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Experience

2023 – present	Associate Professor, Monmouth University.
2018 – 2023	Assistant Professor, Monmouth University.
2013 – 2018	Assistant Professor, State University of New York (SUNY) at New Paltz.
2011 – 2013	Atlantic Association for Research in the Mathematical Sciences (AARMS) Postdoctoral Fellow, Dalhousie University.
2009 – 2011	Natural Sciences and Engineering Research Council (NSERC) of Canada Postdoctoral Fellow, McGill University.

Research Visit

2024	Mathematics Department of Orsay, Université Paris–Saclay, France.
2024	Department of Mathematics and Statistics, Memorial University of Newfoundland, Canada.
2017	Department of Mathematics and Statistics, Memorial University of Newfoundland, Canada.

Education

2009	Ph.D. in Mathematics, University of Minnesota, Twin Cities. **Thesis:** Applications of Moving Frames to Lie Pseudo-Groups
2007	M.Sc. in Mathematics, University of Minnesota, Twin Cities.
2005	M.Sc. in Physics, Université de Montréal.
2003	B.Sc. in Mathematics and Physics, Université de Montréal.

Research Interests

Differential geometry, discrete geometry, differential equations, finite difference equations, geometric numerical analysis, Lie pseudo-groups, moving frames, symmetry, variational calculus.

Research

Peer-Reviewed Journal Articles

[1] (Arora, S. and Bihlo, A.) Invariant physics-informed neural networks for ordinary differential equations, *J. of Machine Learning Research (JMLR)* **25** (2024), 1–24.

[2] (With Olver, P.J. and Sabzevari, M.) Normal forms, moving frames, and differential invariants for nondegenerate hypersurfaces in $\mathbb{C}^2$, *J. Geo. Anal.* **33** (2023), 192.

[3] (With Bihlo, A., and Jackaman, J.) Invariant variational schemes for ordinary differential equations, *Stud. App. Math.* **148** (2022), 991–1020.

[4] (With Arnaldsson, Ö) Invariants of surfaces in three-dimensional affine geometry, *SIGMA* **17** (2021), 033.

[5] (With Benson, J.) Discrete curve flows in two-dimensional Cayley–Klein geometries, *Proceeding of the Symposium Quantum Theory and Symmetry XI July 1st to 5th, 2019*, CRM Series in Mathematical Physics, Springer (2021), 157–167.

[6] (With Benson, J.) Geometric curve flows in low dimensional Cayley–Klein geometries, *J. Int. Sys.* **5** (2020), xyaa003.

[7] (With Bihlo, A., and Jackaman, J.) On the development of symmetry-preserving finite element schemes for ordinary differential equations, *J. Comp. Dyn.* **7** (2020), 339–368.

[8] (With Bihlo, A.) Symmetry-preserving finite element schemes: An introductory investigation, *SIAM J. Sci. Comput.* **41** (2019), A3300–A3325.

[9] (With Benson, J.) Invariant discrete flows, *Stud. Appl. Math.* **143** (2019), 81–119.

[10] (With Olver, P.J.) Recursive moving frames for Lie pseudo-groups, *Results in Math.* **73** (2018), 57.

[11] Symmetry reduction of ordinary differential equations using moving frames, *J. Nonlin. Math. Phys.* **25** (2018), 211–246.

[12] (With Thompson, R.) Group foliation of finite difference equations, *Commun. Nonlinear Sci. Numer. Simul.* **59** (2018), 235–254.

[13] (With Benson, J.) Symmetry reduction of ordinary finite difference equations using moving frames, *J. Phys. A: Math. Theor.* **50** (2017), 195201.

[14] (With Miro, B.[†], and Rose, D.[†]) Equivalence of one-dimensional second-order linear finite difference operators, *J. of Diff. Eq. and Appl.* **22** (2016), 1524–1541.

[15] (With Thompson, R.) Group foliation of differential equations using moving frames, *Forum of Mathematics, Sigma* **3** (2015), e22.

[16] (With Rebelo, R.) Invariant discretization of partial differential equations admitting infinite-dimensional symmetry groups, *J. Diff. Eq. and Appl.* **21** (2015), 285–318.

