Alim Sukhtayev: Curriculum Vitae

Department of Mathematics
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Research Interests

Applied mathematics, analysis of partial differential equations, infinite dimensional dynamical systems and differential equations, stability of periodic and traveling waves.

Education

Ph.D. Mathematics, August 2007- July 2012, University of Missouri-Columbia , USA.
Thesis Advisor: Yuri Latushkin.
Thesis Title: "The Evans function, the Weyl-Titchmarsh function, and the Birman-Schwinger operators".

M.S. Mathematics, September 2005-June 2006, Tavrida National University, Ukraine.
Thesis Advisor: Irina Karpenko.
Thesis Title: "Spectral decomposition of normal operators in Hilbert quaternionic bimodule".

B.S. Mathematics (with Honors), September 2001-June 2005, Tavrida National University, Ukraine.

Appointments

Director of Graduate Studies, Miami University, USA, 2024-present;

Associate Professor, Miami University, USA, 2022-present;

Assistant Professor, Miami University, USA, 2017-2022;

Visiting Assistant Professor, Indiana University Bloomington, USA, 2015-2017;

Visiting Assistant Professor, Texas A&M University, USA, 2012-2015;

Teaching/Research Assistant, University of Missouri-Columbia, USA, 2007-2012;

Teaching Assistant, Crimean Engineering-Pedagogical University , Ukraine, 2006-2007.

Grants and Awards

NSF DMS-2317068 (2023-2024) conference grant to support Fall 2023 Mathematics Conference: Differential Equations and Dynamical Systems and Applications. PI: A. Sukhtayev, $14,880.00.

NSF DMS-1910820 (09.01.2019-08.31.2024) 'Spectral Stability and Oscillations of Dynamical Systems, Boltzmann-Like Models'. PI: A. Sukhtayev, $116,698.00.

NSF DMS-1919555 (2019-2020), conference grant to support Fall 2019 Mathematics Conference: Differential Equations and Dynamical Systems and Applications. Co-PI: A. Sukhtayev, $11,552.00

FRG (Focus Research Groups) grant from BIRS (Banff International Research Station). I spent one week (June 17- June 24, 2018) in Banff, Canada.

Summer Research Award CAS, Miami University, 2017.

AIM's SQuaRE research group (August 25-29, 2014; June 22-26, 2015) supported by American Institute of Mathematics, Palo Alto, CA (with G. Cox, M. Beck, C. Jones, Y. Latushkin).

Several awards in Mathematics High School Olympiads (Ukraine).

Publications

1. Splitting Quantum Graphs, submitted (with N. Smith)
   https://arxiv.org/abs/2402.07409

2. Spectral decomposition and decay to grossly determined solutions for a simplified BGK model, **J. Funct. Anal.** 287 (2024), no. 8, Paper No. 110546, 66 pp. (with K. Zumbrun)

3. Fredholm determinants, Evans functions and Maslov indices for partial differential equations, **Mathematische Annalen**, 2023. (with G. Cox, Y. Latushkin)

4. Renormalized Oscillation Theory for Singular Linear Hamiltonian Systems, **J. Funct. Anal.** 283 (2022), no. 3, Paper No. 109525, 74 pp. (with P. Howard)

5. Renormalized oscillation theory for linear Hamiltonian systems on [0, 1] via the Maslov index, **Journal of Dynamics and Differential Equations**, 2022. (with P. Howard)

6. A dynamical approach to semilinear elliptic equations, **Annales de l'Institut Henri Poincaré C, Analyse Non Linéaire**, 38 (2021), no. 2, 421–450. (with M. Beck, G. Cox, C. Jones, Y. Latushkin)

7. Exponential dichotomies for elliptic PDE on radial domains, **In: Dörfler W. et al. (eds) Mathematics of Wave Phenomena. Trends in Mathematics**. Birkhäuser, Cham. (2020), 49–68. (with M. Beck, G. Cox, C. Jones, Y. Latushkin)

8. A Sturm Liouville theorem for quadratic operator pencils, **Journal of Differential Equations**, Volume 268, Issue 7, 2020, Pages 3848–3879. (with K. Zumbrun)

9. The Maslov and Morse Indices for Sturm-Liouville Systems on the Half-Line, **Discr. Cont. Dynam. Systems Ser. A**, 2020, 40 (2) : 983–1012. (with P. Howard)

10. Spectral stability of hydraulic shock profiles, **Physica D: Nonlinear Phenomena**, 405 (2020), 132360, 9 pp. (with K. Zumbrun, Z. Yang)

11. Instability of pulses in gradient reaction–diffusion systems: A symplectic approach, **Philosophical Transactions of the Royal Society A** 376 (2018), no. 2117. (with M. Beck, G. Cox, C. Jones, Y. Latushkin, K. McQuighan)

