Aren A. Babikian

aren.babikian@utoronto.ca | arenbabikian.com | Citizenship: Canadian

Aren A. Babikian | ArenBabikian | 77eB7-8AAAAJ | 0000-0002-8108-0043

Languages

English - Native proficiency **French** - Native proficiency **Armenian** - Native proficiency

Education

- **Doctor of Philosophy (PhD) - Electrical Engineering** *Jan 2020 - Dec 2024*
  McGill University Montreal, Canada
  - *Thesis Title:* System-Level Testing of Autonomous Vehicles Through Consistent Model Generation with Qualitative Abstractions and Abstract Coverage.
  - *Supervisors:* Gunter Mussbacher, Dániel Varró
- **Master of Engineering - Electrical Engineering** *Jan 2019 - Dec 2019 (fast-tracked to PhD)*
  McGill University Montreal, Canada
  - *Supervisor:* Dániel Varró
  - *GPA:* 4.00/4.00
- **Bachelor of Engineering - Computer Engineering** *Sep 2015 - Dec 2018*
  McGill University Montreal, Canada
  - *GPA:* 3.83/4.00
  - Graduated *with distinction*.

Research Experience

- **Postdoctoral Fellow** *Sep 2024 - Present*
  University of Toronto Toronto, Canada
  - *Department:* Department of Computer Science
  - *Supervisor:* Marsha Chechik
  - *Research topic:* Assuring the Safety of Over-the-air Software Updates for Product Lines of Automotive Systems.
  - *Industrial Collaborator:* General Motors of Canada
- **Visiting Researcher** *Sep 2023 - Oct 2023*
  Linköping University Linköping, Sweden
  - *Lab:* Programming Environments Laboratory (PELAB)
  - *Supervisor:* Dániel Varró
  - *Research topic:* Automated and Complete Generation of Dangerous Traffic Scenarios at Road Junctions.
- **Visiting Researcher** *Jul 2023 - Aug 2023*
  Budapest University of Technology and Economics Budapest, Hungary
  - *Lab:* Critical Systems Research Group (FTSRG)
  - *Supervisor:* Oszkár Semeráth
  - *Research Topic:* Automated Traffic Scenario Generation for In-Simulation Testing of Autonomous Vehicles.

Industrial Internships

- **Research Intern** *Apr 2022 - Jul 2022*
  NVIDIA, Inc. Santa Clara, USA (remote)
  - *Research group:* Autonomous Vehicles (AVs) Group
  - *Supervisors:* Justyna Zander, Wael Elhaddad
  - *Role:*
    - Implemented a framework to automate controller-level verification of in-house AV software.
    - Integrated the framework with in-house tools such as the NVIDIA DRIVE Sim AV simulator.
    - Provided automated and quantifiable evaluation of external AV requirements.
- **Applied Scientist Intern II** *Mar 2021 - May 2021*
  Amazon Web Services, inc. (AWS) Boston, USA (remote)
  - *Research group:* Automated Reasoning Group
  - *Supervisor:* Mark R. Tuttle
  - *Role:*
    - Implemented support for function contracts in CBMC memory-safety proofs.
    - Integrated function contracts in 8 existing FreeRTOS/CoreJSON CBMC proofs.
    - Achieved a 97% improvement in proof run time with the use of function contracts.

- **Applied Scientist Intern** *May 2020 - Aug 2020*
  Amazon Web Services, inc. (AWS) Boston, USA (remote)
  - *Research group:* Automated Reasoning Group
  - *Supervisor:* Kareem Khazem
  - *Role:*
    - Implemented an open-source tool that helps users build their CBMC proofs.
    - Simplified the process of writing CBMC proofs.
    - Validated existing proof build configurations and assessed incorrections.

