## Contact Information


| | |
|---|---|
| Address: | Florida Atlantic University |
| | Department of Mathematical Sciences |
| | Science Building, Room 234 |
| | 777 Glades Road |
| Telephone: | (561)-297-2490 |
| E–mail: | jmirelesjames@fau.edu |


## Areas of Interest

- 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, Florida Atlantic University, Department of Mathematical Sciences. August 2019 – Prestent.
- 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.

### Ph.D. Students

- Shane Kepley. Graduation 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.*
- Jorge Gonzalez. Florida Atlantic University (Current: co-supervised with Dr. Necibe Tuncer).
- Maxime Murray. Florida Atlantic University (Current).
- Emmanuel Fleurantin, Florida Atlantic University (Current: co-supervised with Dr. Vincent Naudot).
- David Blessing. Florida Atlantic University (Current).
- Archana Neupane Timsina. Florida Atlantic University (Current).

## Service and Memberships

- Faculty Associate for the Spring 2019 Fulbright Scholarship of Maciej Capinski (affiliated with AGH University, Krakow, Poland) - Proposal entitled "Diffusion in Celestial Mechanics".
- Florida Atlantic University Peace, Justice, and Human Rights Initiative Affiliate Faculty Member.
- Member of the American Mathematical Society and the Society for Industrial and Applied Mathematics.

- Member Ph.D. committee of Hasala Senpathy Karunaratne Gallolu Kankanamalage: *Output stability analysis for nonlinear systems with time delays.* Department of Mathematical Sciences, Floriad Atlantic University. (Successful defense June, 2017).
  Member Ph.D. committee of Vermont Rutherfoord: *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 Journal of Differential Equations, SIAM Journal on Applied Dynamical Systems, Nonlinear Differential Equations and Applications, Communications in Nonlinear Science and Numerical Simulations, Journal of Computational Dynamics, and others.

- Member of the Department of Mathematical Sciences undergraduate committee on curriculum.

- Chair of the Department of Mathematical Sciences Learning Community: active learning in the Calculus curriculum at FAU. (Fall 2018, Spring 2019).

**Research Support, Fellowships, and Awards**

- 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: Llavefest: a broad perspective on finite and infinite dimensional dynamical systems (FIDDS-17)" $\$20,000$ (May - July 2017).

- Florida Atlantic University Curriculum Grant: $\$10,000$ awarded August 2016.

- AMS-Simmons Travel Grant (Awarded in Summer 2013).

- 2010 Frank Gerth III Dissertation Award, Department of Mathematics, University of Texas at Austin.

## Book Chapters

- "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.

## Refereed Journal Articles

1. "Parameterization method for unstable manifolds of standing waves on the line," with Blake Barker and Jalen Morgan (Submitted).
2. "Finite element approximation of invariant manifolds by the parameterization method," with Jorge Gonzalez and Necibe Tuncer (Submitted).
3. "A functional analytic approach to validated numerics for eigenvalues of delay equations," with J.P. Lessard (Submitted).
4. "Computer assisted proofs of contracting invariant tori for ODEs," with Maciej Capinski and Emmanuel Fleurantin (Submitted).
5. "Torus knot choreographies in the $n$-body problem," with Renato Calleja, Carlos García-Azpeitia, and J.P. Lessard (Submitted).
6. "Transport barriers, resonance tori, and torus-chaos in a vector field with a Naimark-Sacker Bifurcation," with Emmanuel Fleurantin (Submitted).
7. "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, March 2019, 131:13.
8. "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, January 2019, 131:2.
https://doi.org/10.1007/s10569-018-9879-8.
9. "Validated numerics for continuation and bifurcation of connecting orbits for maps," with Ronald Adams. The Qualitative Theory of Dynamical Systems, April 2019, Vol 18, Issue 1, pp 107-137.
10. "Fourier-Taylor Parameterization of Unstable Manifolds for Parabolic Partial Differential Equations: Formalism, Implementation, and Rigorous Validation" with Christian Reinhardt. Indagationes Mathematicae, Volume 39 (2019), pp. 39-80.
11. "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).

12. "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

13. "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)

14. "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.

15. "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

16. "High-order parameterization of stable/unstable manifolds for long periodic orbits of maps," with Jorge Gonzalez, SIAM Journal on Applied Dynamical Systems, Vol 16(3), pp. 1748 – 1795, 2017.

17. "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.

18. "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

19. "Validated computation of heteroclinic sets" with Maciej Capinski, SIAM Journal on applied dynamical systems, Vol 16, Issue 1, pp. 375–409, 2017.

20. "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.

21. "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.

22. "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.

23. "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.

24. "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.

25. "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.

26. "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.

27. "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.

28. "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.

29. "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.

30. "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

31. "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.

32. "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.

33. "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.

34. "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.

35. "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.

36. "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.

37. "Computational Proofs in Dynamics" with K. Mischaikow. Invited Submission to Encyclopedia of Applied and Computational Mathematics. Editor B. Engquist. To Appear in 2016.

38. "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.

39. "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.

**Other Past and Present Student Research Projects**

- *Automatic Algorithms for Maximizing Invariant Manifold Computations* with Maxime Breden, CMLA, ENS Cachan and CNRS, Paris, France.
- *Validated Computations for Infinite Dimensional Stable Manifolds of Parabolic PDEs* with Jonathan Jaquette, Rutgers.
- *Validated inner approximation of Julia sets for complex analytic dynamical systems* with Haripriya Chakraborty, formerly Rutgers University. (Speaker at 2014 JMM).
- *Computer assisted proof of analytic decay rates for periodic problems in applied math* with Allan Hungria, formerly Rutgers University. (Speaker at 2014 JMM).
- *Computer assisted proof of Hexagonal Roll structures for PDE's* with Andréa Deschênes, Laval University, Quebec City.
- *Computer assisted proof of connecting orbits for vector fields* with Christian Reinhardt, formerly TUM University, Munich.
- *Computer assisted proof of periodic orbits for non-polynomial differential equations* with Julian Ransford of Laval University.

- *Invariant Manifolds, the Hartman-Grobman Theorem, and Applications* with Yuri Boaventura, USP São Carlos.

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

- MAD 6407: Numerical Analysis (Graduate Course): Fall 2019.
- MAC 2312: Calculus-Analytic Geometry II: Fall 2019, Summer 2017.
- MAP 6335: Ordinary Differential Equations (Graduate Course): Spring 2019 and 2017.
- MAP 3305: Engineering Mathematics I: Fall 2018, Spring 2015.
- MAC 2313 Calculus and Analytic Geometry III: Fall 2018, Spring 2018.
- MAC 2311 Calculus and Analytic Geometry I: Summer 2018 (sections 2 and 5).
- MAP 2302 Differential Equations I: Spring 2018.
- MAA 4200 Modern Analysis: Fall 2017.
- 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.

## Educational and Outreach

- 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," a three day graduate short course taught with J.P. Lessard at the Instituto de Investigaciones en Matemáticas Aplicadas y en Sistemas, Universidad Nacional Autónoma de México, Mexico City, Mexico, August 1st-3rd, 2018. Course webpage: `https://mym.iimas.unam.mx/renato/curso.html`
  (notes, slides, and videos available)
- 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." Florida Atlantic 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.

- *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 $25 - 26$, 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

- "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. Stanislawa 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, Yesheva 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, Paradice 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 Mecnica, Universidad Nacional Autánoma 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

- "Choreographies in the n-body problem and delay differential equation" 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 SystemsSeminar, 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-Marshal 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.

## Conferences, Workshops, Schools, and Meetings Attended

- 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 Tècnico, 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.