(215) 470 70 70
alena.rodionova@seas.upenn.edu
nellro.github.io/
alenarodionova
nellro

Alëna Rodionova

Research Interests

Automated Vehicles Safety, Cyber-Physical Systems, Control Theory, System Verfication

Education

2017–07/2022 (expected) **Ph.D. in Electrical and Systems Engineering**, GPA: 3.89/4.
University of Pennsylvania (UPenn), Philadelphia, PA
Advisor: George J. Pappas

2012-2014 **Master in Applied Mathematics and Informatics**, Magna cum laude.
Siberian Federal University (SibFU), Russia

2008-2012 **Bachelor of Mathematics**, Magna cum laude.
Siberian Federal University (SibFU), Russia

Experience

2017–present **University of Pennsylvania**, Philadelphia, PA.
Research: Safe and Robust Control of Cyber-Physical Systems
- Theoretical foundations of time robustness. See talk and publication C14 [Best Student Paper Award].
- Designed a framework for time-robust control using Mixed-Integer Linear Programming (MILP) in which the time robustness of a dynamical system is maximized. See Code.
- Risk of not satisfying the specification in time. See publications J7, C15.

Research: Distributed and Safe Autonomy
- Learning-based mission-aware collision avoidance for scalable urban mobility using Long Short-Term Memory (LSTM) recurrent neural network (RNN). See talk and publications J6, C11, C13.
- Autonomous drone safety using temporal logic-based trajectory planning. See publication J5

2019 **Intel Labs, Autonomous Driving Research**, Hillsoro, OR.
Graduate Technical Intern
- Automated driving safety analysis and software integration of CARLA with RSS Library. See talk and publications C12, C8.
- Designed a method for automatic exploration of the performance limits of AV safety models using robustness as a continuous metric of safety. See patent P2.

2018 **General Motors (GM), ECS Process, Methods and Tools Group**, Warren, MI.
Research and Development Intern
- Correctness preserving optimization of Deep Neural Networks (DNNs). See patent P1.
- Coverage analysis in DNNs testing.

2015-2017 **Vienna University of Technology (TU Wien), Institute of Computer Engineering**, Austria.
Researcher at Cyber-Physical Systems Group
- A specification language for emergent properties.
- Designed and implemented qualitative and quantitative filtering semantics for Metric Temporal Logic (MTL). See publications C6 [Best Student Paper Award]., B1.
- Designed a formalization of medical-device algorithms (e.g., arrhythmia-detection) in the language of Quantitative Regular Expressions (QRE). See publications J4, J3.

2013-2015 **Russian Academy of Sciences, Siberian Branch, Institute of Computational Modeling**, Russia.
Project Assistant
- Convection motions with interfaces and their stability. See publications J1, J2.
- Analysis of the non-linear heat and mass transfer regimes and their stability in binary mixtures. See publications C4, C5, C7.

Honors and Awards

2021 Best Student Paper Award at the 60th IEEE Conference on Decision and Control (CDC).

2020 Best of Session Award at the 39th IEEE/AIAA Digital Avionics Systems Conference (DASC).

2019 Travel Grant by CRA-W Grad Cohort Workshop.

2018 MIT EECS Rising Star award, awarded annually to outstanding early-career women in electrical engineering and computer science (EECS), MIT.

2017 The Dean's Fellowship Award from University of Pennsylvania (UPenn), awarded to PhD students in recognition of exceptional performance.

2016 Best Student Paper Award at the 19th ACM International Conference on Hybrid Systems: Computation and Control (HSCC).

2015 Career Grant by The Federal Ministry for Transport, Innovation and Technology (BMVIT), Austria.

2014 Best Presentation Award at the 10th National Scientific Students Conference "Youth & Science".

2014 Master's Degree with Distinction, SubFU Russia.

2012 Bachelor's Degree with Distinction, SubFU Russia.

2011, 2012 Scholarship by Vladimir Potanin Foundation, awarded annually to top Bachelor and Master students nation-wide, Russia.

