Email: tzuhan@msu.edu
Phone: (515) 441-6303
Website: tzuhancs.github.io
LinkedIn: tzuhanhsu
#Citations: 90

Tzu-Han Hsu

Research Interests

My research focuses on developing algorithms for **verification** and **synthesis** using **formal methods** within the relational reasoning framework named **hyperproperties**, including applications in **privacy-aware** policies, **secure information-flow**, **reinforcement learning**, and **safety-guaranteed** analysis.

Education

Ph.D. Student in Computer Science and Engineering 2020–Present
Michigan State University, East Lansing, MI, USA, *Advisor: Dr. Borzoo Bonakdarpour*
GPA: 3.93/4.0 *2024 Best Research Poster Award by MSU College of Engineering*

Master in Computer Science and Engineering
Michigan State University, East Lansing, MI, USA, *Advisor: Dr. Borzoo Bonakdarpour*
GPA: 3.93/4.0 *2021 Google Research Fellowship Nomination by MSU College of Engineering*

Bachelor of Science in Computer Science 2016–20
Iowa State University, Ames, IA, USA
GPA: 3.86/4.0 *Graduated Magna Cum Laude*
2013-2020 ISU Dean's List

Bachelor of Music in Piano Performance 2013–17
Iowa State University, Ames, IA, USA
GPA: 3.86/4.0 *Outstanding Senior Nomination by the ISU Department of Music*

Research Experience

· **Graduate Research Assistant**, *Michigan State University* 2020–Present
Topics: Algorithms for Runtime Enforcement, Automated Program Repair, Policy Synthesis, and Model Checking for Hyperproperties
Keywords: Linear Temporal Logic, SMT Solving, Symbolic Execution, SyGuS

· **Research Intern**, *Microsoft Research (MSR)* Summer 2023
Project: Theorem-Carrying-Transaction: Provable Security for Smart Contracts
Mentors: *Shuo Chen, Nikolaj Bjørner*
Keywords: Solidity, Boogie, EVM, Go-Ethereum, ERC20, UniSwap-V2

· **Applied Science Intern**, *Amazon Web Services Automated Reasoning Group (AWS-ARG)* Summer 2022
Project: Symbolic Model Checking for Distributed Protocols with Parallelization
Mentors: *Aman Goel, Michael Whalen*
Keywords: P Language, Symbolic execution, AWS Lambda, Amazon S3

· **Undergrad Research Assistant**, *Iowa State University* 2019–20
Project: Bounded Model checking for Hyperproperties
Advisor: *Borzoo Bonakdarpour*
Keywords: QBF solvers, HyperLTL, Information-flow security

Journal Papers

[j1] Tzu-Han Hsu, Ana Oliveira da Costa, Andrew Wintenberg, Ezio Bartocci, Borzoo Bonakdarpour
"Gray-box Runtime Enforcement of Hyperproperties"
Acta Informatica (2025) To appear.

Conference Papers

[c1] Tzu-Han Hsu, Arshia Rafieioskouei, Borzoo Bonakdarpour
"HypRL: Reinforcement Learning of Control Policies for Hyperproperties"
Annual Conference on Neural Information Processing Systems (NeurIPS'25), to appear.

[c2] Raven Beutner, Tzu-Han Hsu, Borzoo Bonakdarpour, and Bernd Finkbeiner
"Syntax-Guided Automated Program Repair For Hyperproperties"
International Conference on Computer Aided Verification (CAV'24), Montreal, Canada.

[c3] Tzu-Han Hsu, Borzoo Bonakdarpour, Bernd Finkbeiner, and César Sánchez
"Bounded Model Checking for Asynchronous Hyperproperties"
International Conference on Tools and Algorithms for the Construction and Analysis of Systems (TACAS'23), Paris, France.

[c4] Tzu-Han Hsu, César Sánchez, Sarai Sheinvald, and Borzoo Bonakdarpour
"Efficient Loop Conditions for Bounded Model Checking Hyperproperties"
International Conference on Tools and Algorithms for the Construction and Analysis of Systems (TACAS'23), Paris, France.

[c5] Tzu-Han Hsu, Borzoo Bonakdarpour, Eunsuk Kang, and Stavros Tripakis
"Mapping Synthesis for Hyperproperties"
IEEE International Symposium on Computer Security Foundations (CSF'22/FLoC'22), Haifa, Israel.

