Peter Stechlinski

Department of Mathematics and Statistics
University of Maine
5752 Neville Hall, Room 226
Orono, ME, United States, 04469-5752

+1 (857) 498-5332
peter.stechlinski@maine.edu
umaine.edu/stechlinskilab
May 30, 2024

ACADEMIC POSITIONS

2022–	Associate Professor, Department of Mathematics and Statistics, University of Maine, Orono ME
2022–23, 2024–	Graduate Coordinator, Department of Mathematics and Statistics, University of Maine, Orono ME
2017–22	Assistant Professor, Department of Mathematics and Statistics, University of Maine, Orono ME
2015–17	Postdoctoral Fellow, Process Systems Engineering Laboratory, Department of Chemical Engineering, Massachusetts Institute of Technology, Cambridge MA

EDUCATION

2014	Ph.D., Department of Applied Mathematics, University of Waterloo, Waterloo, Canada
2009	M.Math, Department of Applied Mathematics, University of Waterloo, Waterloo, Canada
2007	B.Math, Department of Applied Mathematics, University of Waterloo, Waterloo, Canada

PUBLICATIONS

Journal Articles

— H. Abdelfattah, S. Eisa and P. Stechlinski. A new nonsmooth optimal control framework for wind turbine power systems, **submitted**.

— P. Stechlinski, S. Eisa and H. Abdelfattah. Identifiability and observability of nonsmooth systems via Taylor-like approximations, **submitted. arXiv:2403.12930**

2023 J. Donnelly and P. Stechlinski. Analyzing the influence of agents in trust networks: applying nonsmooth eigensensitivity theory to a graph centrality problem, **SIAM Journal on Matrix Analysis and Applications**, 44 (28 pages).

2023 C. Butler and P. Stechlinski. Modeling Opioid Abuse: A Case Study of the Opioid Crisis in New England. **Bulletin of Mathematical Biology**, 85, 45 (28 pages).

2023 P. Stechlinski. Dynamic optimization of complementarity systems, **IEEE Transactions on Automatic Control**, 68, 1122-1129.

2022 P. Stechlinski. Generalized derivatives of eigenvalues of a symmetric matrix, **Linear Algebra and Its Applications** 649, 63-95.

2021 M. Ackley and P. Stechlinski. Determining key parameters in riots using lexicographic directional differentiation, **SIAM Journal on Applied Mathematics** 81, 1303-1331.

2021 P. Stechlinski. Theory of index-one nonlinear complementarity systems, **Journal of Differential Equations** 285, 99-127.

2021 M. Ackley and P. Stechlinski. Lexicographic derivatives of nonsmooth glucose-insulin kinetics under normal and artificial pancreatic responses, **Applied Mathematics and Computation** 395, 125876 (17 pages).

2021 S.A. Eisa and P. Stechlinski. Sensitivity analysis of nonsmooth power control systems with an example of wind turbines, **Communications in Nonlinear Science and Numerical Simulation** 95, 105633 (14 pages).

2021 P. Stechlinski and P.I. Barton. Nonsmooth Hessenberg differential-algebraic equations. **Journal of Mathematical Analysis and Applications** 495, 124721 (33 pages).

2020 P. Stechlinski. Optimization-constrained differential equations with active set changes. **Journal of Optimization Theory and Applications** 187, 266-293.

2019 P. Stechlinski, J. Jäschke and P.I. Barton. Generalized sensitivity analysis of nonlinear programs using a sequence of quadratic programs. **Optimization** 68, 485-508.

2018 P. Stechlinski, M. Patrascu, and P.I. Barton. Nonsmooth differential-algebraic equations in chemical engineering. **Computers and Chemical Engineering** 114, 52-68.

2018 P.I. Barton, K.A. Khan, P. Stechlinski, and H.A.J. Watson. Computationally relevant generalized derivatives: theory, evaluation and application. **Optimization Methods and Software** 33, 1030-1072.

2018 P. Stechlinski, K.A. Khan, and P.I. Barton. Generalized sensitivity analysis of nonlinear programs. **SIAM Journal on Optimization** 28, 272-301.

