

Allison K. Sullivan, PhD

ASSISTANT PROFESSOR OF COMPUTER SCIENCE AT THE UNIVERSITY OF TEXAS AT ARLINGTON

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Research Interest

Software Engineering, in particular: Test/Oracle Generation, Automated Bug Localization and Repair, Regression Testing, and Mutation Testing.

Formal Methods and Programming Languages, in particular: Model Based Testing, First-Order Logic, Program Synthesis, Model Checking and Symbolic Execution.

Academic Experience

SEPT 2020	Assistant Professor , The University of Texas at Arlington	Arlington, TX
2018 - 2020	Assistant Professor , North Carolina A&T State University	Greensboro, NC
2012 - 2017	Research Assistant , The University of Texas at Austin	Austin, Texas
2011 - 2012	Undergraduate Research Assistant , The University of Texas at Dallas	Richardson, Texas

Education

The University of Texas at Austin	Austin, Texas
PH.D. IN SOFTWARE ENGINEERING	May 2017
• Dissertation: Automated Testing and Sketching of Alloy Models Advisor: Dr. Sarfraz Khurshid GPA: 3.93	
The University of Texas at Austin	Austin, Texas
M.S. IN SOFTWARE ENGINEERING	May 2014
• Thesis: AUnit - A Testing Framework for Alloy Advisor: Dr. Sarfraz Khurshid	
The University of Texas at Dallas	Richardson, Texas
B.S. IN SOFTWARE ENGINEERING	May 2012
• Specialization: Embedded Systems GPA: 3.99	

Industry Experience

Google, Inc.	Mountain View, CA
FACULTY IN RESIDENCE (FIR)	Jun. 2019 - July. 2019
• Professional Development. FIR is an immersive program that trained me to: design and implement classroom experiments related to project-based learning, conduct resume workshops, and give mock interviews. During this program, I re-designed “Comp 285: Design and Analysis of Algorithms” with feedback from fellow FIR faculty and Google engineers.	
Naval Research Laboratory (NRL)	Washington, D.C.
RESEARCH INTERN IN THE CENTER FOR HIGH ASSURANCE COMPUTER SYSTEMS	Jun. 2015 - Jan. 2016
• Model Based Testing. I expanded the applicability of NRL’s model based testing (MBT) infrastructure by extending the SCR toolset to automatically generate test cases that incorporate assumptions. This included updating the automated translations of SCR models into SPIN, NuSMV, and PVS with formulas that explore the assumption(s).	
IBM Research	Austin, Texas
SOFTWARE TESTING INTERN IN THE VIRTUAL TEST SUITE AUTOMATION TEAM	May. 2013 - Aug. 2013
• Test Automation Toolset. I built a test automation toolset to ensue test suites automatically feed their output into RQM, IBM’s project management tool. This toolset bridges existing automation scripts with the RQM and is in place at IBM today.	

Funding

4 grants | **Total amount:** \$45,655,000 | **My share:** \$975,000

- [1] **Source:** NSF Major Research Instrumentation – **Title:** MRI: Acquisition of a Testbed of Connected Autonomous MicroTransit Vehicles – **Lead PI:** Ali Karimoddini, **My Role:** Co-PI – **Amt:** \$550k, **Share:** \$55k
- [2] **Source:** DoD Research and Engineering (Modernization) – **Title:** Assured Development and Operation of Autonomous Systems (ADAS) – **Lead PI:** Constance Heitmeyer (NRL), **My Role:** Performer – **Amt:** \$45M, **Share:** \$815k

- [3] **Source:** NSF Formal Methods in the Field – **Title:** Alloy Analyzer Plus: an Integrated Development Environment for Alloy – **PIs:** Allison Sullivan – **Amt:** \$100k
- [4] **Source:** NSF HBCU-UP ACE Implementation Project in Data Science Scholarship of Teaching and Learning Award – **Title:** Project Based Learning in the Teaching of Analysis of Algorithms – **PIs:** Allison Sullivan – **Amt:** \$5k

