

Nian-Ze Lee

Curriculum Vitae

2023-11-19

Coordinates

Affiliation: Ludwig-Maximilians-Universität München
Software and Computational Systems Lab
Oettingenstr. 67, Munich, Germany
Citizenship: Taiwanese

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Year of birth: 1991

Research Interests

My research focuses on the application of formal methods to the analysis and optimization of computing systems, including software programs, VLSI circuits, and emerging technologies. Specifically, I am active in the following directions (tools which I developed or contributed to are given in parentheses):

- Development of new algorithms for software verification (CPACHECKER)
- Verification of sequential digital circuits with software techniques (BTOR2C)
- Stochastic Boolean satisfiability and its application to probabilistic systems (RESSAT and ERSSAT)
- Optimization and verification of threshold logic circuits (TLCOLLAPSEVERIFY)

The theoretical foundation of my work is algorithms and data structures, formal methods, mathematical logic, and system modeling. My goal is to invent new approaches and apply them to real-world challenges. I also emphasize software engineering for tool implementation and reproducible evaluation.

Education

2015 – 2021 **Ph.D., Graduate Institute of Electronics Engineering**
National Taiwan University, Taipei, Taiwan
Advisor: Prof. Jie-Hong R. Jiang
Lam Research Thesis Award
Dissertation: *Stochastic Boolean Satisfiability: Decision Procedures, Generalization, and Applications*

2009 – 2014 **B.Sc. in Eng., Department of Electrical Engineering**
Minor in Economics
National Taiwan University, Taipei, Taiwan

Academic Employment

since 2021 **Postdoctoral Researcher**, Host: Prof. Dirk Beyer
Ludwig-Maximilians-Universität München, Munich, Germany

2019 – 2020 **DAAD Scholarship Student**, Host: Prof. Dirk Beyer
Ludwig-Maximilians-Universität München, Munich, Germany

2018 – 2019 **Internship Student in ERATO MMSD Project**, Host: Prof. Ichiro Hasuo
National Institute of Informatics, Tokyo, Japan

2015 – 2021 **Research and Teaching Assistant**, Advisor: Prof. Jie-Hong R. Jiang
National Taiwan University, Taipei, Taiwan

Industrial Employment

2016 **Research Intern**, Mentor: Dr. Victor N. Kravets
IBM Thomas J. Watson Research Center, Yorktown Heights, NY, U.S.A.

Awards and Honors

2022 **Best Master Lecture**
Methods in Software Engineering, instructor: Prof. Gidon Ernst

2021 **Lam Research Ph.D. Thesis Award**
Dissertation title: *Stochastic Boolean Satisfiability: Decision Procedures, Generalization, and Applications*

2021 **Honorary Member of the Phi Tau Phi Scholastic Honor Society**
Achievement of academic excellence upon graduation

Grants

2023 **German Research Foundation (DFG)**, submitted in July
Research funding, requested € 300 K (1 Ph.D. position)

2023 **LMUexcellent PostDoc Support Fund**
Travel funding, € 6.5 K

2019-2020 **German Academic Exchange Service (DAAD)**
Joint scholarship with National Science and Technology Council, € 15 K

Important Publications

Statistics: h-index 8; 3 journal papers and 16 peer-reviewed conference papers in reputable venues, including the **IEEE Transactions on Computers** and **AAAI Conference on Artificial Intelligence**.

The complete list of my peer-reviewed publications can be found via

- My personal website: <https://nianzelee.github.io>
- DBLP: <https://dblp.org/pid/154/3010.html>
- Google Scholar: https://scholar.google.com/citations?user=_8OD03gAAAAJ

Below are my most important publications.

1. Dirk Beyer, Nian-Ze Lee, and Philipp Wendler. Interpolation and SAT-based model checking revisited: Adoption to software verification. *Journal of Automated Reasoning*, 2023. Accepted, preliminary version available on <https://doi.org/10.48550/arXiv.2208.05046>.
2. Dirk Beyer, Po-Chun Chien, and Nian-Ze Lee. Bridging hardware and software analysis with BTOR2C: A word-level-circuit-to-C translator. In *Proceedings of the International Conference on Tools and Algorithms for the Construction and Analysis of Systems*, LNCS 13994, pages 152–172. Springer, 2023. doi: [10.1007/978-3-031-30820-8_12](https://doi.org/10.1007/978-3-031-30820-8_12).
3. Nian-Ze Lee and Jie-Hong R. Jiang. Dependency stochastic Boolean satisfiability: A logical formalism for NEXPTIME decision problems with uncertainty. In *Proceedings of the AAAI Conference on Artificial Intelligence*, pages 3877–3885. AAAI Press, 2021. doi: [10.1609/aaai.v35i5.16506](https://doi.org/10.1609/aaai.v35i5.16506).
4. Nian-Ze Lee and Jie-Hong R. Jiang. Constraint solving for synthesis and verification of threshold logic circuits. *IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems*, 40(5):904–917, 2021. doi: [10.1109/TCAD.2020.3015441](https://doi.org/10.1109/TCAD.2020.3015441).
5. Nian-Ze Lee and Jie-Hong R. Jiang. Towards formal evaluation and verification of probabilistic design. *IEEE Transactions on Computers*, 67(8):1202–1216, 2018. doi: [10.1109/TC.2018.2807431](https://doi.org/10.1109/TC.2018.2807431).

