

Christopher Johannsen

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Research Interests

- ▶ Model checking and satisfiability checking of temporal logic properties for finite- and infinite-state systems.
- ▶ Runtime verification of real-time, resource-constrained embedded systems, especially in the aerospace domain.
- ▶ Scalable verification of security policies (e.g., non-interference) of systems with high-velocity data.

Education

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| PhD in Computer Science, Iowa State University Advisor: Kristin Y. Rozier, GPA: 4.0 | 2022 - Present |
| M.S. in Computer Science, Iowa State University Advisor: Kristin Y. Rozier, GPA: 4.0 Thesis: Dynamic Set Reasoning: Specifying and Optimizing Monitor Encodings | 2022 - 2024 |
| B.S. in Computer Engineering and Philosophy, Iowa State University <i>Summa Cum Laude</i> , GPA: 3.92 | 2017 - 2021 |

Internships and Research Visits

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| SRI International , <i>Computer Science Laboratory Intern</i> , Menlo Park, CA Mentors: Natarajan Shankar, Ahmed Irfan and Stéphane Graham-Legrand ▶ Implemented internal improvements and new frontends to the infinite-state model checker Sally. ▶ Assisted in design of the novel model-checking intermediate language MoXI. ▶ Implemented translation toolchain from high- to mid- to low-level model-checking languages. | 2025, 2026 |
| Fondazione Bruno Kessler (FBK), Formal Methods Unit , <i>Intern</i> , Trento, Italy Mentors: Alessandro Cimatti, Alberto Griggio, and Stefano Tonetta ▶ Developed a novel infinite-state model-checking algorithm for LTL properties. ▶ Researched abstraction and termination analysis techniques for infinite-state systems. | 2024 |
| Siemens EDA (fmr. Mentor Graphics) , <i>Formal Verification Intern</i> , Virtual Mentor: Sagar Chaki ▶ Optimized SMT query ordering for equivalence checking SystemC/SystemVerilog models during High-level Synthesis (HLS). ▶ Implemented abstract interpretation engine for SystemC models. ▶ Evaluated new techniques by creating experiments using customer designs. | 2023, 2021 |
| Motorola Solutions Applied Technologies , <i>Embedded Software Engineering Intern</i> , Schaumburg, IL | 2020 |
| Collins Aerospace , <i>Platform Systems Engineering Co-op</i> , Cedar Rapids, IA | 2019 |

Publications

[NFM 26] [From Natural Language Requirements to Runtime Monitors for Resource-Constrained Systems: Integrating FRET and R2U2](#)
Alexis Aurandt, Christopher Johannsen, Andreas Katis, Anastasia Mavridou, Kristin Yvonne Rozier, and Phillip H. Jones
In Proc. of NASA Formal Methods Symposium (NFM), 2026

[FMCAD 25] [Scalable MLTL Runtime Monitoring and Satisfiability via Bit-Vector Encoding](#)
Christopher Johannsen, Phillip H. Jones, Kristin Yvonne Rozier, and Tichakorn Wongpiromsarn
In Proc. of Formal Methods in Computer-Aided Design (FMCAD), 2025

[iFM 25] CTL Model Checking Partially Specified Systems

Eshita Zaman, [Christopher Johannsen](#), Andrew S. Miner, Gianfranco Ciardo, and Samik Basu
In Proc. of International Conference on Integrated Formal Methods (iFM), 2025

[CAV 25] Infinite-state Liveness Checking with rlive

Alessandro Cimatti, Alberto Griggio, [Christopher Johannsen](#), Kristin Rozier, and Stefano Tonetta
In Proc. of International Conference on Computer Aided Verification (CAV), 2025
(Awarded 2025 ISU Department of Computer Science Publication Award)

[CAV 24] The MoXI Model Exchange Tool Suite

[Chris Johannsen](#), Karthik Nukala, Rohit Dureja, Ahmed Irfan, Natarajan Shankar, Cesare Tinelli, Moshe Y. Vardi, and Kristin Yvonne Rozier
In Proc. of International Conference on Computer Aided Verification (CAV), 2024
(Awarded 2024 ISU Department of Computer Science Publication Award)

[SPIN 24] MoXI: an intermediate language for symbolic model checking

Kristin Yvonne Rozier, Rohit Dureja, Ahmed Irfan, [Chris Johannsen](#), Karthik Nukala, Natarajan Shankar, Cesare Tinelli, and Moshe Y Vardi
In Proc. of International Symposium on Model Checking Software (SPIN), 2024

[FMICS 23] Impossible Made Possible: Encoding Intractable Specifications via Implied Domain Constraints

[Chris Johannsen](#), Brian Kempa, Phillip H Jones, Kristin Y Rozier, and Tichakorn Wongpiromsarn
In Proc. of International Conference on Formal Methods for Industrial Critical Systems (FMICS), 2023

[CAV 23] R2U2 Version 3.0: Re-imagining a Toolchain for Specification, Resource Estimation, and Optimized Observer Generation for Runtime Verification in Hardware and Software

[Chris Johannsen](#), Phillip Jones, Brian Kempa, Kristin Yvonne Rozier, and Pei Zhang
In Proc. of International Conference on Computer Aided Verification (CAV), 2023

[ADA 22] Improving Usability and Trust in Real-Time Verification of a Large-Scale Complex Safety-Critical System