2018 X.Z. Liu and P. Stechlinski. Switching and impulsive control algorithms for nonlinear hybrid dynamical systems. **Nonlinear Analysis: Hybrid Systems** 27, 307-322.

2017 X.Z. Liu and P. Stechlinski. Switching vaccination schemes for vector-borne diseases with seasonal fluctuations. **Journal of Biological Systems** 25, 441-477.

2017 P. Stechlinski and P.I. Barton. Dependence of solutions of nonsmooth differential-algebraic equations on parameters. **Journal of Differential Equations** 262, 2254-2285.

2016 P. Stechlinski and P.I. Barton. Generalized derivatives of differential-algebraic equations. **Journal of Optimization Theory and Applications** 171, 1-26.

2016 X.Z. Liu and P. Stechlinski. Hybrid stabilization and synchronization of nonlinear systems with unbounded delays. **Applied Mathematics and Computation** 280, 140-161.

2015 X.Z. Liu and P. Stechlinski. Application of control strategies to a seasonal model of chikungunya disease. **Applied Mathematical Modelling** 39, 3194-3220.

2014 X.Z. Liu and P. Stechlinski. SIS models with switching and pulse control. **Applied Mathematics and Computation** 232, 727-742.

2014 X.Z. Liu and P. Stechlinski. Hybrid control of impulsive systems with distributed delays. **Nonlinear Analysis: Hybrid Systems** 11, 57-70.

2013 X.Z. Liu and P. Stechlinski. Existence results for a class of hybrid systems with infinite delay. **Dynamics of Continuous, Discrete & Impulsive Systems Series B: Applications & Algorithms** 20, 591-623.

2013 X.Z. Liu and P. Stechlinski. Transmission dynamics of a switched multi-city model with transport-related infections. **Nonlinear Analysis: Real World Applications** 14, 264-279.

2012 X.Z. Liu and P. Stechlinski. Infectious disease models with time-varying parameters and general nonlinear incidence rate. **Applied Mathematical Modelling** 36, 1974-1994.

2012 X.Z. Liu and P. Stechlinski. Control strategies applied to a stochastic disease model with term-time forcing. **Neural, Parallel & Scientific Computations** 20, 37-50.

2011 X.Z. Liu and P. Stechlinski. Pulse and constant control schemes for epidemic models with seasonality. **Nonlinear Analysis: Real World Applications** 12, 931-946.

2010 X.Z. Liu and P. Stechlinski. Stabilizability of a class of nonlinear systems using hybrid controllers. **The Journal of Nonlinear Sciences and Applications** 3, 203-221.

Research Monograph

2017 X.Z. Liu and P. Stechlinski. Infectious Disease Modeling: A Hybrid System Approach. **Springer Series in Nonlinear Systems and Complexity**, Vol. 19. Springer International Publishing, Cham, Switzerland.

Book Chapter

2018 P. Stechlinski, M. Patrascu, and P.I. Barton. Nonsmooth DAEs with Applications in Modeling Phase Changes. In: S. Campbell, A. Ilchmann, V. Mehrmann, T. Reis. (eds) **Applications of Differential-Algebraic Equations: Examples and Benchmarks**. Differential-Algebraic Equations Forum. Springer, Cham, Switzerland.

Conference Proceedings

– P. Stechlinski, H. Abdelfattah, S.A. Eisa, Sensitivity and optimal control theory for linear complementarity systems, **submitted**.

2016 P. Stechlinski and P.I. Barton. Generalized derivatives of optimal control problems with nonsmooth differential-algebraic equations embedded. In: **Proceedings of the 55th IEEE Conference on Decision and Control**, Las Vegas NV, 592-597.

2016 P. Stechlinski and X.Z. Liu. Robust synchronization of distributed-delay systems via hybrid control. In: J. Bélair, I.A. Frigaard, H. Kunze, R. Makarov, R. Melnik, R.J. Spiteri (eds) **Mathematical and Computational Approaches in Advancing Modern Science and Engineering**. Springer, Cham, Switzerland.

2015 P. Stechlinski and X.Z. Liu. Stabilization of impulsive systems via open-loop switched control. **Springer Proceedings in Mathematics & Statistics: Interdisciplinary Topics in Applied Mathematics, Modeling and Computational Science** 117, 425-431.

