

SEAN KAUFFMAN Ph.D.

US and Canadian dual citizen

RESEARCH INTERESTS

Runtime Verification
Real-time Embedded Systems
Security and Reliability

TEACHING INTERESTS

Formal Methods
Systems Programming
Compiler Construction

SUMMARY OF QUALIFICATIONS

- 11 refereed publications in the last 5 years
- 15+ years of industry experience as a software engineer
- 11 of the last 18 terms spent as a course instructor, instructional apprentice, or TA
- Awarded \$85,833 in scholarships since 2014

EDUCATION

Doctor of Philosophy · University of Waterloo, Waterloo ON 2017-2021

- *Department:* Electrical & Computer Engineering
- *Thesis:* Runtime Monitoring for Uncertain Times
- *Supervisor:* Prof. Sebastian Fischmeister

Master of Mathematics · University of Waterloo, Waterloo ON 2014-2016

- *Department:* Computer Science
- *Thesis:* Static Transformation of Power Consumption for Program Tracing and Software Attestation
- *Supervisor:* Prof. Sebastian Fischmeister

Certificate · University of Washington PCE, Bellevue WA 2011-2012

- *Department:* Embedded and Real-Time Systems Programming

Bachelor of Arts · Goshen College, Goshen IN 2001-2005

- *Department:* Computer Science
- *Supervisor:* Prof. David Housman

RESEARCH

Doctoral Research · Electrical & Computer Engineering, University of Waterloo 2017-2021

- Developed a theoretical framework for the monitorability of temporal properties over unreliable communication channels to ensure remote verdict reliability
- Created a language and monitoring system for abstracting event streams into a hierarchy of temporal intervals to aid spacecraft telemetry comprehension
- Collaborated on the design, construction, and testing of a framework for distributed anomaly detection in embedded systems to support autonomous driving research
- Designed and performed ionizing radiation experiments on embedded systems at the Los Alamos Neutron Science Center (LANSCE) to generate realistic datasets for anomaly detection research
- Qualified the development toolchain of an autonomous driving company to meet ISO26262 ASIL-D standards
- Supervised five undergraduate research assistants and mentored four incoming graduate students

Master's Research · Computer Science, University of Waterloo

2014-2016

- Developed static compiler transformations for manipulating the execution side-effects of embedded software to improve security and debugging that relied on those side-effects to differentiate between program segments
- Analyzed the worst-case execution time (WCET) effects of toolchain modifications in model-generated engine control software for a large aerospace manufacturer using full factorial experiments on randomly generated micro-benchmarks

Industry Research · Oracle Corporation

2017-present

- Designed a method for efficient storage and retrieval of items with context-dependant elements to improve the performance and extensibility of the database system for customer product catalogs containing many millions of SKUs

TEACHING

Teaching: Training

Certificate in University Teaching (CUT) · University of Waterloo

2018-2019

- Provides selected PhD students at the University of Waterloo with advanced training in University instruction
- The goal is for participants to become self-aware, critically-reflective teachers who have gained both theoretical knowledge and skills that contribute to success in an academic career
- Comprised of three courses in Graduate Studies (GS): GS 901, GS 902, and GS 903 - which provide a comprehensive teacher-development experience

ExpecTations TA Workshop · UW Faculty of Engineering

December 2017

- Intensive workshop with faculty and student mentors
- Includes both small-group and online activities
- Learners practice giving lessons and marking student work while examining the relationships between TAs, instructors, and students

Fundamentals of University Teaching · UW Centre for Teaching Excellence

2015-2016

- Accredited by the Educational Developers Caucus (EDC)
- Supports Waterloo graduate students in their development as university TAs and instructors
- Comprised of six teaching workshops and three microteaching sessions to deliver mini lessons to peers and receive feedback on teaching

Completed Teaching Workshops · UW Centre for Teaching Excellence

- CTE 2409 – Inclusive Teaching Workshop Spring 2020
- CTE 146 – Teaching Research Projects Workshop Fall 2018
- CTE 165 – Interactive Teaching Workshop Spring 2018
- CTE 750 – Gamification and Game-based Learning Workshop Winter 2018
- CTE 073 – Course Design Workshop Winter 2018
- CTE 020 – Assessing Student Learning Workshop Winter 2018
- CTE 068 – Understanding the Learner Workshop Winter 2018
- CTE 219 – Special Topics In Teaching Workshop: Math Anxiety and Problem-Based Learning Fall 2015
- CTE 226 – Classroom Delivery Skills Teaching Workshop Spring 2015
- CTE 217 – Teaching Methods Teaching Workshop Spring 2015
- CTE 106 – Giving and Receiving Feedback Teaching Workshop Spring 2015
- CTE 202 – Effective Lesson Plans Teaching Workshop Spring 2015
- CTE 247 – TA Course Instructor Relation Workshop Spring 2015