Publications [Google Scholar Citations: 146, h-index: 7, i10-index: 5 as of Feb 15, 2022]

Journals

J7 **A. Rodionova**, L. Lindemann, M. Morari, G. J. Pappas. Time Robustness of Temporal Logic Specifications: Analysis and Control Design. *Theoretical Computer Science (TCS)*, 2022. [In preparation]

J6 **A. Rodionova**, Y. V. Pant, C. Kurtz, K. J. Jang, H. Abbas, R. Mangharam. Learning-'N-Flying: A Learning-based, Decentralized Mission Aware UAS Collision Avoidance Scheme. *ACM Transactions on Cyber-Physical Systems*, 2021. [pdf]

J5 Y. V. Pant, M. Z. Li, **A. Rodionova**, R. A. Quaye, H. Abbas, M. S. Ryerson, R. Mangharam. FADS: A Framework for Autonomous Drone Safety Using Temporal Logic-Based Trajectory Planning. *Transportation Research Part C: Emerging Technologies*, 2021. [pdf]

J4 H. Abbas, **A. Rodionova**, K. Mamouras, E. Bartocci, S. A. Smolka, R. Grosu. Quantitative regular expressions for arrhythmia detection. *IEEE/ACM transactions on computational biology and bioinformatics*, 2018. [pdf]

J3 H. Abbas, R. Alur, K. Mamouras, R. Mangharam, **A. Rodionova**. Real-time decision policies with predictable performance. *Proceedings of the IEEE*, 2018. [pdf]

J2 **A. Rodionova**, E. Rezanova. Stability of two-layer fluid flow. *Journal of Applied Mechanics and Technical Physics*, 2016. [pdf]

J1 V. Bekezhanova, **A. Rodionova**. Longwave stability of two-layer fluid flow in the inclined plane. Fluid Dynamics, 2015. [pdf]

Conferences and Workshops

C15 L. Lindemann*, **A. Rodionova***, G. J. Pappas. Temporal Robustness of Stochastic Signals. *The 25th ACM International Conference on Hybrid Systems: Computation and Control*, 2022. [accepted]

C14 **A. Rodionova**, L. Lindemann, M. Morari, G. J. Pappas. Time-Robust Control for STL Specifications. *IEEE Conference on Decision and Control (CDC)*, 2021. [pdf] – Best Student Paper Award

C13 K. Jang, Y. V. Pant, **A. Rodionova**, R. Mangharam. Learning-to-Fly RL: Reinforcement Learning-based Collision Avoidance for Scalable Urban Air Mobility. *The 39th IEEE/AIAA Digital Avionics Systems Conference (DASC)*, 2020. [pdf] – Best of Session Award

C12 **A. Rodionova**, I. Alvarez, M. S. Elli, F. Oboril, J. Quast, R. Mangharam. How safe is safe enough? Automatic safety constraints boundary estimation for decision-making in automated vehicles. *IEEE Intelligent Vehicles Symposium*, 2020. [pdf]

C11 **A. Rodionova***, Y. V. Pant*, K. J. Jang, H. Abbas, R.Quaye, R. Mangharam. Learning-to-Fly: learning-based collision avoidance for scalable urban air mobility. *IEEE International Conference on Intelligent Transportation Systems*, 2020. [pdf]

C10 H. Abbas, K. Mamouras, **A. Rodionova**, R. Alur, J. Liang, S. Dixit, R. Mangharam. A novel programming language to reduce energy consumption by arrhythmia monitoring algorithms in implantable cardioverter-defibrillators. *The 39th Heart Rhythm Scientific Sessions*, 2018. [pdf]

C9 **A. Rodionova**, M. E. O'Kelly, H. Abbas, V. Pacelli, R. Mangharam. An Autonomous Vehicle Control Stack. *The 4th International Workshop on Applied Verification of Continuous and Hybrid Systems (ARCH)*, 2017. [pdf]