2011 P. Stechlinski and X.Z. Liu. Stabilization of a class of nonlinear systems using state-dependent switching control and impulsive control. **AIP Conference Proceedings** 1368, 77-80.

GRANTS AND FELLOWSHIPS

2024–27	NSF AMPS Standard Grant (DMS 2318773). Collaborative Research: New sensitivity and control theory and tools for systems exhibiting extreme behaviors and faults with application to wind turbines (PI, joint with Sameh Eisa, University of Cincinnati)
2021-22	University of Maine – EMPOWER Program
2018	University of Maine, College of Liberal Arts and Sciences – Pre-Tenure Faculty Research and Creative Activity Fellowship
2018	Bangor Savings Bank and Lyndon Paul Lorusso Memorial Faculty Development Fund – Travel Grant
2015-17	Natural Sciences and Engineering Research Council of Canada – Postdoctoral Fellowship (NSERC PDF)
2011	Natural Sciences and Engineering Research Council of Canada – Alexander Graham Bell Canada Graduate Scholarship (CGS D)

SEMINARS AND PRESENTATIONS

Conference Presentations

2023	Optimal control of nonsmooth dynamical systems via direct methods. *Conference on Applied Mathematics, Modeling and Computational Science (AMMCS)*, Waterloo, Canada.
2023	Optimal control of nonsmooth dynamical systems via direct methods. *SIAM Conference on Control and Its Applications*, Philadelphia, PA.
2022	Theory of optimization-constrained ODEs. *Scientific Computation And Differential Equations (SciCADE)*, Reykjavik, Iceland.
2022	Sensitivity analysis for nonsmooth dynamical systems. *AMS Spring Eastern Sectional Meeting*, Medford, MA [virtual].
2021	Determining influential parameters in nonsmooth models of riots. *SIAM Annual Meeting*, Spokane, WA [virtual].
2020	Sensitivity analysis for nonsmooth biological models. *Joint Annual Meeting between the Society for Mathematical Biology and the European Society for Mathematical Biology (eSMB 2020)*, Toronto, Canada [virtual].
2020	Sensitivity analysis for nonsmooth models. *Second Joint Society for Industrial and Applied Mathematics (SIAM) and The Canadian Applied and Industrial Mathematics Society (CAIMS) Annual Meeting*, Toronto, Canada [virtual].
2019	Theory of optimization-constrained differential equations. *Conference on Applied Mathematics, Modeling and Computational Science (AMMCS)*, Waterloo, Canada.
2019	Theory of nonsmooth DAEs with generalized differentiation index one. *Scientific Computation And Differential Equations (SciCADE)*, Innsbruck, Austria.

2018 Sensitivity analysis for dynamical systems with optimization problems embedded.
SIAM Annual Meeting, Portland, OR.

2018 Generalized sensitivity analysis of nonlinear programs.
23^{rd} *International Symposia on Mathematical Programming (ISMP)*, Bordeaux, France.

2017 Computing generalized derivative elements of nonlinear programs.
XI Int. Conf. on Parametric Optimization & Related Topics (Paraopt), Prague, Czech Republic.

2017 Generalized derivatives of nonsmooth dynamical systems.
Scientific Computation And Differential Equations (SciCADE), Bath, England.

2017 Generalized derivatives of nonlinear programs for use in model predictive control.
SIAM Conference on Control and Its Applications, Pittsburgh, PA.

2017 Generalized derivatives of nonlinear programs.
SIAM Conference on Optimization, Vancouver, Canada.

2016 Optimal control of nonsmooth differential-algebraic equations.
55*th IEEE Conference on Decision and Control*, Las Vegas, NV.

2016 Computing sensitivities for nonsmooth differential-algebraic equations.
AIChE Annual Meeting, San Francisco, CA.

2016 Sensitivity analysis of nonsmooth differential-algebraic equations.
SIAM Annual Meeting, Boston, MA.

2015 Switching controlled synchronization of nonlinear systems with time-delays.
2015 AMMCS-CAIMS Congress International Conference, Waterloo, Canada.

2014 Control strategies applied to a seasonal model of chikungunya disease.
Canadian Mathematical Society Winter Meeting, Hamilton, Canada.