Teaching and Supervision

- **Student Co-supervisor** *Sep 2025 - Apr 2026*
  University of Toronto Toronto, Canada
  - *Department:* Department of Computer Science
  - *Number of Students Supervised:* 6
  - *Project Scope:*
    - Master's Research Project (x1, ongoing)
    - Undergraduate Research Course (x3, upcoming)

- **Student Co-supervisor** *Sep 2022 - Apr 2025*
  McGill University Montreal, Canada
  - *Department:* Department of Electrical and Computer Engineering
  - *Number of Students Supervised:* 14
  - *Project Scope:*
    - Undergraduate Capstone Project (x3, led to three publications)
    - Undergraduate Honours Thesis (x1, led to one paper submission)
    - Undergraduate Ad-hoc Research (x1, led to one publication)

- **Teaching Assistant (TA)** *Jan 2018 - Apr 2023*
  McGill University Montreal, Canada
  - *ECSE 429 - Software Validation* (TA: x6 | Grader: x1)
  - *ECSE 321 - Introduction to Software Engineering* (Course Assistant: x1 | Grader: x1)
  - *Level:* Undergraduate
  - *Professors:* Dániel Varró, Katarzyna Radecka, Robert Sabourin
  - *Role:*
    - Prepared and delivered weekly tutorial sessions.
    - Conducted regular office hours and responded to student questions.
    - Prepared and graded assignments, course projects and exams.
    - Redesigned and updated the course project for the ECSE 429 course.

- **Guest Lecturer** *Mar 2022, Nov 2022*
  McGill University Montreal, Canada
  - *ECSE 429 - Software Validation* (x2)
  - *Professor:* Dániel Varró
  - *Lecture topics:*
    - "Constraint solving and SAT solving in Software Validation"
    - "Formal Methods in Software Validation"

Invited Talks

- **Invited Speaker** *Jun 2025*
  University College London London, UK (remote)
  - *Research Group:* Software Systems Engineering Group
  - *Talk:* "Generating Concrete Traffic Scenarios from Abstract Specifications for Autonomous Vehicles Testing"

- **Invited Speaker** *Jun 2024*
  University of Toronto Toronto, Canada
  - *Research Group:* Programming Languages and Software Engineering Group
  - *Talk:* "Abstract Coverage Guarantees for Scenario-Based Autonomous Vehicle Testing"

- **Invited Speaker** *Aug 2023*
  American University of Armenia Yerevan, Armenia
  - *Department:* Akian College of Science and Engineering
  - *Talk:* "Ensuring the Safety of Autonomous Vehicles through Model-Based Approaches & Optimization Algorithms"

Academic Service

- **Organising Committee Member**
  UAV@ICST | I.C. on Software Testing, Verification and Validation - UAV Testing Tool Competition 2026
  UAV@SBFT | Int'l Workshop on Search-Based and Fuzz Testing - UAV Testing Tool Competition 2026

- **Program Committee Member**
  ETAPS-C | Int'l Joint Conferences On Theory and Practice of Software - Artifact Evaluation 2026
  Deeptest (x2) | Int'l Workshop on Deep Learning for Testing and Testing for Deep Learning 2025, 2026
  MoDELS-C | Int'l Conference on Model Driven Engineering Languages and Systems - Tools and Demos 2025
  SE4ADS | Int'l Workshop on Software Engineering for Autonomous Driving Systems 2025
  LLM4MDE | Large Language Models for Model-Driven Engineering Workshop 2024

- **Reviewer and External Reviewer**
  FASE (x6) | Int'l Conference on Fundamental Approaches to Software Engineering 2021 - 2026
  EMSE (x2) | Springer Empirical Software Engineering 2025
  TOSEM | ACM Transactions on Software Engineering and Methodology 2025
  TSE | IEEE Transactions on Software Engineering 2025
  JSEP | Wiley Journal of Software: Evolution and Process 2025
  SafeComp | Int'l Conference on Computer Safety, Reliability and Security 2025
  SoSyM | Int'l Journal on Software and Systems Modeling 2024
  MoDELS (x2) | Int'l Conference on Model Driven Engineering Languages and Systems 2019, 2022