Publications

REFEREED CONFERENCE PAPERS

- [1] Kaiyuan Wang, Allison Sullivan, Darko Marinov, and Sarfraz Khurshid. Fault Localization for Declarative Models in Alloy. In *The 31st International Symposium on Software Reliability Engineering (ISSRE)*, 2020.
- [2] George Thompson and Allison Sullivan. ProFL: A Fault Localization Framework for Prolog. In *The 29th ACM SIGSOFT International Symposium on Software Testing and Analysis (ISSTA) Demonstration Track*, 2020.
- [3] Allison Sullivan, Darko Marinov, and Sarfraz Khurshid. Solution enumeration abstraction - a modeling idiom to enhance a lightweight formal method. In *International Conference on Formal Engineering Methods (ICFEM)*, 2019.
- [4] Kaiyuan Wang, Allison Sullivan, and Sarfraz Khurshid. ARepair: A repair framework for Alloy. In *International Conference on Software Engineering (ICSE) Demonstration Track*, 2019.
- [5] Kaiyuan Wang, Allison Sullivan, and Sarfraz Khurshid. Automated model repair for Alloy. In *International Conference on Automated Software Engineering (ASE)*, 2018.
- [6] Kaiyuan Wang, Allison Sullivan, Darko Marinov, and Sarfraz Khurshid. Asketch: a sketching framework for Alloy. In *The ACM Joint European Software Engineering Conference and Symposium on the Foundations of Software Engineering (FSE)*, 2018.
- [7] Allison Sullivan, Kaiyuan Wang, and Sarfraz Khurshid. AUnit: A test automation tool for Alloy. In *International Conference on Software Testing, Verification and Validation (ICST)*, 2018.
- [8] Kaiyuan Wang, Allison Sullivan, Darko Marinov, and Sarfraz Khurshid. Solver-based sketching of Alloy models using test valuations. In *International ABZ Conference ASM, Alloy, B, TLA, VDM, Z*, 2018. **Invited for journal submission.**
- [9] Kaiyuan Wang, Allison Sullivan, Manos Koukoutsos, Darko Marinov, and Sarfraz Khurshid. Systematic generation of non-equivalent expressions for relational algebra. In *International ABZ Conference ASM, Alloy, B, TLA, VDM, Z*, 2018.
- [10] Kaiyuan Wang, Allison Sullivan, and Sarfraz Khurshid. MuAlloy: A mutation testing framework for Alloy. In *International Conference on Software Engineering (ICSE)*, 2018.
- [11] Allison Sullivan, Kaiyuan Wang, Razieh Nokhbeh Zaeem, and Sarfraz Khurshid. Automated test generation and mutation testing for Alloy. In *IEEE Conference on Software Testing, Validation and Verification (ICST)*, 2017.
- [12] Nima Dini, Allison Sullivan, Milos Gligoric, and Gregg Rothermel. The effect of test suite type on regression test selection. In *International Symposium on Software Reliability Engineering (ISSRE)*, 2016.
- [13] Allison Sullivan, Razieh Nokhbeh Zaeem, Sarfraz Khurshid, and Darko Marinov. Towards a test automation framework for Alloy. In *International Symposium on Model Checking of Software (SPIN)*, 2014.

REFEREED WORKSHOP PAPERS

- [14] Allison Sullivan, Kaiyuan Wang, Sarfraz Khurshid, and Darko Marinov. Evaluating state modeling techniques in Alloy. In *Workshop on Software Quality Analysis, Monitoring, Improvement, and Applications (SQAMIA)*, 2017.

THESIS AND DISSERTATION

- [15] Allison Sullivan. Automated testing and sketching of Alloy models. In *Texas ScholarWorks - UT Electronic Theses and Dissertations*, 2017.
- [16] Allison Sullivan. AUnit: A testing framework for Alloy. In *Texas ScholarWorks - UT Electronic Theses and Dissertations*, 2014.