2013 Recent results on stability of open-loop and closed-loop switched systems.
AMMCS-2013 International Conference, Waterloo, Canada.

2012 Stabilization of impulsive systems with distributed delays via hybrid control.
8*th International Conference on Differential Equations and Dynamical Systems*, Waterloo, Canada.

2011 Infectious disease models with switching general nonlinear incidence rate.
Canadian Mathematical Society Winter Meeting, Toronto, Canada.

2011 Stabilization of a class of nonlinear systems using state-dependent switching.
AMMCS-2011 International Conference, Waterloo, Canada.

2011 Stochastic epidemic models with seasonality.
6*th International Conference on Dynamical Systems and Applications*, Atlanta, GA.

2010 Epidemic models with switching.
Workshop on Hybrid Dynamical Systems, Waterloo, Canada.

Other Presentations

2024 The mathematics of chaos theory.
Math Club Talk, University of Maine, Orono, ME.

2024 Generalized derivatives of nonsmooth dynamical systems.
Applied Mathematics Seminar, University of Waterloo, Waterloo, Canada.

2024 Analyzing nonsmooth epidemic models using generalized derivatives.
Mathematical Biology Seminar, Queen's University, Kingston, Canada.

2023 Analyzing the influence of agents in trust networks.
Math Club Talk, University of Maine, Orono, ME.

2022 Nonsmooth analysis.
Mathematics Colloquium, University of Maine, Orono, ME.

2020 Modeling diseases using a hybrid system framework. [Canceled due to COVID-19.]
UMaine Medicine Seminar Series, University of Maine, Orono, ME.

2017 Nonsmooth differential-algebraic equations.
Department of Chemical Engineering Seminar, NTNU, Trondheim, Norway.

2017 Sensitivity analysis of nonsmooth dynamical systems.
Department of Mathematics & Statistics Seminar, McMaster University, Hamilton, Canada.

2017 Dynamic optimization of nonsmooth systems.
Mathematics Colloquium, University of Maine, Orono, ME.

2017 Hybrid dynamical systems with applications in epidemic modeling.
Department of Mathematics & Statistics Seminar, University of Maine, Orono, ME.

2016 Nonsmooth differential-algebraic equations.
MIT-SIAM Student Seminar Series, Cambridge, MA.

2014 Infectious disease modelling: a hybrid system approach.
Mathematical Biology Seminar, McMaster University, Hamilton, Canada.

2010 Epidemic models with switching.
University of Waterloo Graduate Student Research Conference, Waterloo, Canada.

TEACHING EXPERIENCE AND ACTIVITIES

University of Maine (Instructor of record)

MAT 126, Calculus I (×1)

MAT 258, Intro. to Differential Equations with Linear Algebra (×7)

MAT 259, Differential Equations (×2)

MAT 401, Capstone Seminar in Mathematics (×1)

MAT 425, Introduction to Real Analysis I (×2)

MAT 426, Introduction to Real Analysis II (×1)

MAT 451, Dynamical Systems (×2)

MAT 487, Numerical Analysis (×1)

MAT 500, Nonlinear Differential Equations (×2)

University of Waterloo (Instructor of record)

MATH 118, Calculus 2 for Engineering (×2)

Teaching Certificates, Workshops, and Conferences

EMPOWER Mentoring Dialogues Workshop, UIPIU *Summer 2022*

CLAS 8th annual Academic Advising Conference, University of Maine *Fall 2019*

Mobile Summer Institute (MoSI-UM), University of Maine *Summer 2019*

Kaufman Teaching Certificate Program (KTCP), Massachusetts Institute of Technology *Winter 2016*

PROFESSIONAL SERVICES AND ACTIVITIES

Thesis Supervision

2024 Cadi Howell. Analyzing nonsmooth neural mass models. Honors College thesis, University of Maine.

2023 Cameron Morin. Nonsmooth epidemic models with evolutionary game theory. M.A., Department of Mathematics and Statistics, University of Maine.

2022 Matthew Billingsley (co-advised). Sensitivity analysis of discontinuous ordinary differential equations. Ph.D., Department of Chemical Engineering, Massachusetts Institute of Technology.