Teaching: Experience

Course Instructor · Wilfrid Laurier University

- *CP 367 – Introduction to System Programming* *Winter 2020, Section A*
 - Independently developed and taught this elective course for about 35 third-year undergraduate CS majors
 - Used flipped-classroom techniques to encourage student engagement
 - Held office hours, answered emails, met with students individually, ran labs, and marked all coursework
 - Built assignments from scratch to emphasize core concepts
 - Adapted the course to online learning near end-of-term due to COVID-19 pandemic

Course Instructor · University of Waterloo

- *CS 241 – Foundations of Sequential Programs* *Winter 2017, Section 4 · Fall 2017, Section 2*
 - Lectured classrooms of about 60 second-year undergraduate CS majors for two terms
 - Individually prepared lectures and classroom activities, and prepared exams with other instructors
 - Held office hours, answered online forum questions, and met with students individually

Guest Lectures · University of Waterloo

- *ECE 455 – Embedded Software* *May 30, 2016*
- *CS 251 – Computer Organization* *May 3, 2016 · May 5, 2016 · March 7, 2019*
- *SE 350 – Operating Systems* *March 15, 2016 · March 17, 2016*
 - Prepared and delivered guest lectures for undergraduate courses in three different departments
 - Covered diverse topics such as WCET analysis, MIPS architecture, virtual machines, and OS security
 - In some cases, wrote exam questions for the covered material

Tutorials · University of Waterloo

- *ECE 458 – Computer Security* *Fridays, Spring 2019*
- *CS 230 – Introduction to Computers and Computer Systems* *May 22, 2018*
- *ECE 455 – Embedded Software* *May 12, 2017 · June 2, 2017 · June 23, 2017*
- *CS 251 – Computer Organization & Design* *August 7, 2015 · April 8, 2016 · August 4, 2016*
 - Created and presented material on the practical application of course topics and on exam review
 - Incorporated active learning activities along with traditional lecturing

Instructional Apprentice · University of Waterloo

- *CS 251 – Computer Organization & Design* *Spring 2015 · Winter 2016 · Spring 2016*
 - Held office hours, answered online forum questions, and delivered tutorials
 - Managed a group of TAs responsible for marking assignments and exams
 - Served as a resource for students to lower the load on instructors

Teaching Assistant · University of Waterloo

- *ECE 458 – Computer Security* *Spring 2019 · Spring 2020*
- *ECE 455 – Embedded Software* *Spring 2017*
- *CS 430 – Applications Software Engineering* *Winter 2015*
- *CS 135 – Designing Functional Programs* *Fall 2014*
 - Marked assignments, labs, and exams
 - Managed labs and held office hours
 - Prepared and delivered tutorials
 - Designed and administered a significant class project for ECE 458 for two terms

WORK EXPERIENCE

Visiting Student Researcher · Jet Propulsion Laboratory · Pasadena, CA

2015–2016

- Collaborated with the Laboratory for Reliable Software (LARS) at NASA JPL on research related to efficiently processing and understanding spacecraft telemetry.

Principal Member of Technical Staff · Oracle Corporation · Bellevue, WA 2011–2014

- Became the lead engineer on the recommendations team, heading most technical discussions and involved in all of them. Took on a mentoring role to the other developers on the team as well as the QA organization.
- Continued to oversee and approve all major code changes and any client-side code changes to the personalized content product developed at ATG. This product has since been tightly integrated with acquired services from RightNow.
- Redesigned the model the recommendations service uses to import, store and retrieve customers' catalog data. The redesign led to vastly improved performance, support for context specific properties, better internationalization support and easier full text search. This design work led to a patent being filed by Oracle at the request of the product VP.
- Led the integration work with a new cloud-based commerce offering being developed by Oracle. During this work became a major contributor to designs for 3rd party integrations of this new offering, and technical consultant to another team building a social-media integration.
- While at Oracle was promoted to the equivalent of Principal Software Engineer.

Member of the Board of Directors · VectorBlox Computing · Vancouver, BC 2012–2014

- VectorBlox sold a soft vector processor core for both Altera and Xilinx FPGA's which can be programmed using C/C++, mitigating the need for customers to develop custom hardware.
- Joined the board early in its life prior to the hiring of employees or the completion of the primary IP. Provided business and technical advice during the hiring of all employees, and development of the Xilinx core.
- VectorBlox was acquired by Microchip Technology Inc. in September, 2019.