- **Student Volunteer**
  MoDELS (x2) | Int'l Conference on Model Driven Engineering Languages and Systems 2020, 2022

Scholarships and Awards

- **NSERC Postgraduate Scholarship - Doctoral (PGS-D)** *May 2020 - Apr 2023*
  Natural Sciences and Engineering Research Council of Canada
- **Graduate Mobility Award (GMA)** *Jun 2023 - Oct 2023*
  McGill University
- **Vadasz Scholar McGill Engineering Doctoral Award (MEDA)** *Jan 2020 - Dec 2023*
  McGill University
- **FRQNT Master's Training Scholarship (B1X)** *May 2019 - Apr 2020*
  Fonds de recherche du Québec - Nature et Technologie
- **McGill Engineering Undergraduate Student Master Award (MEUSMA)** *Jan 2019 - Dec 2020*
  Mcgill University

Publication Record

- **Journal Articles**

1. **Babikian, A.A.**, Semeráth, O. and Varró, D. (2024). Concretization of Abstract Traffic Scene Specifications Using Metaheuristic Search. *IEEE Transactions on Software Engineering*, 50:48-68.
2. **Babikian, A.A.**, Semeráth, O., Li, A., Marussy, K. and Varró, D. (2022). Automated Generation of Consistent Models Using Qualitative Abstractions and Exploration Strategies. *International Journal on Software and Systems Modeling*, 21:1763-1787.
3. Semeráth, O., **Babikian, A.A.**, Chen, B., Li, C., Marussy, K., Szárnyas, G. and Varró, D. (2021). Automated Generation of Consistent, Diverse and Structurally Realistic Graph Models. *International Journal on Software and Systems Modeling*, 20:1713-1734.
4. Marussy, K., Semeráth, O., **Babikian, A.A.** and Varró, D. (2020). A Specification Language for Consistent Model Generation Based on Partial Models. *Journal of Object Technologies*, 19:1-22.

- **Peer-reviewed Conference Papers**

1. Chen, B., **Babikian, A.A.**, Feng, S., Varró, D. and Mussbacher, G. (2025). LLM-based Satisfiability Checking of String Requirements by Consistent Data and Checker Generation. *IEEE 33rd International Requirements Engineering Conference*, in press.
2. Hou-Liu, J., Jiang, Z. and **Babikian, A.A.** (2024). Concretize: A Model-Driven Tool for Scenario-Based Autonomous Vehicle Testing. *ACM/IEEE 27th International Conference on Model Driven Engineering Languages and Systems, Companion Proceedings*, 27:66-70.
3. **Babikian, A.A.** (2024). Refining Abstract Specifications into Dangerous Traffic Scenarios. *IEEE/ACM 46th International Conference on Software Engineering, Companion Proceedings*, 46:456-458.
4. **Babikian, A.A.**, Semeráth, O. and Varró, D. (2020). Automated Generation of Consistent Graph Models with First-Order Logic Theorem Provers. *23rd International Conference on Fundamental Approaches to Software Engineering*, 23:441-461.
5. **Babikian, A.A.** (2020). Automated Generation of Test Scenario Models for the System-Level Safety Assurance of Autonomous Vehicles. *ACM/IEEE 23rd International Conference on Model Driven Engineering Languages and Systems, Companion Proceedings*, 23:1-7.

6. Semeráth, O., **Babikian, A.A.**, Li, A., Marussy, K. and Varró, D. (2020). Automated Generation of Consistent Models with Structural and Attribute Constraints. *ACM/IEEE 23rd International Conference on Model Driven Engineering Languages and Systems*, 23:187-199.
7. Majzik, I., Semeráth, O., Hajdu, C., Marussy, K., Szatmári, Z., Micskei, Z., Vörös, A., **Babikian, A.A.** and Varró, D. (2019). Towards System-Level Testing with Coverage Guarantees for Autonomous Vehicles. *IEEE/ACM 22nd International Conference on Model Driven Engineering Languages and Systems, Companion Proceedings*, 22:89-94.
8. Semeráth, O., **Babikian, A.A.**, Pilarski, S. and Varró, D. (2019). Viatra Solver: A Framework for the Automated Generation of Consistent Domain-Specific Models. *41st ACM/IEEE International Conference on Software Engineering, Companion Proceedings*, 41:43-46.