2022 Llewellyn Searing. From points to potlucks: an exploration of fixed point theorems with applications to game theory models of successful integration practices. Honors College thesis, University of Maine.

2021 Matthew Ackley. Lexicographic sensitivity functions for nonsmooth models in mathematical biology. M.A., Department of Mathematics and Statistics, University of Maine.

2020 Cole Butler. A mathematical model of the opioid epidemic in the state of Maine. Honors College thesis (with highest honors), University of Maine.

2019 Jaeho Choi. Theory of lexicographic differentiation in the Banach space setting. M.A., Department of Mathematics and Statistics, University of Maine.

Conference and Workshop Organization

2023 Minisymposium Co-organizer. Unconventional Control: Nonsmooth and Geometric Methods, Theory, and Novel Applications, *SIAM Conference on Control and Its Applications (CT23)*, Philadelphia PA.

2021 Session Chair. Ecology and epidemiology, *SIAM Annual Meeting*, Spokane WA [virtual].

2021 Minisymposium Co-organizer. ODEs with Embedded Optimization Problems, *Scientific Computation And Differential Equations (SciCADE)*, Innsbruck, Austria. [Postponed due to COVID-19.]

2020 Minisymposium Organizer. Nonsmooth Dynamical Systems, *Second Joint SIAM/CAIMS Annual Meeting*, Toronto, Canada [virtual].

2019 Special Session Co-chair. Recent Progress in Hybrid and Complex Systems, *AMMCS*, Waterloo, Canada.

2019 Minisymposium Co-organizer. Simulation and Sensitivity Analysis of Nonsmooth Dynamical Systems, *Scientific Computation And Differential Equations (SciCADE)*, Innsbruck, Austria.

2017 Special Session Co-chair. Sensitivity and Stability, *ParaoptXI*, Prague, Czech Republic.

2017 Minisymposium Co-organizer. Nonsmooth Dynamical Systems, *Scientific Computation And Differential Equations (SciCADE)*, Bath, England.

2017 Session Chair. Nonlinear Optimization - Part I, *SIAM Conference on Optimization*, Vancouver, Canada.

2016 Minisymposium Co-organizer. Sensitivity Analysis and Optimality Conditions for Nonsmooth Problems, *SIAM Annual Meeting*, Boston MA.

2015 Special Session Co-chair. *Modeling, Analysis And Control In Hybrid Systems, AMMCS-CAIMS Congress International Conference*, Waterloo, Canada.

2012 Registration and Arrangements Duties. 8*th International Conference on Differential Equations and Dynamical Systems*, Waterloo, Canada.

2010 Organizing Committee. *Workshop on Hybrid Dynamic Systems*, Waterloo, Canada.

Journal Refereeing

- Advances in Difference Equations;
- Applied Mathematics and Computation;
- Applied Mathematical Modelling;
- Complexity;
- Computers and Chemical Engineering;
- Discrete and Continuous Dynamical System Series-B;
- European Journal of Operational Research;
- IEEE Transactions on Automatic Control;
- Journal of Biological Dynamics;
- Journal of Biological Systems;
- Journal of Computational Methods in Sciences and Engineering;
- Journal of Differential Equations;
- Journal of Mathematical Analysis and Applications;
- Journal of Nonlinear Systems and Applications;
- Mathematical Biosciences and Engineering;
- Mathematical Modelling and Analysis;
- Nonlinear Analysis: Real World Applications;
- Optimal Control Applications and Methods;
- SIAM Journal on Control and Optimization.

Professional Memberships

Society for Industrial and Applied Mathematics (SIAM).

Volunteering and Public Outreach

2023 Judge. *2023 UMaine Student Symposium*.

2023 Volunteer. *2023 Maine Science Olympiad*.

2022 Judge. *2022 UMaine Student Symposium*.

2021 Judge. *2021 UMaine Student Symposium*. [Virtual due to COVID-19]

2020 Faculty Fellows Program. *Margaret Chase Smith Policy Center*, Orono, ME.

2019 Judge. *2019 UMaine Student Symposium*, Bangor, ME.

2017 Mentor/Student NetPals Program. *Cambridge School Volunteers*, Cambridge, MA.