Senior Software Engineer · Art Technology Group · Seattle, WA 2008–2011

- Continued to lead client-side development of the product recommendations product at ATG. Rearchitected the core client code to support integrations with other products. The library now supports three separate products and has been used on many of the largest sites on the internet including amazon.com, samsclub.com, americanexpress.com, nike.com, walgreens.com, sears.com and almost every major U.S. airline website.
- Designed, implemented and documented a new public API which allowed cross-channel integrations, improved performance by reducing latency and made the service more easily debugged.
- When management looked at replacing a legacy personalized content product, researched and proposed a design using existing technology. Built a prototype and qualified its performance and tradeoffs which led to the design being accepted. Assisted with initial development and training of the team. Responsible for sign-off on any major code changes.
- Designed and built a unique testing framework to allow in-servlet tests to interact with web browsers and inspect the results of those interactions in memory.
- Implemented many performance and scalability improvements in client, server and offline applications to allow the recommendations service to handle over 80 million hits and serve more than 33 million personalized sets of recommendations per day.
- While at ATG was promoted to the equivalent of Senior Software Engineer. In March 2011, ATG was acquired by Oracle.

Software Engineer · CleverSet Inc · Seattle, WA 2007–2008

- CleverSet was founded to perform predictive analysis for government contracts, with customers like NASA, the Navy and DoHHS, then adapted the technology to a SaaS product recommendations service.
- Led client-side development for the commercial side of the business, focusing on performance and reliability improvements, and building test harnesses from scratch.
- Designed and implemented methods for display customization using industry standards and custom extensions, decoupling display from data models. Wrote validation tools for the customers to use when developing their display functions.
- Invented a method for guaranteed delivery when the service was slow or unavailable, preventing most customers from ever noticing downtime.
- In addition to software development, handled client-services, documentation, sales and operations work when required by the small startup. CleverSet was acquired by Art Technology Group in early 2008.

Partner / Software Researcher · HKMN Consulting · Toronto, ON 2006–2007

- Acted as a partner and lead programmer in a consulting company specializing in web services development for not-for-profit companies and research projects.
- Stabilized and developed RSS scraping capabilities for the Webivore social media analysis tool with Ryerson University.

Software Developer / System Administrator · Mennonite.net · Goshen, IN 2004–2005

- System Administrator and Software Developer on an in-house open-source content management system in a very self-supervised environment.
- Rebuilt the mail, database and web infrastructure which was able to cope with the enormous traffic to the Mennonite Disaster Service website after Hurricane Katrina.

Software Developer · Goshen College · Goshen, IN 2002–2004

- Developed and maintained a large repository of custom software for use by college faculty, staff, students and alumni.
- Major projects included student directory services, the school’s first online application, career mentoring and course review software.

PROFESSIONAL SERVICE

Program Committee

- *19th International Conference on Runtime Verification (RV 2019) – Benchmark paper track* 2019

Artifact Evaluation Committee

- *25th Intl. Conf. on Tools and Algs. for the Construction and Analysis of Systems (TACAS 2019)* 2019
- *24th Intl. Conf. on Tools and Algs. for the Construction and Analysis of Systems (TACAS 2018)* 2018

Journal Reviewer

- *Autonomous Agents and Multi-Agent Systems (AGNT)* 2020
- *ACM Transactions on Software Engineering and Methodology (TOSEM)* 2018 · 2019
- *ACM Transactions on Computational Logic (ToCL)* 2018 · 2019
- *ACM Transactions on Embedded Computing Systems (TECS)* 2016

PUBLICATIONS

S. Kauffman, K. Havelund, S. Fischmeister. “What Can We Monitor Over Unreliable Channels?” *International Journal on Software Tools for Technology Transfer*:(June 2021), 1–22. ISSN: 1433-2779. DOI: [10.1007/s10009-021-00625-z](https://doi.org/10.1007/s10009-021-00625-z) *Journal Article*

S. Kauffman, M. Dunne, G. Gracioli, W. Khan, N. Benann, S. Fischmeister. “Palisade: A Framework for Anomaly Detection in Embedded Systems”. *Journal of Systems Architecture* 113:(2021), 101876. ISSN: 1383-7621. DOI: [10.1016/j.sysarc.2020.101876](https://doi.org/10.1016/j.sysarc.2020.101876) *Journal Article*

S. Kauffman, K. Havelund, S. Fischmeister. “Monitorability Over Unreliable Channels”. *International Conference on Runtime Verification (RV’19)*. Volume 11757. LNCS. Springer, 2019, p. 256–272. ISBN: 978-3-030-32079-9. DOI: [10.1007/978-3-030-32079-9_15](https://doi.org/10.1007/978-3-030-32079-9_15) *Conference Paper*

S. Kauffman, S. Fischmeister. “Event Stream Abstraction Using nfer: Demo Abstract”. *International Conference on Cyber-Physical Systems (ICCPs’19)*. ACM Press, 2019, p. 332–333. ISBN: 978-1-4503-6285-6. DOI: [10.1145/3302509.3313327](https://doi.org/10.1145/3302509.3313327) *Conference Demo*

