Aren A. Babikian

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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 Applied to 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 Traffic Scenarios at Road Junctions Using a Multi-level Danger Definition.
- **Visiting Researcher** *Jul 2023 - Aug 2023*
  Budapest University of Technology and Economics Budapest, Hungary
  - *Lab:* Critical Systems Research Group (FTRSG)
  - *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

- **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* (TA: x1 | Grader: x1 | Course Assistant: 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 Speaker** *Aug 2023*
  American University of Armenia Yerevan, Armenia
  - *Department:* Akian College of Science and Engineering
  - *Talk topic:* Safety Assurance for Autonomous Vehicles through Model-Based Approaches and Optimization Algorithms.

- **Undergraduate Project Co-supervisor** *Sep 2022 - Apr 2024*
  McGill University Montreal, Canada
  - *Department:* Department of Electrical and Computer Engineering
  - *Scope:* 3 end-of-curriculum projects (2 capstone projects, 1 honours thesis). 9 students in total.

Academic Service

- **Program Committee Member**
  Int'l Workshop on Deep Learning for Testing and Testing for Deep Learning (Deeptest) 2025
  Int'l Workshop on Software Engineering for Autonomous Driving Systems (SE4ADS) 2025
  Large Language Models for Model-Driven Engineering Workshop (LLM4MDE) 2024

- **Reviewer and Sub-reviewer**
  Int'l Conference on Computer Safety, Reliability and Security (SafeComp) 2025
  Springer Empirical Software Engineering (EMSE) 2025
  ACM Transactions on Software Engineering and Methodology (TOSEM) 2025
  IEEE Transactions on Software Engineering (TSE) 2025
  Int'l Journal on Software and Systems Modeling (SoSyM) 2024
  Int'l Conference on Fundamental Approaches to Software Engineering (FASE) x4 2021 - 2024
  Int'l Conference on Model Driven Engineering Languages and Systems (MoDELS) x2 2019, 2022

- **Student Volunteer**
  Int'l Conference on Model Driven Engineering Languages and Systems (MoDELS) x2 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**
  - **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.
  - **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.
  - 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.
  - 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 Conferences and Workshops**
  - **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.
  - 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.
  - 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.
  - 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.
  - **Babikian, A.A.** (2024). Refining Abstract Specifications into Dangerous Traffic Scenarios. *IEEE/ACM 46th International Conference on Software Engineering, Companion Proceedings*, 46:456-458.
  - **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.
  - **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.
  - **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.
  - 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.
  - 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*, 22:89-94.
  - 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*, 41:43-46.
- **Pre-prints and Submitted Articles**
  - 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. Submitted to *Formal Aspects of Computing*.
  - 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. Submitted to *Empirical Software Engineering*.

- **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*. Submitted to the *International Journal on Software and Systems Modeling*.

- **Posters and Talks**
  - **Babikian, A.A.** (2024). Safety Assurance of Automotive Systems in the Presence of Change. *Consortium for Software Engineering Research (National-level)*. Regular talk.
  - **Babikian, A.A.** (2024). Refining Abstract Specifications into Dangerous Traffic Scenarios. *IEEE/ACM 46th International Conference on Software Engineering*. Poster presentation.
  - **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.
  - **Babikian, A.A.** and Varró, D. (2022). Concretization of Abstract Traffic Scene Specifications Using Multi-Objective Optimization. *13th Meeting of the Software Engineering Research Community in Montreal (Regional-level)*. Lightning talk.
  - **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.