Pei-Wei Chen

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RESEARCH INTERESTS

My research focuses on formal methods, especially formal verification and synthesis. I am broadly interested in bridging theory and practice in reasoning and automation, and am currently exploring how to integrate AI techniques with formal approaches. My goal is to apply formal methods across diverse system and industrial domains.

EDUCATION

University of California, Berkeley *Berkeley, CA*
Ph.D Candidate in Electrical Engineering and Computer Sciences *Aug. 2021 – Present*
- Advisor: Prof. Sanjit A. Seshia

National Taiwan University *Taipei, Taiwan*
B.S. in Electrical Engineering *Sep. 2016 – Jan. 2021*

PUBLICATIONS

1. Yingchen Wang*, **Pei-Wei Chen***, Flavien Solt, Alejandro Sanchez Ocegueda, Adwait Godbole, Sanjit A. Seshia, Christopher W. Fletcher, "A Formal Foundation for Secure Stateful Remote Execution of Enclaves in the Cloud", In submission

2. **Pei-Wei Chen**, Shaokai Lin, Adwait Godbole, Ramneet Singh, Elizabeth Polgreen, Edward A. Lee, Sanjit A. Seshia, "PolyVer: A Compositional Approach for Polyglot System Modeling and Verification", *Formal Methods in Computer-Aided Design (FMCAD'25)*

3. Victoria Marie Tuck, **Pei-Wei Chen**, Georgios Fainekos, Bardh Hoxha, Hideki Okamoto, S. Shankar Sastry, Sanjit A. Seshia, "SMT-Based Dynamic Multi-Robot Task Allocation", *NASA Formal Methods Symposium (NFM'24)*

4. Clark Barrett, **Pei-Wei Chen***, Byron Cook, Bruno Dutertre, Robert B Jones, Nham Le*, Andrew Reynolds, Kunal Sheth*, Christopher Stephens, Michael W Whalen, "SMT-D: New Strategies for Portfolio-based SMT Solving", *Formal Methods in Computer-Aided Design (FMCAD'24)*

5. Kuan-Hao Chao*, **Pei-Wei Chen***, Sanjit A. Seshia, and Ben Langmead, "WGT: Tools and Algorithms for Recognizing, Visualizing and Generating Wheeler Graphs", *iScience 2023*

6. Justin Wong, **Pei-Wei Chen**, Tianjun Zhang, Joseph E. Gonzalez, Yuandong Tian, Sanjit A. Seshia, "Ashera: Neural Optimization Modulo Theories", Tech. rep. UCB/EECS-2023-103. EECS Department, UC Berkeley, 2023

7. **Pei-Wei Chen**, Yu-Ching Huang, Jie-Hong Roland Jiang, "A Sharp Leap from Quantified Boolean Formula to Stochastic Boolean Satisfiability Solving", *AAAI Conference on Artificial Intelligence (AAAI'21)*

8. **Pei-Wei Chen**, Yu-Ching Huang, Cheng-Lin Lee, Jie-Hong Roland Jiang, "Circuit Learning for Logic Regression on High Dimensional Boolean Space", *Design Automation Conference (DAC'20)*

RESEARCH EXPERIENCES

Berkeley Learn and Verify Lab, Prof. Sanjit A. Seshia *Berkeley, CA*
PHD CANDIDATE *Aug. 2021 – Present*

A Formal Foundation for Secure Stateful Remote Execution of Enclaves in the Cloud
- Identified security flaws in stateful execution and proposed a novel notion of security with a provably secure platform model.
- Designed a Key Management Service that refines our model with minimal performance overhead while achieving security.

PolyVer: A Compositional Approach for Polyglot System Modeling and Verification [PDF]
- Proposed a contract-based approach to automatically verify multi-language systems using language verifiers and an LLM oracle.
- Showed applicability and flexibility via verifying Lingua Franca (a polyglot language for buidling real-time systems) programs.

SMT-Based Dynamic Multi-Robot Task Allocation [PDF]
- Proposed an extensible SMT-based approach for multi-robot task allocation that guarantees soundness and completeness.
- Showed applicability and scalability under a uniform task arrival model using incremental SMT.