12. Diffusive stability of spatially periodic patterns with a conservation law, preprint.
    https://arxiv.org/abs/1610.05395

13. Diffusive stability of spatially periodic solutions of the Brusselator model, **Communications in Mathematical Physics** 358 (2018), no. 1, 1-43. (with K. Zumbrun, S. Jung, R. Venkatraman)

14. The Maslov and Morse indices for Schrödinger operators on $\mathbb{R}$, **Indiana University Mathematics Journal** 67 (2018), no. 5, 1765-1815. (with P. Howard, Y. Latushkin)

15. The Morse and Maslov Indices for Schrödinger Operators, **Journal d'Analyse Mathematique** 135 (2018), no. 1, 345-387. (with Y. Latushkin, S. Sukhtaiev)

16. The Maslov and Morse indices for Lagrangian pairs on $\mathbb{R}^{2n}$, **J. Math. Anal. Appl.** 451 (2017), no. 2, 794-821. (with P. Howard, Y. Latushkin)

17. Hadamard-type formulas via the Maslov form, **J. Evol. Equ.** 17 (2017), no. 1, 443-472. (with Y. Latushkin)

18. The Maslov and Morse indices for Schrödinger Operators on $[0,1]$, **Journal of Differential Equations** 260 (2016), no. 5, 4499-4549 (with P. Howard)

19. The Morse and Maslov indices for multidimensional Schrödinger operators with matrix-valued potentials, **Trans. Amer. Math. Soc.** 368 (2016), no. 11, 8145–8207 (with G. Cox, C. Jones, Y. Latushkin)

20. Vakhitov-Kolokolov and energy vanishing conditions for linear instability of solitary waves in models of classical self-interacting spinor fields, **Nonlinearity** 28 (2015), 577–592 (with G. Berkolaiko, A. Comech)

21. The Evans function and the Weyl-Titchmarsh function, in Special issue on stability of travelling waves, **Disc. Cont. Dynam. Syst. Ser. S** 5 (2012), no. 5, 939 - 970 (with Y. Latushkin)

22. The algebraic multiplicity of eigenvalues and the Evans function revisited, in Memorial M. Birman's volume, **Mat. Model. Nat. Phenom.**, 5 (2010) 269 - 292 (with Y. Latushkin)

23. Spectral decomposition of normal operators in Hilbert quaternion bimodules, **Scientific Notes of Taurida National University**, 19(58) (2006), no. 1, 3-20 (with I. Karpenko, D. Tyshkevich) (in Russian)

24. On an approach to differentiation of functions of a quaternion variable, **Scientific Notes of Taurida National University**, 17(56) (2004), no. 1, 30-37 (with I. Karpenko, D. Tyshkevich) (in Russian)

Teaching experience

Instructor, MTH 655 Advanced Differential Equation, Spring 2024, Miami University

Instructor, MTH 151 Calculus I, Fall 2020, Miami University

Instructor, MTH 246 Linear Algebra and Differential Equations for Engineers, Fall 2020, Fall 2023, Fall 2024, Miami University

Instructor, MTH 435/MTH 535 Mathematical Modeling Seminar, Spring 2019, Miami University

Instructor, MTH 251 Calculus II, Fall 2018, Spring 2021, Fall 2023, Miami University

Instructor, MTH 245 Differential Equations for Engineers, Fall 2018, Fall 2022, Spring 2023, Miami University

Instructor, MTH 495/MTH 495H/MTH 595/MME 495/MME 595 Introduction to Applied Nonlinear Dynamics, Spring 2018, Spring 2021, Spriing 2023, Miami University

Instructor, MTH 252 Calculus III, Spring 2018, Fall 2022, Spring 2023, Miami University

Instructor, MTH 347 Differential Equations, Fall 2017, Miami University

Instructor, MTH 249 Calculus II, Fall 2017, Miami University

Instructor, Math M311 - Multivariable Calculus - Spring 2017, Indiana University Bloomington.

Instructor, Math M441 - Introduction to Partial Differential Equations with Applications I - Fall 2016, Indiana University Bloomington.

Instructor, Math M118 - Finite Mathematics - Fall 2015, Spring 2016, Indiana University Bloomington.

Instructor, Math 308 - Differential Equations - Spring 2013, Spring 2014, Spring 2015, Texas A&M University.

Instructor, Math 151 - Engineering Mathematics I - Fall 2012, Fall 2013, Fall 2014, Texas A&M University.

Teaching Assistant, Math 1500, Math 1500H(honors) - Calculus I, University of Missouri-Columbia.

Teaching Assistant, Math 1700, Math 1700H(honors)- Calculus II, University of Missouri-Columbia.

Teaching Assistant - College Algebra, Precalculus, Calculus III, Crimean Engineering-Pedagogical University, Ukraine.