[17] (With Milson, R.) Point equivalence of second-order ODEs: Maximal invariant classification order, *J. Symb. Comp.* **67** (2015), 16–41.

[18] (With Rebelo, R.) Symmetry preserving numerical schemes for partial differential equations and their numerical tests, *J. of Diff. Eq. and Appl.* **19** (2013), 738–757.

[†]Undergraduate student co-author.

[19] Solving local equivalence problems with the equivariant moving frame method, *SIGMA* **9** (2013), 029.

[20] Inductive moving frames, *Results in Math.* **64** (2013), 37–58.

[21] Geometric affine symplectic curve flows in $\mathbb{R}^4$, *J. Diff. Geo. and its Appl.* **30** (2012), 631–641.

[22] (With Thompson, R.) On the cohomology of the invariant Euler–Lagrange complex, *Acta Applicandae Math.* **116** (2011), 199–226.

[23] Equivariant moving frame method and the local equivalence of $u_{xx} = r(x, u, v, u_x, v_x)$ under fiber-preserving transformations, *J. of Dynamical and Control Systems* **17** (2011), 555–589.

[24] (With Itskov, I., and Olver, P.J.) Lie completion of pseudo-groups, *Transformation Groups* **16** (2011), 161–173.

[25] (With Olver, P.J., and Pohjanpelto, J.) On the structure of Lie pseudo-groups, *SIGMA* **5** (2009), 077.

[26] Structure equations of Lie pseudo-groups, *J. of Lie Theory* **18** (2008), 869–895.

[27] Comment on 'Invariants of differential equations defined by vector fields', *J. of Phys. A: Math. Theor.* **41** (2008), 478001.

[28] (With Winternitz, P.) Discretization of partial differential equations preserving their physical symmetries, *J. Phys. A: Math. Gen.* **38** (2005), 9765–9783.

[29] Discretizations preserving all Lie point symmetries of the Korteweg-de Vries equation, *Group Theoretical Methods in Physics: Proceedings of the XXV International Colloquium on Group Theoretical Methods in Physics, Cocoyoc, Mexico, 2–6 August, 2004*, Editors: G.S. Pogosyan, L.E. Vicent, and K.B. Wolf, Institute of Physics, Conference Series Number 185, CRC Press (2005), 539–544.

[30] (With Mousseau, N.) Energy landscape around a minimum in a-Si, *Phys. Rev. B* **68** (2003), 125209.

[31] (With Mousseau, N., Beaucage P.) Numerical studies of the dynamics of silicon: Relaxation, nucleation and energy landscape, invited paper, Symposium A, MRS Spring Meeting 2003, San Francisco.

Peer-Reviewed Book Chapter

[32] (With Bihlo, A.) Symmetry-preserving numerical schemes, in *Symmetries and Integrability of Difference Equations: Lecture Notes of the Abecederian School of SIDE 12, Montréal 2016*, CRM Series in Mathematical Physics, Springer (2017), 261–324.

In Progress

[33] (With Olver, P.J. and Sabzevari, M.) Convergence of normal form power series for infinite-dimensional Lie pseudo-group actions.

Undergraduate Research Supervision

2017 Jonathan Colón (SURE[‡] awardee), *Bäcklund transformations of finite difference equations.*

2017 Jonathan Colón (AYURE[§] awardee), *Point equivalence of scalar second-order ordinary finite difference equations.*

2015 Olivia Seirup (SURE awardee), *Discrete equi-affine invariant variational problems in the plane.*

2015 Bradley Miro and Dylan Rose (AYURE awardees), *Equivalence of 1-dimensional linear second-order finite difference operators.*

2014 Ali Immel (SURE awardee), *Numerical investigation of the group foliation method.*

2014 Olivia Seirup, *Applications of moving frames in the Euclidean plane.*

Independent Studies

2024 Eliana Joskowski, *Complex Analysis.*

2016 Samantha Wyler, *Sturm–Liouville theory, orthogonal functions, and boundary value problems.*

2016 Jonathan Colón, *Applications of Lie group analysis in financial mathematics.*

2015 Nicholas France, *Lie groups and their applications in physics.*

Teaching Experience

Monmouth University

Applied Discrete Mathematics, Calculus with Analytic Geometry I, Calculus with Analytic Geometry II, Introduction to Mathematical Reasoning, Linear Algebra, Pre-Calculus Mathematics, Pre-Calculus Modeling for the Biological Sciences, Quantitative Analysis for Business II, Quantitative Reasoning and Problem Solving, Real Analysis.