- **Peer-reviewed Workshop Papers**

1. **Babikian, A.A.**, Chen, B. and Mussbacher, G. (2025). Exploring Large Language Models for Requirements on String Values. *ACM/IEEE 2nd Workshop on Multi-disciplinary, Open, and integRatEd Requirements Engineering*, in press.
2. Jiang, Z. and **Babikian, A.A.** (2025). OptObstacles at the SBFT 2025 Tool Competition - UAV Testing Track. *ACM/IEEE 18th International Workshop on Search-Based and Fuzz Testing*, in press.
3. Jiang, Z., Semeráth, O. and **Babikian, A.A.** (2025). Towards a Traffic Scenario Catalog for Collaborative Testing of Autonomous Vehicles. *ACM/IEEE 1st International Workshop on Software Engineering for Autonomous Driving Systems*, in press.
4. **Babikian, A.A.** and Varró, D. (2024). OptAngle at the SBFT 2024 Tool Competition - Cyber-Physical Systems Track. *ACM/IEEE 17th International Workshop on Search-Based and Fuzz Testing*, 17:73-74.

- **Pre-prints and Submitted Articles**

1. **Babikian, A.A.**, Di Sandro, A., Formica, F., Menghi, C. and Chechik, M. (2025). Automated Repair of Cyber-Physical Systems Requirements: Fixing Errors in Requirements Tables . *ArXiv preprint*.
2. Murphy, L., Viger, T., Di Sandro, A., **Babikian, A.A.** and Chechik, M. (2025). Assurance Case Development for Evolving Software Product Lines: A Formal Approach. *ArXiv preprint*. *Formal Aspects of Computing*, in review.
3. Viger, T., Murphy, L., Diemert, S., Menghi, C., **Babikian, A.A.**, Joyce, J., Di Sandro, A., Anwari, N., Cyffka, E. and Chechik, M. (2025). Evaluating AI-Supported Eliminative Argumentation for Developing Reliable Assurance Cases. *Empirical Software Engineering*, in review.
4. **Babikian, A.A.**, Ficsor, A., Semeráth, O., Mussbacher, G. and Varró, D. (2024). Automated and Complete Generation of Traffic Scenarios at Road Junctions Using a Multi-level Danger Definition. *ArXiv preprint*. *International Journal on Software and Systems Modeling*, in review.

- **Posters and Talks**

1. **Babikian, A.A.** (2024). Safety Assurance of Automotive Systems in the Presence of Change. *Consortium for Software Engineering Research (National-level)*. Regular talk.
2. **Babikian, A.A.** (2024). Refining Abstract Specifications into Dangerous Traffic Scenarios. *IEEE/ACM 46th International Conference on Software Engineering*. Poster presentation.
3. **Babikian, A.A.** and Varró, D. (2023). Applying Meta-Heuristic Search for Scenario-based Testing of Autonomous Vehicles. *5th International Workshop on Artificial Intelligence and Model Driven Engineering*. Lightning talk.
4. **Babikian, A.A.** and Varró, D. (2022). Concretization of Abstract Traffic Scene Specifications Using Multi-Objective Optimization. *13th Meeting of the Softw. Engineering Research Community in Montreal (Regional-level)*. Lightning talk.
5. **Babikian, A.A.**, Chen, B., Li, C., Marussy, K., Semeráth, O., Szárnyas, G. and Varró, D. (2019). Characterization and Automated Generation of Realistic Domain-Specific Graph Models. *Consortium for Software Engineering Research (National-level)*. Poster presentation.