University Service

NASA's University Leadership Initiative (ULI)

- I was a Co-PI on a 20 member team lead by Dr. Abdollah Homaifar at NC A&T for NASA's ULI solicitation. Our proposal "Secure and Safe Assured Autonomy (S²A²)" was successfully funded.
- The grant **total:** \$7.9M, **My share had I stayed at NC A&T:** \$635k.

Corporate Outreach and Professional Development

- Member of the NC A&T team that helped bring Facebook's Engineer in Residence Program to A&T's CS department.
- NC A&T's CS Representative to Intel's HBCU Consortium, worked on NC A&T's submission to Intel's HBCU Beyond 2020 grant.
- NC A&T Representative to Facebook T3 "Train the Trainer" summit on Data Structures and Algorithms.

Club Advisor

- **UT Arlington:** I am the co-advisor for “Society of Women Engineers (SWE)”
- **NC A&T:** I was the faculty advisor for “Girls Who Code Loops” and “Society of Women Engineers (SWE)”

Faculty Advisor for Student Teams

- Coach for NC A&T’s Advancing Minorities’ Interest in Engineering (AMIE) Design Challenge teams (Spring 2019 and Spring 2020).
- Coach for NC A&T’s 2019 Black Enterprise 2019 BE SMART Hackathon team. **Placed 1st**

Faculty Mentor for NC A&T’s SAE International AutoDrive Challenge Student Team from Fall 2018 to Spring 2020

- Placed 2nd overall in Year 2 (2018-2019), my first year on the project.
- **Functional Safety Group.** Mentored 4 graduate students, 1 undergraduate student.
- **Mapping Group.** Mentored 4 graduate students. **Placed 3rd in Year 2 Mapping Challenge**

Organizer for the Triad Programming Contest

- 2020: Lead organizer for the contest (<https://triad-pc-2020.github.io/>).
- 2019: Co-organized the contest and served as a judge for the contest.

Faculty Supervisor

- **Jeffrey Moore II** – **Level:** Masters, **Focus:** Hardware Verification Using Alloy, **Projected grad date:** Fall 2020

Graduated Students

- **Jasmine Mabrey**
 - **MS May 2020:** Automated Defect Classification using Machine Learning
 - **First job:** Sandia National Laboratory, Albuquerque, NM
 - **Award:** Named NC A&T Rising Scholar
- **George Thompson**
 - **MS May 2020:** Towards Automated Fault Localization for Prolog **Nominated for Outstanding Thesis Award**
 - **First job:** Sandia National Laboratory, Albuquerque, NM
- **Regina Bunch**
 - **MS December 2018:** AMail: Email for Autism
 - **First job:** Cigna, Philadelphia, PA
- **Joelle Banks** – **Level:** Undergraduate, **Focus:** Empirical Study of Program Repair Techniques, **Graduation date:** May 2020
- **William Dunston** – **Level:** Undergraduate, **Focus:** Extending Java-Based Program Repair, **Graduation date:** May 2020

Student Committee Member

I have had the honor of serving on the following student committees:

- **PhD Committee Member:** : Hanan Alshahr (Fall 2019, NC A&T)
- **Master Thesis Committee Member:** Derrick Leflore (Fall 2019, NC A&T), Shannon Wiggins Brown (Spring 2020, NC A&T)
- **External Member:** Yuanrui Ren (Fall 2018, The University of Texas at Austin).

Former member of NC A&T’s Center of Excellence in Cybersecurity Research, Education and Outreach (CREO)

- 2018 -2020: I worked with an interdisciplinary group to apply formal methods to the cybersecurity field.

Open Source Contributions

Fault Localization Tool for Prolog

- **ProFL.** ProFL is a command-line fault localization tool for Prolog models. The toolset provides spectrum-based and mutation-based fault localization techniques: <https://github.com/george1d127/ProFL>.