SUNY at New Paltz

Applied Mathematics 1, Applied Mathematics 2, Axiomatic Geometry, Calculus 2, Calculus 3, Calculus 4, College Mathematics, Foundations of Analysis, Intermediate Analysis 1, Linear Algebra, Ordinary Differential Equations, Precalculus.

Dalhousie University

Applied Analysis, Intermediate Calculus 1, Intermediate Calculus 2, Introduction to Complex Variables, Matrix Theory and Linear Algebra 2.

McGill University

Ordinary Differential Equations for Engineers, Advanced Calculus for Engineers, Calculus 3.

University of Minnesota

Precalculus.

[§]AYURE = Academic Year Undergraduate Research Experience (Competitive award).
[§]SURE = Summer Undergraduate Research Experience (Competitive award).

Services

Seminar and Conference Organization

2022	Co-organizer, *Symmetry, Invariants, and their Applications: A Celebration of the 70th Birthday of Peter Olver*, Dalhousie University, Canada, August 3–5.
2021	Co-organizer, *Moving Frames and their Modern Applications*, BIRS, Canada, November 22–26.
2020	Co-organizer, *Moving Frames and their Modern Applications*, BIRS, Canada, July 6 – July 10. (Canceled due to COVID-19 pandemic)
2018 – present	*Math & Cookies* (Student Seminar), Monmouth University.
2016	*11th Annual Spuyten Duyvil Undergraduate Mathematics Conference*, SUNY New Paltz, April 23.
2014 – 2018	*Math & Cookies* (Student Seminar), SUNY New Paltz.
2013 – 2018	*Mathematics Research Seminar*, SUNY New Paltz.
2013	*Computational Aspects of Moving Frames*, SIAM Conference on Applied Algebraic Geometry, Colorado State University, USA, August 1–4.
2013	*Pseudogroups and their Applications*, Canadian Mathematical Society Summer Meeting, Dalhousie University, Canada, June 4–7.
2012	*Summer Undergraduate Research Seminar*, Dalhousie University.
2011	*Workshop on Moving Frames in Geometry*, Centre de Recherches Mathématiques, Montréal, Canada, July 13–17.
2008 – 2009	*Mathematical Physics Research Seminar*, University of Minnesota, Twin Cities.
2008 – 2009	*Junior Colloquium* (Graduate Student Seminar), University of Minnesota, Twin Cities.
2008 – 2009	*Undergraduate Math Club Seminar*, University of Minnesota, Twin Cities.

Refereeing Service

- Acta Applicandae Mathematicae
- Analysis and Mathematical Physics
- Axioms
- Communications in Nonlinear Science and Numerical Simulation
- Computer Algebra in Scientific Computing
- Discrete and Continuous Dynamical Systems
- Foundations of Computational Mathematics
- International Symposium of Symbolic and Algebraic Computation
- Involve, a Journal of Mathematics
- Journal of Geometry and Physics
- Journal of Mathematical Analysis and Applications
- Journal of Mathematical Physics
- Journal of Nonlinear and Mathematical Physics

- Journal of Physics A: Mathematical and Theoretical
- La Matematica
- Lecture Notes in Computer Science
- Letters in Mathematical Physics
- LMS Journal of Computation and Mathematics
- Mathematical Physics, Analysis and Geometry
- Mathematics
- Minnesota Journal of Undergraduate Mathematics
- Open Communications in Nonlinear Mathematical Physics
- Physica Scripta
- Proceedings of the Institute of Applied Mathematics
- Reports on Mathematical Physics
- SIGMA (Symmetry, Integrability and Geometry: Methods and Applications)
- Symmetry
- The European Physical Journal Plus
- Transactions of Mathematics and Its Applications

Reviewing Service

2024	Standard Projects 2025, GAČR Czech Science Foundation.
2024	Ph.D. thesis review: Julien Heyd, *Applications géométriques de la méthode d'équivalence d'Élie Cartan*, Université Paris–Saclay.
2018	Innovational Research Incentives Scheme Veni, The Netherlands Organisation for Scientific Research (NWO).
2015	Poster on the Hill Reviewer, Council on Undergraduate Research.
2011 – present	Mathscinet Reviewer, American Mathematical Society (33 reviews).

