

Mykhaylo Mykolaiovich Malakhov

THE BASICS

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Citizenship: United States
Date of birth: June 27, 1998

Pronouns: he, him, his

RESEARCH INTERESTS

I focus on the intersection of mathematics, biology, and data science. In particular, my current work involves analyzing differential equation and periodic matrix models of chemical reactions, wildlife disease spread and management, and animal behavior.

EDUCATION

Andrews University

B.S. in Mathematics (expected May 2020)

- Minor in Computing
- Honors Thesis: *Managing White-nose Syndrome in Bats: A Spatially Dynamic Modelling Approach*
- Goldwater Scholar
- J. N. Andrews Honors Scholar
- Total GPA: 4.0/4.0

Budapest Semesters in Mathematics (Fall 2019)

I am studying abroad through the Budapest Semesters in Mathematics program for the Fall 2019 semester.

RESEARCH EXPERIENCE

Research in Industrial Projects for Students (RIPS) program; Institute for Pure and Applied Mathematics (IPAM); University of California, Los Angeles (UCLA) (Summer 2019)

Advisors:

- An Do, Institute of Mathematical Sciences, Claremont Graduate University
- Robert S. Martin, In-Space Propulsion Branch, Air Force Research Laboratory, Edwards Air Force Base
- Daniel Q. Eckhardt, In-Space Propulsion Branch, Air Force Research Laboratory, Edwards Air Force Base

I worked on the Air Force Research Laboratory team and also served as Project Manager. We used results from dynamical systems theory, optimal transport theory, and information theory to develop novel techniques for attractor reconstruction and model calibration. My team successfully reconstructed the behavior of every species in hydrogen-oxygen combustion and inferred correct reaction rate coefficients from a time series of one observable.

SMALL Undergraduate Research Project; Williams College (Summer 2018)

Advisors:

- Julie C. Blackwood, Department of Mathematics and Statistics, Williams College
- Katriona Shea, Department of Biology and Center for Infectious Disease Dynamics, The Pennsylvania State University

I was part of the mathematical ecology group, where I worked on two projects. In one project we investigated how seasonal bat dispersal could affect the success of white-nose syndrome control strategies by posing and numerically analyzing the first spatially-explicit ODE model of white-nose syndrome. The second project focused on the perspective of ecosystem federalism as applied to infectious disease management; we explored the allocation of regulatory authority between different levels of government using a two-patch *SIRS*-type model.

Seabird Ecology Team REU; Andrews University (Summer 2017)

Advisors:

- Shandelle M. Henson, Department of Mathematics and Department of Biology, Andrews University
- J. M. Cushing, Department of Mathematics and Interdisciplinary Program in Applied Mathematics, University of Arizona

My group studied the effects of rising sea surface temperatures on seabird behavior and population dynamics by analyzing a 3-dimensional, nonlinear periodic matrix model using both numerical and analytic techniques. We demonstrated the existence of backward bifurcations due to egg cannibalism and proved that egg-laying synchrony is always detrimental when breeding seasons are short.

PUBLICATIONS

Mykhaylo M. Malakhov, Benjamin MacDonald, J. M. Cushing, and Shandelle M. Henson. “Selection of Stage Structure in a Seabird Population Model”. In preparation.

Junyan Duan[†], Mykhaylo M. Malakhov[†], Jordan J. Pellett[†], Ishan S. Phadke[†], Katriona Shea, and Julie C. Blackwood. “Transboundary Disease Management Under Alternative Objectives”. In preparation.

Junyan Duan[†], Mykhaylo M. Malakhov[†], Jordan J. Pellett[†], Ishan S. Phadke[†], Jackson Barber, and Julie C. Blackwood. “Management Efficacy in a Spatially Dynamic Model of White-nose Syndrome”. Under review.

Mykhaylo M. Malakhov, Brianna Fitzpatrick, Rebecca Alexandra Lopez, Abhishek Shivkumar, An Do, Daniel Q. Eckhardt, and Robert S. Martin. *Attractor Reconstruction and Empirical Parameter Inference for Hydrogen-Oxygen Chemistry*. August 23, 2019. U.S. Air Force internal report.

Mykhaylo M. Malakhov. *Managing White-nose Syndrome in Bats: A Spatially Dynamic Modelling Approach*. April 4, 2019. Honors Thesis.
<https://digitalcommons.andrews.edu/honors/216>

[†] Authors contributed equally to this work

CONFERENCE PRESENTATIONS

Attractor Reconstruction and Empirical Parameter Inference for Hydrogen-Oxygen Chemistry. 2019 RIPS Projects Day; IPAM; UCLA; Los Angeles, CA. Jointly with Brianna Fitzpatrick, Rebecca Lopez, and Abhishek Shivkumar. (August 2019)

Managing White-nose Syndrome in Bats: A Spatially Dynamic Modelling Approach. 2019 Honors Thesis Symposium; Andrews University; Berrien Springs, MI. (April 2019)

Modeling the impact of bat dispersal on white-nose syndrome control strategies. Mathematics Section; Michigan Academy of Science, Arts, and Letters; Alma College; Alma, MI. (March 2019)

Federalism in Epidemic Modeling: Multi-objective Management of Interconnected Populations. AMS-MAA-SIAM Special Session on Research in Mathematics by Undergraduates and Students in Post-Baccalaureate Programs; Joint Mathematics Meetings; Baltimore, MD. Jointly with Ishan Phadke. (January 2019)

Cannibalism and synchrony in a periodic matrix seabird population model. Mathematics Section; Michigan Academy of Science, Arts, and Letters; Central Michigan University; Mount Pleasant, MI. (March 2018)

Backward Bifurcations in a Periodic Matrix Model of Seabird Population Dynamics. MAA General Contributed Paper Session on Modeling and Applications; Joint Mathematics Meetings; San Diego, CA. (January 2018)

