, 2016, Leiden, the Netherlands.
- “Parameterization of periodic invariant objects for maps”, CDSNS Colloquium, Georgia Institute of Technology, Atlanta, Georgia, May 2-nd, 2016.
- “An introduction to computer aided proof in nonlinear analysis”, Dynamical systems seminar, department of mathematical sciences, Yeshiva University, New York City, New York, January 28-th, 2016.
- “Validated numerics and connecting orbits for parabolic differential equations,” Session on Numerical Approximation of Spectra and Computer-assisted Proof, 2015 SIAM Conference on Analysis of Partial Differential Equations, Paradise Valley-Scottsdale, Scottsdale, Arizona, USA, December 9, 2015.
- “Validated computation of connecting orbits in infinite dimensions,” Session on Computational and topological methods in dynamical systems, 2015 Winter Meeting of the Canadian Mathematical Society, Montréal, Quebec, Canada, December 6, 2015.
- “Period solutions of differential equations: automatic differentiation for Fourier series and computer assisted proof,” Seminario de Matemáticas, Departamento Académico de Matemáticas, Instituto Tecnológico Autónomo de México, October 16, 2015.
- “Numerical computation of the Floquet normal form an applications,” Colloquio de Matemáticas Aplicadas Instituto de Investigaciones, en Matemáticas Aplicadas y Sistemas Departamento de Matemáticas y Mecánica, Universidad Nacional Autónoma de México. October, 14th, 2015.
- “Computing invariant dynamics for differential equations: spectral methods, errors, and computer assisted proof,” Mathematics Colloquium Series, Nova Southeastern University, Fort Lauderdale, Florida, September 10-th, 2015.

- “Coexistence of stationary hexagons and rolls in a spatial pattern formation problem: a computer assisted proof,” DyToComp Conference on Dynamics, Topology, and Applications, Bedlewo, Poland, June 15-th, 2015.
- “Parameterization Method for Local Stable/Unstable Manifolds of Periodic Orbits,” Featured Minisymposium: Invariant Manifolds Unravelling Complicated Dynamics. SIAM Conference on Applications of Dynamical Systems, Snowbird, Utah, May 20-th, 2015.
- “Computer assisted proof for coexistence of stationary hexagons and rolls in a spatial pattern formation problem,” CDSNS Colloquium, Georgia Tech, Atlanta Georgia, April, 29-th, 2015.
- “Fixed Point Approach to Rigorous Computation of Connecting Orbits in Infinite Dimensions,” BIRS 5 Day Workshop on Rigorously Verified Computing for Infinite Dimensional Nonlinear Dynamics, Banff International Research Station, Alberta, Canada, September 23, 2014.
- “Parameterization Method for Invariant Manifolds and Some Validated Computations of Their Intersections” Boulder Dynamics 2014, Conference in Honor of James Meiss’ 60th Birthday, July 22, Boulder, Colorado, 2014.
- “Some Recent Developments in the Parameterization of Stable/Unstable Manifolds,” 10th AIMS Conference on Dynamical Systems and Applications, Special Session on Rigorous and Numerical Methods for Invariant Manifolds, July 10, Madrid, Spain, 2014.
- “Nonlinear Equations, Newton’s Method, and some Computer Assisted Proofs,” Basic Notions and Research Perspectives Seminar, Department of Mathematics, Rutgers University, May 5-th 2014.
- “Computer Assisted Analysis of Some Problems in Partial Differential Equations,” Department of Mathematics Colloquium, Yeshiva University, March 12, 2014.
- “Computational Intersection Theory for Invariant Manifolds of Dynamical Systems,” Mathematical Sciences Colloquium, Florida Atlantic University, February 6, 2014.
- “Approximation of Julia sets with computer assisted validation for complex analytic dynamical systems,” AMS Special Session on Complex Dynamics I, Joint Mathematics Meeting, Baltimore Maryland, January 17, 2014.
- “Computer-Assisted Proof of Analytic Solutions for Ordinary and Partial Differential Equations,” Department of Mathematics Colloquium, Florida Atlantic University, November 14, 2013.