Editorial Service

2022 – 2024	Guest editor, SIGMA Special Issue on Symmetry, Invariants, and their Applications in Honor of Peter J. Olver's 70th Birthday.

Monmouth University Service

2024 – present	Member, School of Science Personnel Committee
2023 – present	Faculty Peer Observer.
2021 – present	Member, Honors School Council.
2020 – present	Course Champion, MA118 – Quantitative Analysis for Business II.
2020 – 2023	Member, Math Placement Test Assessment, Department of Mathematics.
2019 – present	Student Academic Advisor (On average 3 students per semester).
2019	Panel member, New Faculty Orientation.
2019	Conference program booklet chairperson, Metropolitan Association of College and University Biologists (MACUB) conference, October 26.

2019 – 2022 Chair, School of Science Scholarship Committee.

2019 – present Member, Mathematics Department Sabbatical Committee.

SUNY New Paltz Service

2018 Faculty Reappointment, Tenure, and Promotion Department Sub-Committee.

2016 – 2018 Advisory Board Member: Undergraduate Research, Scholarship and Creative Activities.

2016 – 2017 Lecturer Search Committee.

2016 Chair, Discretionary Salary Award Department Sub-Committee.

2016 Open House for Accepted Students, April 2.

2016 Faculty Reappointment, Tenure, and Promotion Department Sub-Committee.

2015 – 2017 Mathematics Adjuncts Search Committee.

2015 Discretionary Salary Award Department Sub-Committee.

2015 – 2018 Precalculus Course Coordinator.

2015 – 2018 Robinson and Robison Mathematical Excellence Awards Committee.

2015 Open House for Accepted Students, March 28.

2014 – 2015 Faculty Advisor, Association for Women in Mathematics SUNY New Paltz Chapter.

2014 – 2018 Student Academic Advisor (On average 15 students per semester).

2014 Community Outreach Initiative at Esopus Hall, April 2.

2014 Open House for Incoming Students, April 5.

2014 "Meet the Faculty" Orientation for Incoming Students, August 22.

2013 – 2014 Faculty Search Committee.

2013 Fall Open House, October, 26.

New York State Master Teacher Service

2017 Program Interviewer, June 3.

2016 Program Interviewer, August 27.

2015 Workshop, *Mamikon's Visual Calculus*, September 14.

2015 Program Interviewer, June 20.

2014 Program Interviewer, February 15.

2014 Program Interviewer, November 15.

Grants

2022 NSF-2217293: *Conference on Symmetry, Invariants, and their Applications*, Dalhousie University, Canada, August 3–5, 2022 ($35,883 USD).

2022 Atlantic Association for Research in the Mathematical Sciences (AARMS) Conference Grant: *Symmetry, Invariants, and their Applications: A Celebration of Peter Olver's 70th Birthday*, Dalhousie University, Canada, August 3–5, 2022 ($8,000 CAD).

Fellowships and Awards

2020 *Summer Faculty Fellowship*, Monmouth University.

2011 – 2013 *AARMS Postdoctoral Fellowship.*

2009 – 2011 *NSERC Postdoctoral Fellowship (PDF).*

2009 – 2011 *Postdoctoral Research Fellowship (B3)* (declined), Fond de recherche du Québec: Nature et technologies (FQRNT).

2008 – 2009 *Doctorate Dissertation Fellowship*, University of Minnesota, Twin Cities.

2006, 2008 *Summer Fellowship*, University of Minnesota, Twin Cities.

2005 – 2008 *Doctoral Research Scholarship (B2)*, FQRNT.

2005 – 2007 *NSERC Postgraduate Scholarship (PGS D)* (declined).

2005 *Pico Nobel* (Teaching Assistant Award), Department of Physics, Université de Montréal.

2004 – 2005 *Sun Life scholarship*, Sun Life.

2003 – 2005 *Masters Research Scholarship (B1)*, FQRNT.

