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#Citations: 106

# Tzu-Han Hsu



## RESEARCH INTERESTS

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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

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### 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

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- **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

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- [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

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- [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

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- [a1] Thomas Ball, Nikolaj S. Bjørner, Ashley J. Chen, Shuo Chen, Yang Chen, Zhongxin Guo, Tzu-Han Hsu, Peng Liu, Nanqing Luo  
**“Theorem-Carrying Transactions: Runtime Verification to Ensure Interface Specifications for Smart Contract Safety (v2)”**
- [a2] Tzu-Han Hsu, Borzoo Bonakdarpour, and César Sánchez  
**“HyperQB: A QBF-Based Bounded Model Checker for Hyperproperties (v5)”**
- [a3] Tzu-Han Hsu, Yu Wang, Borzoo Bonakdarpour, Miroslav Pajic  
**“Multi-Agent Path Planning with Hyperproperties (v1)”**

## RESEARCH FELLOWSHIPS

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- **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

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

## INVITED RESEARCH TALKS

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- **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

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- **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:**
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  - ACTA** *Acta Informatica* '22,'25

## TEACHING EXPERIENCE

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- **Graduate Teaching Assistant** Spring 2020  
Michigan State University, CSE 260: Discrete Structures in Computer Science

- **Undergrad Teaching Assistant**  
Iowa State University, COM S 227: Introduction to Object-Oriented Programming

Spring, Fall 2018

## HONORS AND SCHOLARSHIPS

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- **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

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- **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

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- **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

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**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.