Chris Johannsen

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Education

Iowa State University, Ph.D. in Computer Science   2022 - Present
GPA: 4.0, Advisor: Kristin Y. Rozier

Iowa State University, M.S. in Computer Science   2022 - 2024
GPA: 4.0, Advisor: Kristin Y. Rozier
Thesis: *Dynamic Set Reasoning: Specifying and Optimizing Monitor Encodings*

Iowa State University, B.S. in Computer Engineering and Philosophy   2017 - 2021
GPA: 3.92, *Summa Cum Laude*

Employment

1/18 - Now   **Research Assistant**, *Iowa State University, Laboratory for Temporal Logic*, Ames, IA
▶ Implemented new compiler and specification language for the runtime verification tool R2U2.
▶ Optimized R2U2 monitor encodings using equality saturation and novel logical rewrite rules.
▶ Led OpenUAS undergraduate research team in developing an open-source fixed-wing UAS.

5/24 - 8/24   **Formal Methods Unit Intern**, *Fondazione Bruno Kessler, Formal Methods Unit*, Trento, Italy
▶ Developed a novel infinite-state model-checking algorithm for LTL properties.
▶ Researched abstraction and termination analysis techniques for infinite-state systems.

5/23 - 8/23
5/21 - 8/21   **Formal Verification Intern**, *Siemens EDA (fmr. Mentor Graphics)*, Wilsonville, OR
▶ Optimized SMT query ordering for SystemC/SystemVerilog equivalence checking.
▶ Implemented abstract interpretation engine for SystemC models.
▶ Evaluated new techniques by creating experiments using customer designs.

5/22 - 8/22   **Computer Science Laboratory Intern**, *SRI International*, Menlo Park, CA
▶ Assisted in design of the novel model-checking intermediate language MoXI.
▶ Implemented SMV to MoXI to Btor2 translation toolchain in Python.
▶ Contributed to formally-verified translation of MoXI using the PVS theorem prover.

6/20 - 8/20   **Embedded Software Engineering Intern**, *Motorola Solutions Applied Technologies*, Schaumburg, IL
▶ Developed software for a localized wireless network in a military context.

6/19 - 12/19   **Platform Systems Engineering Co-op**, *Collins Aerospace*, Cedar Rapids, IA
▶ Tested system-level avionics for aircraft including E-3 Sentry/AWACS and C-130.
▶ Maintained and updated English-level system requirements.

Teaching

▶ AER E 361: **Computational Techniques for Aerospace Design**, Co-Lecturer: Spring 2024
▶ COM S 507: **Applied Formal Methods**, Co-Instructor: Fall 2023
▶ COM S 507: **Applied Formal Methods**, Grader: Fall 2019, Fall 2021
▶ AER E 361: **Computational Techniques for Aerospace Design**, Grader: Spring 2021
▶ PHIL 230: **Moral Theory and Practice**, Grader: Fall 2021

Projects

- ▶ **MoXI**: Model eXchange Interlingua, an intermediate language for symbolic model checking. Implemented a translation toolchain and reference parser/type checker. [Website]
- ▶ **R2U2**: Realizable Responsive Unobtrusive Unit, a lightweight runtime verification engine. Maintain its compiler, C2PO. [Website]
- ▶ **SLEC**: Sequential Logic Equivalence Checking. Implemented abstract interpretation engine and improved coverage analysis. [Website]
- ▶ **SMART**: Stochastic Model-checking Analyzer for Reliability and Timing. Worked on CTL model checking engine. [Website]

Service

- ▶ **Reviewer**, *Tools and Algorithms for the Construction and Analysis of Systems (TACAS)*, 2025
- ▶ **Reviewer**, *Tools and Algorithms for the Construction and Analysis of Systems (TACAS)*, 2024
- ▶ **Student Volunteer**, *Computer Aided Verification (CAV)*, 2023
- ▶ **Reviewer**, *Automated Technology for Verification and Analysis (ATVA)*, 2023
- ▶ **Reviewer**, *Formal Methods in Computer-Aided Design (FMCAD)*, 2022

Awards and Honors

- ▶ **Outstanding Senior in Engineering**, Iowa State University, 2021
  Awarded to top student in each undergraduate engineering major [Link]
- ▶ **Phi Beta Kappa**, Member, 2021

Grants and Scholarships

- ▶ **2024 ISU Department of Computer Science Publication Award**
  Won for CAV publication, $500

- ▶ **Scholarship for Attendance at FMCAD 2023**

- ▶ **Travel Scholarship for Verification Mentor Workshop 2023**
  Part of CAV 2023.