C8 H. Abbas, M. E. O'Kelly, **A. Rodionova**, R. Mangharam. Safe at any speed: A simulation-based test harness for autonomous vehicles. *International Workshop on Design, Modeling, and Evaluation of Cyber Physical Systems (CyPhy)*, 2017. [pdf]

C7 H. Abbas, **A. Rodionova**, E. Bartocci, S. A. Smolka. Quantitative regular expressions for arrhythmia detection algorithms. *International Conference on Computational Methods in Systems Biology*, 2017. [pdf]

C6 **A. Rodionova**, E. Bartocci, D. Nickovic, R. Grosu. Temporal logic as filtering. *The 19th International Conference on Hybrid Systems: Computation and Control*, 2016. [pdf] – Best Student Paper Award

C5 **A. Rodionova**, V. Bekezhanova. Longwave stability of two-layer fluid flow in the inclined plane. *The 15th National Young Scientists Conference on Mathematical Modeling and Information Technologies*, 2014. [pdf]

C4 **A. Rodionova**, V. Bekezhanova. Stability of two-layer fluid flow with evaporation effect and longwave perturbations. *The 10th National Scientific Conference of Students and Young Scientists: Youth & Science*, 2014. [pdf] – Best Presentation Award

C3 **A. Rodionova**, V. Bekezhanova. Microscale static two-layer fluid flow in the inclined plane. *9th National Scientific Conference of Students and Young Scientists: Youth & Science*, 2013. [pdf]

C2 **A. Rodionova**, I. Panfilov. Static and dynamic penalty functions for constrained optimization in genetic algorithms. *8th National Scientific Conference of Students and Young Scientists: Youth & Science*, 2012. [pdf]

C1 S. Senashov, **A. Rodionova**, I. Shefer. New contact transformations. *14th International Scientific Conference Reshetnev Readings*, 2010. [pdf]

Book Chapters

B1 **A. Rodionova**, E. Bartocci, D. Nickovic, R. Grosu. Temporal logic as filtering. *Dependable Software Systems Engineering, NATO Science for Peace and Security Series - D: Information and Communication Security*, 2017. [pdf]

Magazine Articles

M1 H. Abbas, M. E. O'Kelly, **A. Rodionova**, R. Mangharam. A driver's license test for driverless vehicles. *Mechanical Engineering Magazine (ASME)*, 2017. [pdf]

Patents

P2 **Method and device for determining a configuration for an autonomous vehicle**.
A. Rodionova, I. Alvarez.
Patent Application 16/726,276, US2020130709A1 (12/24/2019). [pdf]

P1 **Correctness preserving optimization of Deep Neural Networks**.
P. M. Peranandam, R. Sethu, A. Rodionova.
Patent Application 16/227,195, US2020202214A1, (12/20/2018). [pdf]

Developed Software

S6 Time-robust control using Mixed-Integer Linear Programming (MILP). [code], [C14]

S5 Robustness-guided testing: automatic safety constraints boundary estimation for decision-making in automated vehicles. [code], [C12]

S4 FADS: Framework for Autonomous Drone Safety. [code], [J5]

S3 Learning-to-Fly: learning-based collision avoidance for scalable urban air mobility. [J6], [C11]

S2 Neprune: DNN pruning framework. [P1]

S1 DNN classification algorithms for cardiac arrhythmias discrimination. [code]

Invited Talks

Automated Vehicles Safety

09/2020 Grace Hopper Celebration – Verifying Safety Laws for Automated Vehicles. Orlando, FL.

09/2020 PGM Research Seminar – Learning-to-Fly: Learning-based Collision Avoidance for Scalable Urban Mobility. Philadelphia, PA.

11/2019 Intel Autonomous Driving Community Of Practice 2019: RSS Workshop – Robustness-Guided Testing of RSS Rules. Intel Labs, Hillsboro, OR.