- “Computer-Assisted Proof of Connecting Orbits in Dynamical Systems by the Projected Boundary Approach,” Applied and Computational Math Seminar, George Mason University, November 8, 2013.
- “Constructive Banach Space Methods for Studying Invariant Dynamics and Computer Assisted Analysis,” Thematic Session on Dynamical Systems at the Annual Meeting of the Canadian Applied and Industrial Mathematics Society, Quebec City, June 19, 2013.
- “Rigorous Computation of Connecting Orbits in Higher Dimensions,” SIAM Conference on Applications of Dynamical Systems, Snowbird, Utah, May 19, 2013.
- “Computer Assisted Analysis of Invariant Manifolds and Connecting Orbits for Nonlinear Dynamical Systems,” New York Seminar on General Topology and Topological Algebra, Baruch College CUNY, April 18, 2013.
- “Fixed point problems and rigorous computer assisted analysis of Dynamical Systems: Equilibria, Periodic Orbits, Invariant Manifolds, and Connecting Orbits,” Dynamical Systems Seminar, Cornell University, April 12, 2013.
- “Computer Assisted Analysis of Invariant Manifolds and Connecting Dynamics,” First International Conference on Dynamics of Differential Equations, Georgia Institute of Technology, Atlanta, Georgia, March 16, 2013.
- “Toward Computer Assisted Morse Theory,” CDSNS Colloquium, Department of Mathematics, Georgia Institute of Technology, September 7, 2012.
- “Computer Assisted Proof of Transverse Heteroclinic Connections for Vector Fields,” Dynamics, Topology and Computations, Bedlewo, Poland, June 27, 2012.
- “Parameterization of Invariant Manifolds with Rigorous Computer Assisted Error Bounds,” Tenth Workshop on Interactions Between Dynamical Systems and Partial Differential Equations (JISD 2012), Barcelona, Spain, May 30, 2012.
- “High Order Approximation of Stable/Unstable Manifolds with Rigorous Computer Assisted Error Bounds,” Workshop on Rigorous Computations in Dynamical Systems, Université Laval, Québec City, Québec, May 23, 2012.
- “Numerical Computation of One Parameter Branches of (Un)Stable Manifolds with Rigorous Error Bounds,” ICMC Summer Meeting on Differential Equations, Special Session on Computational Dynamics, Universidade de Sao Palo, Sao Carlos, Brazil, February 8, 2012.

- “Parameterization of Invariant Manifolds, Fixed Point Problems, and Rigorous Computation of Connecting Dynamics,” Summer Conference on General Topology and its Applications, Special Session on Dynamics and Applications, City College of New York, United States, July 27, 2011.
- “Parameterization of Invariant Manifolds and Numerical Computation of Connecting Dynamics,” ICIAM 2011 Mini-Symposium on Applied Topological Dynamics, Vancouver, Canada, July 18, 2011.
- “Parameterization of Invariant Manifolds with Rigorous Error Bounds and Application to Computer Assisted Proof for Connecting Orbits,” Foundations of Computational Mathematics Conference, Workshop on Computational Topology, Budapest, Hungary, July 14, 2011.
- “Rigorous Numerics for Connecting Orbits for Maps and Flows,” SIAM Conference on Applications of Dynamical Systems, Mini-Symposium on Computation and Topology in Dynamics, Snowbird, Utah, USA, May 24, 2011.
- “Computer Assisted Proof of the Existence of Connecting Orbits and Parameterization of Invariant Manifolds,” Applied Mathematics Seminar, Basque Center for Applied Mathematics, Bilbao, Spain, January 11, 2011.
- “Parameterization of Invariant Manifolds and Computation of Connecting Orbits,” Joint SIAM/RSME-SCM-SEMA Meeting; Emerging Topics in Dynamical Systems and Partial Differential Equations, Barcelona, Spain, June 3, 2010.
- “Connecting Dynamics and Parameterization of Invariant Manifolds,” 8th AIMS Conference on Dynamical Systems, Differential Equations and Applications, Jersey Dresden University of Technology, Dresden, Germany, May 27, 2010.
- “Rigorous Computation of Connecting Orbits for Flows I: Problem Description and Parameterization of Invariant Manifolds,” 2010 Spring Eastern Sectional Meeting, New Jersey Institute of Technology, Newark, New Jersey, May 22 – 23, 2010.
- “Adaptive Set-Oriented Algorithms for Conservative Systems,” Duke University Department of Mathematics Special Seminar, April 28, 2010.
- “Rigorous Computation of Symmetric Connecting Orbits for Systems of Second Order ODE’s,” 33rd Annual Texas Partial Differential Equations Conference, April 10, 2010.
- “Homoclinic Tangle Dynamics in a Vortex Bubble,” International Colaboratory for Emerging Technologies Workshop on Classical and Random Dynamics in Mathematical Physics, University of Texas at Austin, April 2, 2010.