Brian Kempa, [Chris Johannsen](#), and Kristin Yvonne Rozier
Ada User Journal, 2022

[ICUAS 21] OpenUAS Version 1.0

[Chris Johannsen](#), Marcella Anderson, William Burken, Ellie Diersen, John Edgren, Colton Glick, Stephanie Jou, Adhyaksh Kumar, John Levandowski, Evelyn Moyer, Taylor Roquet, Alexander VandeLoo, and Kristin Yvonne Rozier
In Proc. of International Conference on Unmanned Aircraft Systems (ICUAS), 2021

Teaching

Guest Lecturer

Computational Techniques for Aerospace Design (AER E 361) Spring 24, Spring 25, Spring 26
Lectured series on C structs and matrix representations.
Applied Formal Methods (AER E/COM S 407/507) Fall 24, Fall 25

Teaching Assistant

Applied Formal Methods (AER E/COM S 407/507) Fall 21, Fall 23

Grader

Computational Techniques for Aerospace Design (AER E 361) Spring 21, Spring 23
Moral Theory and Practice (PHIL 230) Fall 21
Applied Formal Methods (AER E/COM S 407/507) Spring 21

Professional Service

Artifact Committee Member

Quantitative Evaluation of SysTems (QEST) and Formal Modeling and Analysis of Timed Systems (FORMATS) 2025, 2026
Tools and Algorithms for the Construction and Analysis of Systems (TACAS) 2026
International Symposium on Model Checking Software (SPIN) 2026

Conference Reviewer

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| <i>Tools and Algorithms for the Construction and Analysis of Systems (TACAS)</i> | 2024, 2025 |
| <i>Automated Technology for Verification and Analysis (ATVA)</i> | 2023 |
| <i>Formal Methods in Computer-Aided Design (FMCAD)</i> | 2022 |

Student Volunteer

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| <i>Computer Aided Verification (CAV)</i> | 2023, 2024, 2025 |
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Awards and Honors

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| Outstanding Senior in Engineering , Iowa State University <i>Awarded to top student in each undergraduate engineering major</i> [Link] | 2021 |
| Phi Beta Kappa , Member | 2021 |

Research Funding and Scholarships

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| Iowa State University Department of Computer Science Publication Award <i>Awarded for CAV Publications, \$1,000 total</i> | 2024, 2025 |
| NASA Cooperative Agreement <i>Assisted with writing statement of work for role as PhD student, \$143,494 total</i> | 2021, 2022 |
| Iowa Space Grant Consortium NASA STEM Grant <i>Awarded to OpenUAS Project as Project Lead, \$4,203 total</i> | 2020, 2021 |
| Iowa State University Award for Competitive Excellence <i>Applied to B.S., \$32,000 total</i> | 2017 - 2021 |
| Dennis Muilenburg Scholarship <i>Applied to B.S., \$16,000 total</i> | 2017 - 2021 |

Travel Scholarships

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| Verification Mentor Workshop (affiliated with CAV) | 2023, 2024, 2025 |
| FMCAD Student Scholarship | 2024 |
| Summer School on Formal Specifications and Analysis for Software Engineers (SPECS) | 2025 |
| SRI International Summer School on Formal Methods (SSFT) | 2023, 2025 |

Contributed Projects

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| R2U2 : Realizable Responsive Unobtrusive Unit, a lightweight runtime verification engine. <i>Maintain its compiler and analysis tool, C2PO.</i> | Iowa State University |
| Sally : SMT-based Infinite-state model checker. | SRI |
| SABRe : Stream Analyzer via Bitwise Reasoning, a runtime monitoring tool. | Iowa State University |
| MoXI : Model eXchange Interlingua, an intermediate language for symbolic model checking. <i>Implemented a translation toolchain and reference parser/type checker.</i> | Iowa State University |
| SLEC : Sequential Logic Equivalence Checker. <i>Implemented abstract interpretation engine and improved coverage analysis.</i> | Siemens EDA |
| SMART : Stochastic Model-checking Analyzer for Reliability and Timing. <i>Implemented CTL model checking of partially specified systems.</i> | Iowa State University |

Technical Talks

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| Scalable MLTL Runtime Monitoring and Satisfiability via Bit-Vector Encoding Fondazione Bruno Kessler (FBK), Formal Methods Unit | 2025 |
| Dynamic Set Reasoning: Specifying and Optimizing Monitor Encodings Fondazione Bruno Kessler (FBK), Formal Methods Unit | 2024 |
| C2PO Translates for R2U2: Making Specification More Practical Workshop on Spacecraft Flight Software | 2023 |
| SpaceBots: Boldly Going Where No Bots Have Gone Before Workshop on Spacecraft Flight Software | 2022 |
| Abstract Interpretation: An Introduction Guest lecture, Applied Formal Methods, Iowa State University | 2021 |

Workshops and Training

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| Summer School on Formal Specifications and Analysis for Software Engineers (SPECS) Carnegie Mellon University | 2025 |
| SRI International Summer School on Formal Methods (SSFT) Menlo College, hosted by SRI | 2023, 2025 |
| Verification Mentorship Workshop (VMW) Affiliated with CAV | 2023, 2024, 2025 |

Memberships

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| ACM , Member | 2026 |
| IEEE , Member | 2026 |
| Phi Beta Kappa , Member | 2021 |