2003 – 2005 *NSERC Postgraduate Scholarship (ES A).*

2002 *GCM Summer Scholarship for Bachelor Students*, Groupe de recherche en physique et technologie des couches minces.

2002 *University Research Scholarship for Undergraduate Students*, NSERC.

2000 – 2004 *Member of the Provost Honour Roll (Faculty of Arts and Sciences)*, Université de Montréal.

2000 *Welcome Scholarship*, Université de Montréal.

Presentations

Research Talks

2024 • *Convergence of Normal Form Power Series for Infinite-Dimensional Lie Pseudo-Group Actions*, Harmonic Analysis Seminar, Université Paris–Saclay, Paris, France, September 10.

2023 • *Symbolic Invariant Calculus*, Semi-plenary lecture, Symbolic Analysis workshop, Foundations of Computational Mathematics, Université Sorbonne, Paris, France, June 19–21.

2020 • Semi-plenary lecture, Symbolic Analysis workshop, Foundations of Computational Mathematics (FoCM), Simon Fraser University, Vancouver, Canada, meeting canceled due to COVID-19 pandemic.

2019 • *Invariant Discrete Curve Flows*, 11$^{\text{th}}$ International Symposium: Quantum Theory and Symmetries, Centre de Recherche Mathématiques, Montréal, Canada.

2018 • *Group Foliation of Finite Difference Equations Using Equivariant Moving Frames*, Kolchin Seminar, CUNY Graduate Center, USA.

2017 • *Symmetry-Preserving Finite Element Methods: Preliminary Results*, Workshop on Connections in Geometric Numerical Integration and Structure-Preserving Discretization, Banff International Research Station for Mathematical Innovation and Discovery, Canada.

• *Equivariant Moving Frames and Symmetry Reduction of Ordinary Differential Equations*, Memorial University, Canada.

2016 • *Symmetry-Preserving Numerical Schemes*, CMS Winter Meeting, Niagara Falls, Canada.

• *Symmetry Reduction of Ordinary Finite Difference Equations Using Moving Frames*, 12^{th} International Conference on Symmetries and Integrability of Difference Equations (SIDE), Sainte-Adèle, Canada.

• *Symmetry-Preserving Numerical Schemes*, Abecedarian Summer School of SIDE, Université de Montréal, Canada.

2015 • *Equivariant Moving Frames*, Geometry and Symmetry based Mathematical and Computational Methods with Applications in Engineering, Science and Education, SUNY Polytechnic Institute, USA.

2014 • *Group Foliation of Finite Difference Equations*, 30^{th} International Colloquium on Group Theoretical Methods in Physics, University of Ghent, Belgium.

2013 • *Recursive Moving Frames*, Focused Research Workshop on Exterior Differential Systems and Lie Theory, Fields Institute, Canada.

• *What is a Moving Frame?*, Department Seminar, SUNY New Paltz, USA.

• *Recursive Moving Frames*, SIAM Conference on Applied Algebraic Geometry, Colorado State University, USA.

• *Recursive Moving Frames*, CMS Summer Meeting, Dalhousie University, USA.

• *Symmetries, Moving Frames, and Group Foliation*, SUNY New Paltz, USA.

2012 • *Group Foliation of Differential Equations Using Moving Frames*, CMS Winter Meeting, Montréal, Canada.

• *Group Foliation of Differential Equations Using Moving Frames*, Colloquium, Dalhousie University, Canada.

• *Repère Mobiles Équivariants et la Méthode de Foliation d'une Équation par son Groupe de Symétrie*, Colloque, Université Laval, Canada.

• *Symmetries and Moving Frames*, Dalhousie Postdoc Research Day, Dalhousie University, Canada.

• *Recursive Moving Frames for Lie Pseudo-Groups*, Symmetries of Differential Equations: Frames, Invariants and Applications: A conference in honor of the 60th birthday of Peter Olver, University of Minnesota, Twin Cities, USA.

2011 • *Inductive Moving Frames*, Colloquium, Dalhousie University, Canada.

• *Equivariant Moving Frames, Lie Pseudo-Groups, and Local Equivalence Problems*, Special Seminar, North Carolina State University, USA.