S. Kauffman, K. Havelund, R. Joshi, S. Fischmeister. “Inferring Event Stream Abstractions”. *Formal Methods in System Design* 53:(2018), 54–82. ISSN: 1572-8102. DOI: [10.1007/s10703-018-0317-z](https://doi.org/10.1007/s10703-018-0317-z) *Journal Article*

S. Kauffman, S. Fischmeister. “Mining Temporal Intervals from Real-time System Traces”. *International Workshop on Software Mining (SoftwareMining’17)*. IEEE, 2017, p. 1–8. ISBN: 978-1-5386-1389-4. DOI: [10.1109/SOFTWAREMINING.2017.8100847](https://doi.org/10.1109/SOFTWAREMINING.2017.8100847) *Workshop Paper*

A. Narayan, **S. Kauffman**, J. Morgan, G. M. Tchamgoue, Y. Joshi, C. Hobbs, S. Fischmeister. “System Call Logs with Natural Random Faults: Experimental Design and Application”. *International Workshop on Silicon Errors in Logic – System Effects (SELSE’17)*. SELSE-13. IEEE, 2017 *Workshop Paper*

S. Kauffman, K. Havelund, R. Joshi. “nfer—A Notation and System for Inferring Event *Conference Paper*

Stream Abstractions". *International Conference on Runtime Verification (RV'16)*. Volume 10012. LNCS. Springer, 2016, p. 235–250. DOI: [10.1007/978-3-319-46982-9_15](https://doi.org/10.1007/978-3-319-46982-9_15)

S. Kauffman, R. Joshi, K. Havelund. "Towards a logic for inferring properties of event streams". *International Symposium on Leveraging Applications of Formal Methods (ISoLA'16)*. Volume 9953. LNCS. Springer, 2016, p. 394–399. DOI: [10.1007/978-3-319-47169-3_31](https://doi.org/10.1007/978-3-319-47169-3_31) Conference Paper

S. Kauffman, C. Moreno, S. Fischmeister. "Static Transformation of Power Consumption for Software Attestation". *International Conference on Embedded and Real-Time Computing Systems and Applications (RTCSA'16)*. IEEE, 2016, p. 188–194. ISBN: 978-1-5090-2479-7. DOI: [10.1109/RTCSA.2016.45](https://doi.org/10.1109/RTCSA.2016.45) Conference Paper

C. Moreno, **S. Kauffman**, S. Fischmeister. "Efficient Program Tracing and Monitoring Through Power Consumption – With a Little Help From the Compiler". *Design, Automation & Test in Europe Conference & Exhibition (DATE'16)*. IEEE, 2016, p. 1556–1561. ISBN: 978-3-9815-3707-9. DOI: [10.3850/9783981537079_0829](https://doi.org/10.3850/9783981537079_0829) Conference Paper

PATENTS

Context Dependent Data Management & Display · US10417685B2 September 2019

- Inventors: Stephen Drye, **Sean Kauffman**, Matt Landau.
- Methods and mechanisms for storage, communication and display of context dependent properties of items with inheritance.

SPECIAL TRAINING

ISO 26262 · SGS-TÜV July 2017

- kVA Automotive Functional Safety Training (**Certified Automotive Functional Safety Professional**)

Esterel SCADE · ANSYS January 2015

- Model-Based Design with SCADE Suite

FUNDING

Major Awards

- **Ontario Graduate Scholarship (OGS)** \$15,000 · \$15,000 · \$15,000 2018 · 2019 · 2020
A prestigious competition-based provincial graduate scholarship
- **President's Graduate Scholarship (UW PGS)** \$5,000 · \$5,000 · \$5,000 2018 · 2019 · 2020
Given to outstanding graduate students who hold certain major federally and provincially funded competition-based scholarships
- **Faculty of Engineers UW Graduate Scholarship (FOE)** \$1,500 · \$1,500 · \$1,500 *Fall 2019 · Spring 2020 · Fall 2020*
Engineering faculty scholarship for graduate students who have shown strong merit in the previous term

Minor Awards

- **Faculty of Engineering Domestic Doctoral Student Award (ENG DDSA)** \$2,833 · \$8,500 2016 · 2017
Given to eligible domestic students entering a doctoral program in the Faculty of Engineering
- **Waterloo Senate Graduate Scholarship (ENG Senate Grad Schlp)** \$1,000 2016
Helps deserving graduate students in good academic standing who have not received a major external scholarship
- **Math Domestic Graduate Student Award (MATH DGSA)** \$1,000 · \$2,000 · \$2,000 2014 · 2015 · 2016
Supports domestic graduate students in the Faculty of Mathematics who are engaged in research-based programs

- *Math Graduate Experience Award - Computer Science (MATH GEA)* \$3,000 · \$1,000 2014 · 2015
Provides financial support for full-time graduate students who acquire experience as a Teaching Assistant during the course of their graduate degree program

Total Funding: \$85,833