Conference Organizing

Co-director, Fall 2023 Mathematics Conference: Differential Equations and Dynamical Systems and Applications, Miami University, Oxford, OH, September 29-30, 2023.

Co-organizer, Special Session on 'Geometric methods in spectral theory of traveling waves and patterns' at 13th AIMS Conference on Dynamical Systems, Differential Equations and Applications, Wilmington, NC, May 31 - June 4, 2023.

Co-organizer (with Jared Bronski, Mathew Johnson and Robert Marangell), Special Session on "Hamiltonian methods in spectral calculations", The Twelfth IMACS International Conference on Nonlinear Evolution Equations and Wave Phenomena: Computation and Theory, to be held in March 29 - April 01, 2022.

Co-director, Fall 2019 Mathematics Conference: Differential Equations and Dynamical Systems and Applications, Miami University, Oxford, OH, September 20-21, 2019.

Co-organizer (with Alin Pogan, Miami University), Special Session on "Spectral Methods and Stability of Localized Patterns", the SIAM Conference on Nonlinear Waves and Coherent Structures, Sheraton Philadelphia Society Hill Hotel, Philadelphia, Pennsylvania, August 8-11, 2016.

Co-organizer (with Mathew Johnson, University of Kansas and Yuri Latushkin, University of Missouri, Columbia), Special Session on "Spectral methods in Stability of Traveling Waves", The Ninth IMACS International Conference on Nonlinear Evolution Equations and Wave Phenomena: Computation and Theory, University of Georgia, Athens, GA, April 01-04, 2015.

Co-organizer, *Analysis/PDE Reading Seminar* at Texas A&M Univertisy (joint with Andrew Comech).

Organizer, *Mathematical Physics and Harmonic Analysis Seminar* at Texas A&M Univertisy, Spring 2015.

Mentoring

Undergraduate research project, Yaqi Dai, May-July 2015.

Undergraduate research project, Hongxin Fu, Spring 2019 - Fall 2019.

Undergraduate research project, Josh Borovik, Fall 2020 - Summer 2021.

Undergraduate research project, Carissa Osborne, Spring 2021

Master's research project, Katherine Vorpe, 2020-2021.

Master's research project, Steven Evans, 2021-2022.

Undergraduate/graduate research project, Nathaniel Smith, 2021-2024.

Invited Talks

Equadiff 2024, Karlstad University, Karlstad, Sweden, June 10 - 14, 2024.

CIRM conference on Mathematical aspects of the physics with non-self-adjoint operators, Centre International de Rencontres Mathématiques, Marseille, France, June 3 - 7, 2024.

Joint Alabama-Florida Conference on Differential Equations, Dynamical Systems and Applications, Florida State University, Tallahassee, Florida, May 18-19, 2024.

34th International Workshop on Operator Theory and its Applications, University of Helsinki, Finland, July 31 - August 4, 2023.

13th AIMS Conference on Dynamical Systems, Differential Equations and Applications, Wilmington, NC, May 31 - June 4, 2023.

The Twelfth Ohio River Analysis Meeting (ORAM 12), University of Cincinnati, March 18–19, 2023.

The Twelfth IMACS International Conference on Nonlinear Evolution Equations and Wave Phenomena: Computation and Theory, University of Georgia, Athens, GA, March 29 - April 01, 2022.

International Conference on Mathematics of Wave Phenomena, Karlsruhe Institute of Technology, February 14-18, 2022 (virtual).

AMS Fall Southeastern Sectional Meeting, to be held virtually, November 20-21, 2021.

The 44th SIAM Southeastern Atlantic Section Conference, Auburn University, September 18-19, 2021.

PDE/Applied Math Seminar, Indiana University Bloomington, March 15, 2021.

The SIAM Conference on Nonlinear Waves and Coherent Structures, Bremen, Germany, July 27-30, 2020 (canceled due to global travel restrictions).

Measure Theory Seminar, Kent State University, November 8, 2019.

Analysis in Missouri: a Midwestern symposium, University of Missouri, Columbia, September 5-8, 2019.

2019 SIAM Conference on Applications of Dynamical Systems, Snowbird, Utah, May 19-23, 2019.

The Eleventh IMACS International Conference on Nonlinear Evolution Equations and Wave Phenomena: Computation and Theory, University of Georgia, Athens, GA, April 17-19, 2019.

PDE/Applied Math Seminar, Brigham Young University, October 18, 2018.

PDE/Applied Math Seminar, Indiana University Bloomington, September 10, 2018.

International Conference on Mathematics of Wave Phenomena, Karlsruhe Institute of Technology, Karlsruhe, Germany, July 23-27, 2018.

2018 SIAM Conference on Nonlinear Waves and Coherent Structures, DoubleTree by Hilton Hotel Anaheim-Orange County, Orange, California, June 11-14, 2018.