[c6] Tzu-Han Hsu, César Sánchez, and Borzoo Bonakdarpour
"Bounded Model Checking for Hyperproperties"
International Conference on Tools and Algorithms for the Construction and Analysis of Systems (TACAS'21), Luxembourg, Luxembourg.

arXiv Preprints

[a1] Tzu-Han Hsu, Borzoo Bonakdarpour, and César Sánchez
"HyperQB: A QBF-Based Bounded Model Checker for Hyperproperties (v5)"

[a2] Tzu-Han Hsu, Yu Wang, Borzoo Bonakdarpour, Miroslav Pajic
"Multi-Agent Path Planning with Hyperproperties (v1)"

Research Fellowships

· **Michigan State University Graduate Research Fellowship** 2021, 2022
Received Summer Support for outstanding students selected by MSU CSE department.

· **Google Research Fellowship Nomination** 2021
Selected as one of the only four nominees selected by MSU College of Engineering.

Research Award

· **Best Research Poster Award** 2024
Awarded by Michigan State University College of Engineering Graduate Research Symposium.

Invited Research Talks

- **Purdue University Programming Languages Group (PurPL) Seminar** 2025
  Invited by prof. Benjamin J Delaware, scheduled in mid Nov. 2025
- **Academia Sinica (National Academy of Scientific Research, Taiwan)** 2023
  Hosted by prof. Yu-Fang Chen
- **Portland State University Department of Computer Science PLV Seminar** 2022
  Hosted by prof. Yao Li
- **University of California Santa Cruz: Languages, Systems, and Data Seminar** 2021
  Hosted by prof. Lindsey Kuper and prof. Tyler Sorensen
- **RWTH Aachen University, Germany** 2021
  Hosted by prof. Joost-pieter katoen and prof. Erika Ábrahám

Professional Services

- **Program Committee:**

EMSOFT	*International Conference on Embedded Software, WiP-LB TPC*	'25

- **Conference Paper Reviews**:

CSL	*European Association for Computer Science Logic*	'25
SRDS	*International Symposium on Reliable Distributed Systems*	'24
EMSOFT	*International Conference on Embedded Software*	'24
CAV	*International Conference on Computer Aided Verification*	'24
RV	*International Conference on Runtime Verification*	'24,'25
TACAS	*Tools and Algorithms for the Construction and Analysis of Systems*	'23,'25
FM	*International Symposium on Formal Methods*	'23
ICCPS	*International Conference on Cyber-Physical Systems*	'23
VSTTE	*Verified Software: Theories, Tools, Experiments*	'23
NFM	*NASA Formal Methods*	'23
DISC	*International Symposium on Distributed Computing*	'22
CSF	*Computer Security Foundations Symposium*	'22
ATVA	*Int'l Symposium on Automated Technology for Verification and Analysis*	'21

- **Conference Artifact Evaluation**:

CAV	*International Conference on Computer Aided Verification*	'23,'24

- **Journal Reviews:**

ACTA	*Acta Informatica*	'22,'25

Teaching Experience

- **Graduate Teaching Assistant** Spring 2020
  Michigan State University, CSE 260: Discrete Structures in Computer Science
- **Undergrad Teaching Assistant** Spring, Fall 2018
  Iowa State University, COM S 227: Introduction to Object-Oriented Programming

Honors and Scholarships

- **Outstanding Senior Nomination** by ISU Music Department 2020
- **Dean's List** of Iowa State University College of Liberal Arts and Sciences 2013–20
- **Future Leader Award** issued by U.S. Ambassador to China Terry Branstad 2018
- **Gold Level Scholarship Recipient** as Iowa State University International Student Ambassador 2013–18
- **Outstanding Student Scholarship Recipient** by Iowa State University Music Department 2013–18

Leadership and Volunteer Experiences

- **Research Conference Student Volunteer** at Computer Aided Verification for information publicity 2021
- **Certificate of Achievement** from The Society for Collegiate Leadership & Achievement 2016–20
- **Department Student Representative** of Iowa State University Student Council 2017–18
- **Volunteer/Event Coordinator** at Iowa Education without Borders (non-profit organization) 2017–18
- **Student Mentor** at Iowa Youth Leadership Summer Camp 2017–18
- **Student Volunteer** at Iowa State University Annual K-12 Computational Thinking Competition 2020

Music Awards and Honors

- **Assistant Concertmaster (Violin)** at Iowa State University Symphony Orchestra 2015-17
- **Soloist Winner - Piano Division** Fort Dodge Orchestra Young Artists Concerto Competition 2015
- **1st Prize Winner** Iowa State University Symphony Orchestra Concerto Competition 2014
- **State-Level Competition Winner** Music Teacher National Association (MTNA) Piano Competition 2014

Industrial Experience

Software Engineer Intern 2019–20
Worrell Medical Design Inc., Minneapolis, MN

- Developed a Virtual Reality Environment on *Oculus Quest* for usability testing in Human Factors Engineering.
- Programmed well-functioning C# scripts in *Unity3D* engine with desired behaviors and outcomes.
- Analyzed user feedback and debugged/adjusted/improved the existing versions of the program with human factors engineers.