- “Computation of Connecting Dynamics by Parameterization of Invariant Manifolds,” Dynamics/Complex Networks Seminar, Department of Applied Mathematics, University of Colorado, Boulder, February 18, 2010.
- “Computation of Heteroclinic Arcs for the Volume Preserving Henon Map,” VIII Americas Conference on Differential Equations, PASI 2009, Boca del Río, Veracruz, Mexico, October 20, 2009.
- “A Set-Oriented Search Procedure for Topological Horseshoe actors in Conservative Maps,” Dynamical Systems Seminar, Department of Mathematics, Jagiellonian University, Krakow Poland, June 19, 2009.
- “Parameterization of Heteroclinic Arcs,” Dynamics, Topology and Computation, Stephan Banach International Mathematical Center, Bedlewo, Poland, June 2, 2009.
- “Computation of Heteroclinic Connections for the Volume Preserving Henon Map,” Hamiltonian Systems and Applications Special Session, 7th AIMS International Conference on Dynamical Systems, Differential Equations, and Applications, Arlington Texas, May 21, 2008.
- “Top Down Set-Oriented Computations for Area Preserving Maps,” Topological Dynamics Special Session, 7th AIMS International Conference on Dynamical Systems, Differential Equations and Applications, Arlington Texas, May 19, 2008.

### Seminar Talks at Home

- “Divergent series in dynamical systems theory: an illustrative example,” Analysis and Applications Seminar, Florida Atlantic University, February 9th, 2023.
- “A trefoil knot in the Lorenz equations,” Analysis and Applications Seminar, Florida Atlantic University, September 15th, 2022.
- “Collision dynamics in some gravitational N-body problems (part II),” Analysis and Applications Seminar, Florida Atlantic University, February 13th, 2020.
- “Collision dynamics in some gravitational N-body problems (part I),” Analysis and Applications Seminar, Florida Atlantic University, January 30th, 2020.
- “Validated Numerics for Unstable Manifolds of Delay Differential Equations,” Analysis and Applications Seminar, Florida Atlantic University, September 12, 2019.
- “Choreographies in the n-body problem and delay differential equations,” Analysis and Applications Seminar, Florida Atlantic University, January 17, 2019.

- “Validated numerics for equilibrium solutions of delay differential equations,” Analysis and Applications Seminar, Florida Atlantic University, September 27, 2018.
- “Connecting orbits in a circular restricted four body problem (part II),” Analysis and Applications Seminar, Florida Atlantic University, April 26, 2018.
- “Connecting orbits in a circular restricted four body problem,” Analysis and Applications Seminar, Florida Atlantic University, March 29, 2018.
- “Introduction to computer assisted proof in nonlinear analysis”, Analysis and Applications Seminar, Florida Atlantic University, October 26, 2017.
- “Introduction to the parameterization method (II): applications and infinite dimensional extensions”, Analysis and Applications Seminar, Florida Atlantic University, September 28, 2017.
- “Introduction to the parameterization method (I): geometric and analytic preliminaries”, Analysis and Applications Seminar, Florida Atlantic University, September 21, 2017.
- “Parameterization of invariant vector bundles with applications to stability of nonlinear waves”, Analysis and Applications Seminar, Florida Atlantic University, April 13, 2017.
- “Parameterization of unstable manifolds for parabolic PDEs: part I,” Analysis and Applications Seminar, Florida Atlantic University, Department of Mathematical Sciences, November 10-th, 2016.
- “Spectral Methods for Computing Invariant Objects in Dynamical Systems Theory,” Analysis and Applications Seminar, Florida Atlantic University Department of Mathematical Sciences, May 7th, 2015.
- “Constructive Implicit Function Theory,” Analysis and Applications Seminar, Florida Atlantic University Department of Mathematical Sciences, February 12, 2015.
- “Toward Computer Assisted Proof of Homoclinic Chaos for Infinite Dimensional Dynamical Systems,” Analysis and Applications Seminar, Florida Atlantic University Department of Mathematical Sciences, November 20, 2014.
- “Parameterization of Invariant Manifolds and Invariant Bundles,” Algebra-Logic Seminar, Florida Atlantic University, October 10, 2014.
- “A Brief Introduction to Validated Computations and Computer Assisted Proof in Analysis,” Analysis and Applications Seminar, Florida Atlantic University, Boca Raton, Florida, September 11 2014.