WGT: Tools and Algorithms for Recognizing, Visualizing and Generating Wheeler Graphs [PDF]
- Developed a toolkit that identifies and visualizes Wheeler graphs, the foundation for graph-based pangenome indexes.
- Identified 1000-node graphs in seconds and outperformed previous methods in performance and number of solved instances.

Automatic Underwater Unmanned Vehicle (UUV) Generation and Packing with Satisfiability Modulo Theories and Oracles (SMTO)
- Developed a human-AI co-design framework for generating UUVs that optimizes over energy usage given a mission.
- Applied SMT/SMTO to optimize over irregular UUV shapes while ensuring valid packing solutions.

Ashera: Neural Optimization Modulo Theories (OMT) [PDF]
- Developed an OMT solver (framework) incorporating an SMT solver (the verifier) and an ILP solver (the optimizer).
- Outperformed previous state-of-the-art OMT and MILP solvers in solving performance.

Applied Logic and Computation Lab, Prof. Jie-Hong Roland Jiang   *Taipei, Taiwan*
RESEARCH ASSISTANT   *Jul. 2019 – Jan. 2021*

Clause-selection Based Method for Solving Stochastic Boolean Satsifiability (SSAT) [PDF]
- Developed a general SSAT solver for solving SSAT formulas without any constraints.
- Outperformed previous state-of-the-art SSAT solvers in both solving performance and memory usage.

Circuit Learning for Logic Regression on High Dimensional Boolean Space [PDF]
- Proposed a decision-tree based algorithm for learning compact Boolean expressions of unknown functions.
- Won 1st place in 2019 ICCAD CAD Contest and outperformed others by up to 7000X in circuit size.

Electronic Design Automation Lab, Prof. Yao-Wen Chang   *Taipei, Taiwan*
RESEARCH ASSISTANT   *Jul. 2019 – Jul. 2020*

Floorplanning for Wafer-scale Deep Learning Accelerators [PDF]
- Proposed a B*-tree based algorithm for simultaneous resource allocation and placement for deep learning accelerators.
- Won 4th place in 2020 ISPD Contest and demonstrated robustness and stability under multiple constraints.

INDUSTRY EXPERIENCES

Amazon Web Services   *Portland, OR*
APPLIED SCIENTIST INTERN *(with Robert Jones)*   *May 2024 – Aug. 2024*

Distributed Satisfiability Modulo Theories Solvers [PDF]
- Extended SMT-D with open-source SMT solvers and analyzed on open and internal benchmarks.

Amazon Web Services   *Santa Clara, CA*
APPLIED SCIENTIST INTERN *(with Robert Jones)*   *May 2023 – Aug. 2023*

Distributed Satisfiability Modulo Theories Solvers
- Implemented infrastructure and developed heuristics for a scalable distributed SMT solver, SMT-D.

TEACHING

***Teaching Assistant*, Introduction to Embedded Systems (Fall 2025)**, Prof. Sanjit A. Seshia and Prabal Dutta   *Aug. 2025 – Dec. 2025*
***Teaching Assistant*, Introduction to Embedded Systems (Fall 2023)**, Prof. Sanjit A. Seshia and Prabal Dutta   *Aug. 2023 – Dec. 2023*
***Teaching Assistant*, Introduction to Electronic Design Automation (Spring 2019)**, Prof. Jie-Hong R. Jiang   *Feb. 2020 – Jun. 2020*
***Teaching Assistant*, Cornerstone EECS Design and Implementation (Spring 2018)**, Prof. Tzi-Dar Chiueh   *Feb. 2019 – Jun. 2019*

HONORS AND AWARDS

2024	**Taiwan Study Abroad Fellowship**, Ministry of Education, Taiwan
2023	**Outstanding Graduate Student Instructor Award**, UC Berkeley
2021	**Berkeley Fellowship for Graduate Study**, UC Berkeley
2020	**NTU Presidential Award (4 awards out of 8 semesters)**, National Taiwan University
2020	**2nd Prize**, National Taiwan University Innovation Awards
2020	**4th Place**, 2020 ISPD Contest
2019	**1st Place**, 2019 ICCAD CAD Contest Problem A
2019	**2nd Place**, 2019 CADathlon at ICCAD
2019	**TSMC Scholarship**, Taiwan Semiconductor Manufacturing Company