AMS Spring Southeastern Sectional Meeting Vanderbilt University, Nashville, TN, April 14-15, 2018.

AMS Spring Central Sectional Meeting, Ohio State University, Columbus, OH March 16-18, 2018.

Waves, Spectral Theory and Applications - Part 2, University of North Carolina at Chapel Hill, October 20-22, 2017.

2017 SIAM Conference on Applications of Dynamical Systems, Snowbird, Utah, May 21-25, 2017.

The Tenth IMACS International Conference on Nonlinear Evolution Equations and Wave Phenomena: Computation and Theory, University of Georgia, Athens, GA, March 29 - April 01, 2017.

2017 Joint Mathematics Meetings, AMS Special Session on Dynamics of Fluids and Nonlinear Waves, Atlanta, January 5-7, 2017.

PDE/Applied Math Seminar, Indiana University Bloomington, November 28, 2016.

2016 SIAM Conference on Nonlinear Waves and Coherent Structures, Sheraton Philadelphia Society Hill Hotel, Philadelphia, Pennsylvania, August 8-11, 2016.

AMS Fall Eastern Sectional Meeting, Rutgers University, New Brunswick, NJ, November 14-15, 2015.

PDE/Applied Math Seminar, Indiana University Bloomington, September 14, 2015.

The Ninth IMACS International Conference on Nonlinear Evolution Equations and Wave Phenomena: Computation and Theory, University of Georgia, Athens, GA, April 01-04, 2015.

Mathematical Physics and Harmonic Analysis Seminar, Texas A&M University, December 16, 2014.

Workshop "Stability of solitary waves", University of Pisa – DiGiorgi center, Pisa, May 26-30, 2014.

AMS Western Spring Sectional Meeting, University of New Mexico, Albuquerque, April 4-6, 2014.

AMS Southeastern Spring Sectional Meeting, University of Tennessee, Knoxville, March 21-23, 2014.

Mathematical Physics and Harmonic Analysis Seminar, Texas A&M University, September 27, 2013.

AMS Spring Central Sectional Meeting, Iowa State University, Ames, April 26-28, 2013.

Math Webinar on Maslov Index, March 20, 2013 (one hour talk).

Mathematical Physics and Harmonic Analysis Seminar, Texas A&M University, February 22, 2013.

Math Webinar on Maslov Index, January 30, 2013 (one hour talk).

Differential Equations Seminar, University of Missouri-Columbia, October 6, 2011.

2011 SIAM Conference on Applications of Dynamical Systems Snowbird, Utah, USA, 2011.

Workshop on Gradient systems, Kacov, June 2010.

Differential Equations Seminar, University of Missouri-Columbia, March 15, 2009.

Invited Workshops and Visits

AIM workshop on Computer assisted proofs for stability analysis of nonlinear waves, San Jose, CA, June 5 - June 9, 2023.

Joint Alabama-Florida Conference on Differential Equations, Dynamical Systems and Applications, Auburn University, May 13-14, 2023.

The zoom conference on the occasion of the 70th birthday of Ari Laptev, August 12 - 13, 2020.

The Fall 2019 Informal Analysis Seminar organized by Kent State University on November 9-10, 2019.

Stability of Nonlinear Waves: Analysis and Computation, The Henri Poincaré Institute, Paris, France, July 1-5, 2019.

BIRS FRG Workshop, Banff, Canada, 'Stability Indices for Nonlinear Waves and Patterns in Many Space Dimensions', June 17 - 24, 2018.

KUMU Conference on PDE, Dynamical Systems, and Applications, University of Missouri-Columbia, Columbia, MO, April 23 - April 24, 2016.

SQuaRE (AIM's research program) "Maslov Index for Multidimensional Problems", American Institute of Mathematics, San Jose, June 22-26, 2015.

SQuaRE (AIM's research program) "Maslov Index for Multidimensional Problems", American Institute of Mathematics, Palo Alto, August 25-29, 2014.

Math Webinar on Maslov Index, 2012-2013.

2012 SIAM Conference on Nonlinear Waves and Coherent Structures, University of Washington, Seattle, June 13-16, 2012.

Workshop on Stability of Coherent Structures and Patterns, University of Washington, Seattle, June 11-12, 2012.

Geometric Methods for Infinite-Dimensional Dynamical Systems, Brown University, Providence, 4-6 November 2011.

14th International Internet Seminar on Evolution Equations 2010/2011.

The 28th Southeastern Atlantic Regional Conference on Differential Equation, Little Rock, October 10-11, 2008.

International conference "Modern Analysis and Applications", Odessa, Ukraine 2007.

International Conference "XVI Crimean Autumn Mathematical School-symposium" (KROMSH), Laspi-Batiliman, Crimea, Ukraine 2005.