Talks

Invited Speech

“*Bridging Hardware and Software Analysis*”, EDA Group Seminar, Graduate Institute of Electronics Engineering, National Taiwan University, November 2023

Workshop Presentation

“*Bridging Hardware and Software Verification Witnesses*”, [1st Workshop on Verification Witnesses and Their Validation](#), July 2023

“*Enriching Software Verification with Analyses and Applications from Hardware*”, [7th International Workshop on CPAchecker](#), October 2022

Software

ABC: Sequential logic synthesis and formal verification

<https://github.com/berkeley-abc/abc>

Contributor

BENCHEXEC: Reliable benchmarking and resource measurement

<https://github.com/sosy-lab/benchexec>

Contributor

BTOR2C: Translation from word-level circuits to C programs

<https://gitlab.com/sosy-lab/software/btor2c>

Principal designer, implementer, and maintainer

CPACHECKER: Configurable software verification

<https://cpachecker.sosy-lab.org>

Contributor, conceptual extensions, and implementation of interpolation-based analyses

RESSAT and ERSSAT: Stochastic satisfiability solvers

<https://github.com/NTU-ALComLab/ssatABC>

Principal designer, implementer, and maintainer

TLCOLLAPSEVERIFY: Optimization and verification of threshold logic circuits

<https://github.com/NTU-ALComLab/TLCollapseVerify>

Principal designer, implementer, and maintainer

Student Mentoring

2021-	Po-Chun Chien, DFG RTG ConVeY Ph.D. student, LMU Munich Topic: Bridging hardware and software verification
2023	Marek Jankola Ph.D. student, LMU Munich Topic: Replicating interpolation-based hardware verification for software
2023	Ádám Zófia, Erasmus Program Ph.D. student, Budapest University of Technology and Economics Topic: Witness validation for hardware-translated programs
2023	Bastiaan Laarakker, Google Summer of Code Master student, University of Amsterdam Topic: Backward bounded model checking in CPAchecker

University Activities

Statistics: I have been a teaching assistant of 5 graduate courses, 2 graduate seminars, 2 undergraduate courses, and 1 undergraduate seminar, and supervised 3 Bachelor's theses at LMU and NTU since 2016.

Graduate Course

Software Verification, Summer 2023, instructor: Prof. Dirk Beyer

Methods in Software Engineering, Summer 2022, instructor: Prof. Gidon Ernst
(**Best Master Lecture** at Institute of Informatics)

Software Verification, Winter 2021, instructor: Prof. Dirk Beyer

Logic Synthesis and Verification, Fall 2020, instructor: Prof. Jie-Hong R. Jiang

Logic Synthesis and Verification, Fall 2018, instructor: Prof. Jie-Hong R. Jiang

Graduate Seminar

Algorithms for Model Checking, Winter 2023, with Po-Chun Chien

Reproducibility of Software Engineering Research, Winter 2022, with Dr. Stefan Winter

Undergraduate Course

Formal Languages and Complexity, Summer 2020, instructor: Prof. Dirk Beyer

Introduction to Electronic Design Automation, Spring 2016, instructor: Prof. Jie-Hong R. Jiang

Undergraduate Seminar

Tools for Software Verification, Winter 2021, with Dr. Stefan Winter and Sudeep Kanav

Bachelor's Thesis or Project

Salih Ates, *Improving Array Encoding in Hardware-to-Software Translation*, 2023

Siang-Yun Lee, *Threshold Logic Synthesis and Canonicalization*, 2018-2019

Yen-Shi Wang, *Random-Exist and Exist-Random Stochastic Satisfiability Solving*, 2017-2018

Professional Activities

Conference/Workshop Organizer

The 8th International Workshop on CPAchecker, 2023 (co-chair: Prof. Marie-Christine Jakobs)

Journal Referee

IEEE Transactions on Computers, 2023

International Journal on Software Tools for Technology Transfer, Springer, 2023

ACM Transactions on Design Automation of Electronic Systems, 2023

Formal Methods in System Design, Springer, 2022

IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems, 2022

IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems, 2021

IEEE Transactions on Very Large Scale Integration (VLSI) Systems, 2021

IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems, 2020

IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems, 2019

IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems, 2018

Conference Referee

Int. Conf. on Computer Design (ICCD), 2023

Int. Conf. on Tools and Algorithms for the Construction and Analysis of Systems (TACAS), 2023

AAAI Conf. on Artificial Intelligence (AAAI), 2022

Joint European Software Engineering Conference and Symposium on the Foundations of Software Engineering (ESEC/FSE), 2022
Annual NASA Formal Methods Symposium (NFM), 2022
Design Automation Conference (DAC), 2022
Int. Conf. on Automated Software Engineering (ASE), 2022
AAAI Conf. on Artificial Intelligence (AAAI), 2021
Design Automation Conference (DAC), 2021
Int. Conf. on Computer-Aided Design (ICCAD), 2021
Int. Conf. on Software Engineering and Formal Methods (SEFM), 2020

References

1. Dirk Beyer, Professor, LMU Munich, Germany, <https://www.sosy-lab.org/people/beyer>
2. Jie-Hong R. Jiang, Professor, NTU, Taipei, Taiwan, <http://cc.ee.ntu.edu.tw/~jhjiang>
3. Victor N. Kravets, Full Researcher, IBM Thomas J. Watson Research Center, NY, U.S.A.

Additional references are available on request.