Solution Enumeration Tool for Alloy

- **Seabs.** Toolset to guide solution enumeration for Alloy models using abstract functions, which specify how the solutions must differ: <https://github.com/Allisonius/Seabs>.

Verification and Synthesis Tools for Alloy

- **AUnit Analyzer.** Extension to the Alloy Analyzer that provides support for AUnit, namely: test creation and execution, coverage reporting, and automated test generation: <https://sites.google.com/view/aunitanalyzer>.
- **MuAlloy.** A command line tool built on top of Alloy 4.2 that provides mutation testing and mutation-based test generation for Alloy models: <https://github.com/kaiyuanw/MuAlloy>.
- **ARepair.** A command line tool built on top of Alloy 4.2 that automatically repairs faulty Alloy models, including models with multiple faults: (<https://github.com/kaiyuanw/ARepair>).
- **ASketch.** A command line tool built on top of Alloy 5.0 that can synthesis partial Alloy models, producing complete models which are correct w.r.t. a test suite: <https://github.com/kaiyuanw/ASketch>.

Honors & Awards

Oct 2019	Grace Hopper Celebration 2019 Faculty Scholarship from AnitaB.org
2012 - 2016	Virginia and Ernest Cockrell Jr. Fellowship in Engineering Recipient , University of Texas at Austin.
Spring 2012	ECS Departmental Honors , University of Texas at Dallas.
2008 - 2012	Academic Excellence Scholarship Recipient , University of Texas at Dallas.

Teaching Experience

Fall 2020	Instructor , CSE 5311: Design and Analysis of Algorithms, University of Texas at Arlington.	<i>Graduate</i>
Spring 2020	Instructor , COMP 496: Senior Design, North Carolina A&T State.	<i>Undergrad</i>
Spring 2020	Instructor , COMP 681: Formal Methods, North Carolina A&T State.	<i>Graduate</i>
Fall 2019	Instructor , COMP 285: Analysis of Algorithms, North Carolina A&T State.	<i>Undergrad</i>
Fall 2019	Instructor , COMP 611: System Testing and Evaluation, North Carolina A&T State.	<i>Graduate</i>
Spring 2019	Instructor , COMP 496: Senior Design, North Carolina A&T State.	<i>Undergrad</i>
Spring 2019	Instructor , COMP 681: Formal Methods, North Carolina A&T State.	<i>Graduate</i>
Fall 2018	Instructor , COMP 285: Analysis of Algorithms, North Carolina A&T State.	<i>Undergrad</i>
Spring 2016	Teaching Assistant , EE 382C: Verification and Validation, University of Texas at Austin.	<i>Graduate</i>
Spring 2014	Teaching Assistant , EE 382C: Requirements Engineering, University of Texas at Austin.	<i>Graduate</i>
Fall 2011	Teaching Assistant , CS 3345: Data Structures & Algorithms, University of Texas at Dallas.	<i>Undergrad</i>

Professional Service

Panelist	2 panels at the National Science Foundation (NSF), Alexandria, VA in 2020
PC Member	The ACM Joint European Software Engineering Conference and Symposium on the Foundations of Software Engineering Tools and Demonstration Track (FSE Demo 2020)
PC Member	The 27th International SPIN Symposium on Model Checking of Software (SPIN 2020)
PC Member	Special Interest Group on Computer Science Education Technical Symposium (SIGCSE 2020)
PC Member	5th International Conference on Research in Equity and Sustained Participation in Engineering, Computing, and Technology (RESPECT 2020)
Reviewer	Software Tools for Technology Transfer (STTT)
Co-Reviewer	27th International Symposium on Software Testing and Analysis (ISSTA 2018)
Co-Reviewer	11th International Conference on Software Testing, Verification and Validation (ICST 2018)
Co-Reviewer	25th International Symposium on the Foundations of Software Engineering (FSE 2017)
Co-Reviewer	10th International Conference on Software Testing, Verification and Validation (ICST 2017)
Co-Reviewer	31st IEEE/ACM International Conference on Automated Software Engineering (ASE 2016)