OTHER ORAL
PRESENTATIONS

Attractor Reconstruction and Empirical Parameter Inference for Hydrogen-Oxygen Chemistry. Invited guest lecture; Air Force Research Laboratory; Edwards Air Force Base; Boron, CA. Jointly with Brianna Fitzpatrick, Rebecca Lopez, and Abhishek Shivkumar. (August 2019)

Application of Convergent Cross Mapping to Chemical Reactions. RIPS Midterm Presentations Session; IPAM; UCLA; Los Angeles, CA. Jointly with Brianna Fitzpatrick, Rebecca Lopez, and Abhishek Shivkumar. (July 2019)

SMALL Projects for a Big World: Spatial Models of Infectious Disease. eigen*Talk (undergraduate math/physics colloquium); Andrews University; Berrien Springs, MI. (November 2018)

Differential Geometry: History, Theory, and Applications. eigen*Talk (undergraduate math/physics colloquium); Andrews University; Berrien Springs, MI. Jointly with other MATH 487 Differential Geometry students. (April 2018)

Effects of Sea Surface Temperature on Seabird Behavior in the Pacific Northwest. eigen*Talk (undergraduate math/physics colloquium); Andrews University; Berrien Springs, MI. (September 2017)

Uncertainty in Mathematics: A Historical Analysis of the Validity and Rigor of Mathematical Statements. eigen*Talk (undergraduate math/physics colloquium); Andrews University; Berrien Springs, MI. Jointly with Robert C. Moore and Lukasz Krzywón. (April 2017)

POSTER
PRESENTATIONS

Managing White-nose Syndrome in Bats: A Spatially Dynamic Modeling Approach. 2019 Honors Scholars and Undergraduate Research Poster Symposium; Andrews University; Berrien Springs, MI. (March 2019)

Efficacy of Control in a Spatially Dynamic Model of White-nose Syndrome. Summer Science Poster Session; Williams College; Williamstown, MA. Jointly with Ishan Phadke. (August 2018)

A Periodic Matrix Model of Seabird Behavior and Population Dynamics. 2018 Honors Scholars and Undergraduate Research Poster Symposium; Andrews University; Berrien Springs, MI. (March 2018)

TEACHING
EXPERIENCE

Department of Mathematics, Andrews University

Lecturer for L^AT_EX short course (Spring 2019)
Grader for MATH 355 Foundations of Advanced Mathematics (Spring 2018, Spring 2019)
Tutor for the Mathematics Center (Spring 2017 – Spring 2019)
Teaching Assistant for MATH 192 Calculus II (Spring 2017)
Private math tutor (Fall 2016 – Spring 2019)

HONORS AND
AWARDS

National and International Awards

Member, Nu Sigma Chapter of Sigma Tau Delta: The International English Honor Society (inducted 2019)
Member, Chapter 249 of The Honor Society of Phi Kappa Phi (inducted 2019)
Barry M. Goldwater Scholarship – \$15,000 (2018)
Member, Michigan Gamma Chapter of Pi Mu Epsilon: The National Mathematics Honor Society (inducted 2018)
Associate Member, Andrews-Whirlpool Chapter of Sigma Xi: The Scientific Research Honor Society (inducted 2017)

Andrews University Awards

Dean's List (every semester)
J. N. Andrews Honors Scholar (admitted into the program 2016)
Full Tuition ACT/SAT Scholarship – \$145,000 (awarded 2016 for four years)

Andrews University Department of Mathematics Awards

Award for Excellence in Probability Theory with Statistical Applications (2019)
Award for Excellence in Complex Analysis (2019)
Award for Excellence in Applied Mathematics (2019)
Award for Excellence in Abstract Algebra (2019)
Award for Excellence in Geometry (2019)
Harold T. Jones Scholarship – \$2,250 (2018) for highest overall excellence
Louis Ulloth Scholarship – \$2,250 (2018) for most significant leadership
Award for Excellence in Differential Equations (2018)
Award for Excellence in Mathematical Modeling in Biology (2018)
Award for Excellence in Calculus III (2018)
Putnam Competition team member (2017 and 2018) and highest scorer (2018)
Award for Excellence in Foundations of Advanced Mathematics (2017)
Award for Excellence in Calculus II (2017)
Award for Excellence in Calculus I (2017)

SERVICE AND
OUTREACH

President, Michigan Gamma Chapter, Pi Mu Epsilon (2018 – present)

I organize π Day festivities, game nights, and other fun activities. After one year of service I was reelected for a second term.

Vice President, AU Chapter, Engineers Without Borders (2018 – 2019)

I oversaw all club administration and functions, as well as the initial phases of a \$60,000+ solar energy project in Madagascar. The summer of 2018 I traveled to Madagascar to help conduct the assessment phase of our project.

Mathematics President, eigen*: the AU math/physics club (2017 – 2018)

I planned math-related colloquia and events and invited guest speakers. I also organized the first-ever Putnam Competition team and preparation course at AU.

Treasurer, AU Chapter, Engineers Without Borders (2017 – 2018)

I oversaw all club and project finances, grant applications, and fundraising. During my time as Treasurer we raised about \$20,000.

Founding Student Leader, codeShack: Google igniteCS @ AU (2016 – 2017)

I helped start a computer science education program at the local elementary school and wrote a successful application for Google igniteCS funding.

RELEVANT
SKILLS

Human Languages:

English (native), Russian (native), Spanish (intermediate), Ukrainian (beginner), Hungarian (beginner)

Computer Languages (by descending level of proficiency):

MATLAB and GNU Octave, L^AT_EX, Java, Python, C++, Processing

Software and packages:

Microsoft Office, Linux, Scientific WorkPlace, Cantera, GitHub