2010 • *Solving Local Equivalence Problems with the Equivariant Moving Frame Method*, AMS Sectional Meeting, Special Session on Geometric Flows, Moving Frames and Applications, Macalester College, USA.

• *Solving Local Equivalence Problems with the Equivariant Moving Frame Method (Extended Version)*, Mathematical Physics Seminar, University of Minnesota, Twin Cities, USA.

2009 • *The Local Cohomology of the Invariant Variational Bicomplex*, Centre interuniversitaire de recherche en géométrie et topologie, Université du Québec à Montréal, Canada.

• *Comparison of Cartan's and Olver–Pohjanpelto's Structure Equations of Lie Pseudo-Groups*, Mathematical Physics Seminar, University of Minnesota, Twin Cities, USA.

• *The Invariant Variational Bicomplex*, Mathematical Physics Seminar, University of Minnesota, Twin Cities, USA.

• *Differential Invariant Algebra of the Infeld–Rowlands Equation*, Mathematical Physics Seminar, University of Minnesota, Twin Cities, USA.

2008 • *Structure Equations of Lie Pseudo-Groups*, Mathematical Physics Seminar, University of Minnesota, Twin Cities, USA.

Talks for Students

2024 • *Feynman's Integration Trick*, Math & Cookies, Monmouth University, USA.

2019 • *Mamikon's Visual Calculus*, Math & Cookies, Monmouth University, USA.

2018 • *Using Linear Algebra to Evaluate Certain Indefinite Integrals*, Math & Cookies, Monmouth University, USA.

2017 • *Lambert W Function*, Math & Cookies, SUNY New Paltz, USA.

• *Equivariant Moving Frames*, Hudson River Undergraduate Research Conference, Westfield State University, USA.

2016 • *Discrete Calculus*, 11$^{\text{th}}$ Annual Spuyten Duyvil Undergraduate Mathematics Conference, SUNY New Paltz, USA.

2015 • *Moving Frames*, 10$^{\text{th}}$ Annual Spuyten Duyvil Undergraduate Mathematics Conference, Manhattan College, USA.

• *Summability of Divergent Series*, Math & Cookies, SUNY New Paltz, USA.

2013 • *The Pythagorean Theorem*, Math & Cookies, SUNY New Paltz, USA.

• *Symmetries and Their Applications*, Mid-Hudson Mathematics Conference for Undergraduates, Bard College, USA.

• *Symmetry*, Amherst College, USA.

2011 • *An Introduction to Equivariant Moving Frames*, Graduate Student Seminar, Dalhousie University, Canada.

2010 • *Group Foliation of PDE Using Moving Frames*, ISM Graduate Students Seminar, McGill University, Canada.

• *Integration of Invariant ODE Using Moving Frames*, Centre interuniversitaire de recherche en géométrie et topologie – Junior Seminar, Université du Québec à Montréal, Canada.

2009 • *Symmetries of Differential Equations*, Junior Colloquium, University of Minnesota, Twin Cities, USA.

2008 • *Classical Invariant Theory Through an Example*, Undergraduate Math Club, University of Minnesota, Twin Cities, USA.

• *Differential Invariants*, Undergraduate Math Club, University of Minnesota, Twin Cities, USA.

• *Equivalence Problems*, Junior Colloquium, University of Minnesota, Twin Cities, USA.

• *Symmetry and Integration of Ordinary Differential Equations*, Junior Colloquium, University of Minnesota, Twin Cities, USA.

2007 • *Moving Frames for Lie Pseudo-Groups*, Junior Colloquium, University of Minnesota, Twin Cities, USA.

• *Symmetries in Variational Problems*, Junior Colloquium, University of Minnesota, Twin Cities, USA.

2006 • *Exterior Calculus and Maxwell's Equations*, Junior Colloquium, University of Minnesota, Twin Cities, USA.

2005 • *Discrétisation invariante des équations différentielles*, Colloque panquébécois ISM des étudiants avancés en mathématiques, Canada.

• *Théorème de Noether*, Institut des sciences mathématiques, Université du Québec à Montréal, Canada.

2004 • *Symétries et résolution d'équations différentielles ordinaires du premier ordre*, Séminaire des étudiants en mathématiques, Université de Montréal, Canada.