- “Computational Intersection Theory: Overview, Applications, and Outlook,” Computational and Applied Mathematics Seminar, Rutgers University, January 28, 2014.
- “Parameterization of Sub-Stable Manifolds and their Stable and Unstable Linear Bundles,” Computational and Applied Mathematics Seminar, Rutgers University, October 21, 2013.
- “Geometric Reducibility and Invariant Manifolds Associated with Fixed Points of Symplectic Mappings,” Working Dynamical Systems Seminar, Department of Mathematics, University of Texas at Austin, October 6, 2010.
- “Reducibility for Invariant Manifolds in Volume Preserving Dynamical Systems,” Working Dynamical Systems Seminar, Department of Mathematics, University of Texas at Austin, May 5, 2010.
- “Reliable Computation of Invariant Dynamics for Discrete Conservative Dynamical Systems,” Workshop on Rigorous Computations in Mechanics, Department of Mathematics, University of Texas at Austin, November 11, 2009 (Thesis Defense)
- “Heteroclinic Manifolds in the Volume Preserving Henon Map,” Working Dynamical Systems Seminar, University of Texas at Austin, May 5, 2009.
- “Introduction to A-Posteriori Implicit Function Theorems,” Junior Analysis, University of Texas Austin, March 2, 2009.
- “Computation of Heteroclinic Manifolds for the Volume Preserving Henon Map,” Working Dynamical Systems Seminar, University of Texas at Austin, April 23, 2008.
- “Topological and Set Oriented Numerics for Dynamical Systems,” Working Dynamical Systems Seminar, University of Texas at Austin, February 23, 2008.
- “Transition Tori in some perturbed Hamiltonian Systems: Windowing and the Conley Index,” Working Dynamical Systems Seminar, University of Texas at Austin, October 18, 2006.
- “Introduction to the Method of Correctly Aligned Windows,” Working Dynamical Systems Seminar, University of Texas at Austin, February 1, 2006.
- “Correctly Aligned Windows,” Junior PDE Seminar, University of Texas at Austin. January 30, 2006.
- “The Stable Manifold Theorem Via an Isolating Block,” Working Dynamical Systems Seminar, University of Texas at Austin. November 2, 2005.

- “The Ważewski Retract Principle for Flows,” Junior PDE Seminar, University of Texas at Austin. September 19, 2005.
- “The Ważewski Principle,” Working Dynamical Systems Seminar, University of Texas at Austin. April 27, 2005.
- “The Question of Sharp Bounds for the Chang-Marshall Inequality,” Junior Analysis/Applied Math Seminar, University of Texas at Austin. November 6, 2003.
- “Chaotic Oscillators in Secure Communications,” Working Dynamical Systems Seminar, University of Texas at Austin. April 2003.