- ▶ **NASA Cooperative Agreement for advancing the R2U2 statement of work**
  2022: $83,761, Fall 2021: $31,991, Spring 2021: $27,742

- ▶ **Iowa State University REU Winter 2020 Session**
  Funded for research at Laboratory for Temporal Logic, 2020, $3,000

- ▶ **Iowa Space Grant Consortium NASA STEM grant**
  Awarded to OpenUAS Project as Project Lead, 2020-2021, $4,203

- ▶ **Award for Competitive Excellence**, Iowa State University
  Applied to B.S., 2017-2021, $32,000

- ▶ **Dennis Muilenburg Scholarship**, Iowa State University
  Applied to B.S., 2017-2021, $16,000

Publications

- ▶ Chris Johannsen, Karthik Nukala, Rohit Dureja, Ahmed Irfan, Natarajan Shankar, Cesare Tinelli, Moshe Y. Vardi, and Kristin Yvonne Rozier. The MoXI Model Exchange Tool Suite. In Arie Gurfinkel and Vijay Ganesh, editors, *Computer Aided Verification*, pages 203–218, Cham, 2024. Springer Nature Switzerland **(2024 ISU Department of Computer Science Publication Award)**

► Kristin Yvonne Rozier, Rohit Dureja, Ahmed Irfan, Chris Johannsen, Karthik Nukala, Natarajan Shankar, Cesare Tinelli, and Moshe Y Vardi. MoXI: an intermediate language for symbolic model checking. In *Proceedings of the 30th International Symposium on Model Checking Software (SPIN). LNCS, Springer*, 2024

► Chris Johannsen, Brian Kempa, Phillip H Jones, Kristin Y Rozier, and Tichakorn Wongpiromsarn. Impossible Made Possible: Encoding Intractable Specifications via Implied Domain Constraints. In *International Conference on Formal Methods for Industrial Critical Systems*, pages 151–169. Springer, 2023

► Chris Johannsen, Phillip Jones, Brian Kempa, Krisitin Yvonne Rozier, and Pei Zhang. R2U2 Version 3.0: Re-imagining a Toolchain for Specification, Resource Estimation, and Optimized Observer Generation for Runtime Verification in Hardware and Software. In *International Conference on Computer Aided Verification (CAV), Paris, France, July 17-22, 2023*, 2023

► Brian Kempa, Christopher Johannsen, and Kristin Yvonne Rozier. Improving Usability and Trust in Real-Time Verification of a Large-Scale Complex Safety-Critical System. *Ada user journal*, 43(3), 2022

► 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. OpenUAS Version 1.0. In *2021 International Conference on Unmanned Aircraft Systems (ICUAS)*, pages 1449–1458, 2021

Theses

► Christopher George Johannsen. Dynamic set reasoning: Specifying and optimizing monitor encodings. Master's thesis, Iowa State University, 2024

Technical Talks

► "C2PO Translates for R2U2: Making Specification More Practical", *Workshop Presentation*, Workshop on Spacecraft Flight Software, Feb. 2023.

► "SpaceBots: Boldly Going Where No Bots Have Gone Before", *Workshop Presentation*, Workshop on Spacecraft Flight Software, Feb. 2022.

► "Abstract Interpretation: An Introduction", *Guest Lecture*, COM S 507 - Applied Formal Methods, Iowa State University, Ames, IA, Oct 28, 2021.

Workshops and Training

► Verification Mentorship Workshop, 2024
► Verification Mentorship Workshop, 2023
► SRI International Twelfth Summer School on Formal Methods (SSFT), 2023 (Virtual)
► SRI International Eleventh Summer School on Formal Methods (SSFT), 2022
► Flight Software Workshop, 2022 (Virtual)