10/2019 Intel Science and Technology Center (WAS-ISTC) Monthly Seminar – Test harness for guided search of unsafe driving instances. Virtual.

10/2019 PRECISE Industry Day – Verifying Robot Safety Laws for Autonomous Vehicles. University of Pennsylvania (UPenn), Philadelphia, PA.

10/2018 EECS Rising Stars – Foundations of Safe Autonomy: On-Board Verification and Formally-Constrained Machine Learning. Massachusetts Institute of Technology (MIT), Cambridge, MA.

Verification & Formal Methods

04/2018 CyberCardia (NSF Frontiers) PI Meeting – Quantitative Regular Expressions for Arrhythmia Detection Algorithms. Georgia Institute of Technology (Georgia Tech), Atlanta, GA.

04/2016 CyberCardia (NSF Frontiers) PI Meeting – Cardiac Arrhythmias Analysis: VT/SVT Discrimination Algorithm. Stony Brook University (SBU), Stony Brook, NY.

12/2015 ARVI Meeting – Temporal Logic as Filtering. Estonian Academy of Science, Tallinn, Estonia.

09/2015 CyberCardia (NSF Frontiers) PI Meeting – On Temporal Logic and Signal Processing. NSF Stafford Place, Arlington, VA.

Applied Mathematics

09/2014 Research Seminar – Stability of Two-Layer Fluid Flow with Evaporation Effect. Institute of Computational Modeling, Krasnoyarsk, Russia.

04/2014 Invited talk – Enumerative Combinatorics. Kyrgyz State Technical University, Bishkek, Kyrgyzstan

Teaching

Fall 2020 **Linear Systems Theory**, ESE500 UPenn.
Teaching Assistant with George J. Pappas

Spring 2020 **Machine Learning**, CIS520 UPenn.
Teaching Assistant with Shivani Agarwal

Spring 2018 **Model-Based Embedded Systems**, ESE680 UPenn.
Guest Lecturer for "Parametric Timed Automata" and "Quantitative Semantics of TL"

Sept 2012 - Feb 2015 **Mathematics**, School of Physics and Mathematics, SibFU, Russia.
High School Teacher

Sept 2013 - July 2014 **Mathematics**, Krasnoyarsk Educational Institution Lyceum 6, Russia.
Middle School Teacher

Aug 2010, 2011 **STEM**, Krasnoyarsk Summer School, Siberian Federal University.
Teaching Assistant

Professional Services

Reviewer

Journal Reviewer

Chaos: An Interdisciplinary Journal of Nonlinear Science, 2018

International Journal of Formal Methods in System Design (FMSD), 2017

International Journal on Software Tools for Technology Transfer (STTT), 2017

Conference Reviewer

ACM/IEEE International Conference on Cyber-Physical Systems (ICCPS), 2022, 2020, 2018

IEEE Intelligent Vehicles Symposium (IV) 2021

International Workshop on Autonomous Systems Design (ASD), 2020
International Conference on Embedded Software (EMSOFT), 2019, 2018
International SPIN Symposium on Model Checking of Software (SPIN), 2017
International Conference on Tools and Algorithms for the Construction and Analysis of Systems (TACAS), 2016
International Conference on Runtime Verification (RV), 2016
International Symposium on Automated Technology for Verification and Analysis (ATVA), 2016
International Workshop on Hybrid Systems Biology, (HSB), 2016
International Conference on Formal Modeling and Analysis of Timed Systems (FORMATS), 2015
International Conference on Computational Methods in Systems Biology (CMSB), 2015

Conference Organization: ACM International Conference on Hybrid Systems: Computation and Control (HSCC), 2016.

Technical Skills

Programming	Python, MATLAB, C++
Optimization	S-TLiRo CPLEX, CVX, CVXPY, YALMIP, MPT, CasADi, Gurobi, Simulink
Miscellaneous	CARLA Simulator, RSS, TensorFlow, Keras, UPPAAL

Language Skills

English	Proficient
Russian	Native
German	Basic