### Online talks (videos available)

- Computer assisted proof of collision and near collision orbits in the circular restricted three body problem  
<https://www.youtube.com/watch?v=3bujRZcW2pg&t=77s>
- Computer Assisted Proofs in Celestial Mechanics and Astrodynamics  
<https://www.youtube.com/watch?v=15hsiVrP7M8>
- Boundary value problems and transversality in conservative systems : computer assisted proofs.  
[https://www.youtube.com/watch?v=T6\\_3dbh3qMA&t=1262s](https://www.youtube.com/watch?v=T6_3dbh3qMA&t=1262s)
- Computer assisted proofs in nonlinear dynamics 1/3: Introduction and the method of radii polynomials.  
<https://www.youtube.com/watch?v=SnQaQ1AWIJ8&t=626s>
- Computer assisted proof workshop (1/3): Introduction and the method of radii polynomials  
<https://www.youtube.com/watch?v=SnQaQ1AWIJ8>
- Computer assisted proof workshop (2/3): finite dimensional ODEs and applications in Celestial Mechanics  
<https://www.youtube.com/watch?v=q01QPz-NzKo>
- Computer assisted proof workshop (3/3): Validated Taylor integrators by the method of Arioli/Koch.  
<https://www.youtube.com/watch?v=iDiyN8EMVds>
- Fixed point approach to rigorous validated computation of connecting orbits in infinite dimensions.  
<http://www.birs.ca/events/2014/5-day-workshops/14w5098/videos/watch/201409230906-Mireles-James.html>
- FAU Analysis and Topology Group: recruitment video  
<https://www.youtube.com/watch?v=hjIqMIw6MgY&t=6s>

## Conferences, Workshops, Schools, and Meetings Attended

- Global and Local Aspects in Dynamical Systems: from Exponentially Small Phenomena to Instability (GLADS 22) Conference commemorating the 60th birthday of Tere Serra. Centre de Recerca Matemàtica, Barcelona, Spain. July 5th-9th
- Workshop on Data Driven Dynamics: Algebraic Topology, Combinatorics and Analysis. Centre de Recherches Mathématiques, University of Montreal, Montreal, Canada. April 15-18, 2019.
- Mathematical Sciences Research Institute – Program in Hamiltonian systems: from topology to applications through analysis. Fall 2018, Berkeley, California (visited from November 3rd - 11th).
- Winter School on Computational Mathematics, Organized by Faculty of Mathematics and Computer Science, Jagiellonian University in Kraków, January 28th- February 3rd, 2018, Bedlewo, Poland.
- Winter School on Computational Mathematics, Organized by Faculty of Mathematics and Computer Science, Jagiellonian University in Kraków, February 7-13, 2016, Bedlewo, Poland.
- IMA Annual Program Year Workshop: “Algebraic Topology in Dynamics, Differential Equations, and Experimental Data”, February 10-14, 2014 (Poster Presented: Computational Intersection Theory).
- American Institute of Mathematics Workshop: “Rigorous Computation for Infinite Dimensional Nonlinear Dynamics,” Palo-alto, California, August 26-30, 2013.
- IV Developers Workshop on the Conley-Morse Database Project, March 19-22, 2012 - Kauai, Hawaii, USA.
- Algebra and Topology: Methods, Computation, and Science; ATMS 4, Munster, Germany, June 21-26, 2010.
- Computational Topology and Dynamics Workshop (Supported by US Department of Energy), Bozeman, Montana, August 10-12, 2008.
- Colab Mathematics Summer School; Theoretical and Applied Hamiltonian Dynamics, Instituto Superior Técnico, Lisbon, Portugal, June 16-20, 2008.
- Institut de Matemàtica; Advanced School on Specific Algebraic Manipulators, Barcelona, Spain, September 12-15, 2007.
- Institut de Matemàtica; Advanced Course on Long Time Integrations, Barcelona, Spain, September 3-7, 2007.
- NATO Advanced Study Institute / Séminaire de Mathématiques Supérieures: Hamiltonian Dynamical Systems and Applications. University of Montreal, Montreal Canada. June 18-29, 2007.

- IMA PI Summer Program for Graduate Students: Topology and it's Applications. Mississippi State University, Starkville Mississippi. July 10-28, 2006.
- 2006 Joint Meeting of AMS, MAA, and SIAM. San Antonio, Texas. January 12-15, 2006.
- Coupled 60: Focused Research Group Workshop. University of Houston, Houston, Texas. February 3-6, 2005.
- 2005 Texas Dynamics Workshop. Trinity University, San Antonio, Texas. April 8-9, 2005.
- 2004 Texas Dynamics Workshop. University of Houston, Houston, Texas. March 26-27, 2004.
- Dynamical Systems Denton 2003 Conference. University of North Texas, Denton, Texas. May 25-29, 2003.
- 2003 Texas Dynamics Workshop. University of Texas at Austin, Austin, Texas. March 27-28, 2003.