

Nian-Ze Lee

Curriculum Vitae

2025-12-02

Coordinates

Affiliation:	National Taiwan University Department of Electrical Engineering Graduate Institute of Electronics Engineering LMU Munich Department of Computer Science	ORCID: DBLP: Google Scholar: Webpage: Year of birth:	0000-0002-8096-5595 dblp.org/pid/154/3010.html 8OD03gAAAAJ nianzelee.github.io 1991
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Research Interests

My research focuses on applying formal methods to facilitate the construction of correct and secure systems. My goal is to invent new analysis approaches for real-world applications involving heterogeneous components, such as software, hardware, or emerging technology. Currently, I am active in the following directions (tools which I have developed or contributed to are given in parentheses):

- Cross-application of hardware and software verification techniques ([BTOR2C](#), [BTOR2-CERT](#), and [CPV](#))
- Development of new algorithms for software verification ([CPACHECKER](#))
- Unification and transformation for formal methods ([MoXICHECKER](#) and [HARNESSFORGE](#))
- Artificial intelligence and machine learning for formal verification ([BTOR2-SELECT](#))

The theoretical foundation of my work is algorithms and data structures, formal methods, mathematical logic, and system modeling. 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: <i>Stochastic Boolean Satisfiability: Decision Procedures, Generalization, and Applications</i>
2009 – 2014	B.Sc. in Eng., Department of Electrical Engineering Minor in Economics National Taiwan University, Taipei, Taiwan

Academic Employment

2025 –	Assistant Professor (Tenure Track) Department of Electrical Engineering, National Taiwan University, Taipei, Taiwan
2021 – 2024	Postdoctoral Researcher , Host: Prof. Dirk Beyer Department of Computer Science, LMU Munich, Munich, Germany

Visiting and Honorary Appointments

2025 – 2028	Garmin Scholar Fellowship National Taiwan University, Taipei, Taiwan
2025 – 2030	Gastprofessor (Visiting Professor), Host: Prof. Dirk Beyer Department of Computer Science, LMU Munich, Munich, Germany
2019 – 2020	DAAD Scholarship Student , Host: Prof. Dirk Beyer Department of Computer Science, LMU Munich, Munich, Germany

2018 – 2019

Internship Student at ERATO MMSD Project, Host: Prof. Ichiro Hasuo
National Institute of Informatics, Tokyo, Japan

Industrial Employment

2016

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

Shortlisting

2024

Call for Tenure-Track Assistant Professorship for “Reliable Software and Distributed Systems”, School of Electrical, Information, and Media Engineering, University of Wuppertal (offer rejected)

Grants

2025-2028

National Science and Technology Council, Taiwan

Research funding, NT\$ 2,880 K

Topic: *Advancing the MoXI Ecosystem: Robust, Versatile, and Community-Driven Symbolic Model Checking*

2024-2027

German Research Foundation (DFG)

Research funding, € 363.6 K

Topic: *Bridging Hardware and Software Analysis* (1 Ph.D. position)

2024-2026

Intel University Research & Collaboration

Research funding, \$ 90 K

Topic: *Configurable Program Analysis for Automated Firmware Verification*

2025-2026

NTU New Faculty Grant

Initiation and research funding, NT\$ 2,100 K

2023-2024

LMUExcellent PostDoc Support Fund

Travel funding, € 13.3 K

2019-2020

German Academic Exchange Service (DAAD)

Joint scholarship with National Science and Technology Council, Taiwan, € 15 K

Awards and Recognitions

2025

Two **Bronze Medals** in *Word-Level Bit-Vector Track* and *Word-Level Array Track*, respectively, at the 13th Hardware Model Checking Competition (HWMCC)

Tool: [Btor2-SELECT](#) (ML-based algorithm selection for hardware model checking)

2025

Third-Place Winner in *Reachability Safety Category* at the 14th International Competition on Software Verification (SV-COMP)

Tool: [CPV](#) (circuit-based program verification)

2024

ACM SIGSOFT Distinguished Paper Award at the 32nd ACM International Conference on the Foundations of Software Engineering

A Transferability Study of Interpolation-Based Hardware Model Checking for Software Verification

2024

ACM SIGSOFT Best Artifact Award at the 32nd ACM International Conference on the Foundations of Software Engineering

A Transferability Study of Interpolation-Based Hardware Model Checking for Software Verification

2024

Best Paper Award at the 30th International Symposium on Model Checking Software *Augmenting Interpolation-Based Model Checking with Auxiliary Invariants*

2024

Distinguished Artifact Award at the 30th International Conference on Tools and Algorithms for the Construction and Analysis of Systems

Btor2-Cert: A Certifying Hardware-Verification Framework Using Software Analyzers

2022

Best Master Lecture

Methods in Software Engineering, instructor: Prof. Gidon Ernst

2021	Lam Research Thesis Award <i>Stochastic Boolean Satisfiability: Decision Procedures, Generalization, and Applications</i>
2021	Honorary Member of the Phi Tau Phi Scholastic Honor Society Achievement of academic excellence upon graduation

Important Publications

Statistics: h-index 12; 5 journal papers and 25 peer-reviewed conference papers in prestigious venues, including the **Proceedings of the ACM on Software Engineering** and **IEEE Transactions on Computers**.

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

- My personal website: <https://nianzelee.github.io/files/Nian-Ze.Lee.Publications.pdf>
- DBLP: <https://dblp.org/pid/154/3010.html>
- Google Scholar: https://scholar.google.com/citations?user=_8OD03gAAAAJ
- ORCID: <https://orcid.org/0000-0002-8096-5595>

Below are my five recent and most important publications.

1. Zhengyang Lu, Po-Chun Chien, Nian-Ze Lee, Arie Gurfinkel, and Vijay Ganesh. Btor2-Select: Machine learning based algorithm selection for hardware model checking. In *Proceedings of the International Conference on Computer Aided Verification*, LNCS 15931, pages 296–311. Springer, 2025. doi: [10.1007/978-3-031-98668-0_15](https://doi.org/10.1007/978-3-031-98668-0_15).
2. Dirk Beyer, Nian-Ze Lee, and Philipp Wendler. Interpolation and SAT-Based Model Checking Revisited: Adoption to Software Verification. *Journal of Automated Reasoning*, 69(1):5, 2025. doi: [10.1007/s10817-024-09702-9](https://doi.org/10.1007/s10817-024-09702-9).
3. Dirk Beyer, Po-Chun Chien, Marek Jankola, and Nian-Ze Lee. A transferability study of interpolation-based hardware model checking for software verification. *Proceedings of the ACM on Software Engineering*, 1(FSE):90:1–90:23, 2024. doi: [10.1145/3660797](https://doi.org/10.1145/3660797).
4. Zsófia Ádám, Dirk Beyer, Po-Chun Chien, Nian-Ze Lee, and Nils Sirrenberg. Btor2-Cert: A certifying hardware-verification framework using software analyzers. In *Proceedings of the International Conference on Tools and Algorithms for the Construction and Analysis of Systems*, LNCS 14572, pages 129–149. Springer, 2024. doi: [10.1007/978-3-031-57256-2_7](https://doi.org/10.1007/978-3-031-57256-2_7).
5. Dirk Beyer, Po-Chun Chien, and Nian-Ze Lee. Augmenting interpolation-based model checking with auxiliary invariants. In *Proceedings of the International Symposium on Model Checking Software*, LNCS 14624, pages 227–247. Springer, 2024. doi: [10.1007/978-3-031-66149-5_13](https://doi.org/10.1007/978-3-031-66149-5_13).

Talks

Invited Speech

“Btor2-Select: Machine Learning Based Algorithm Selection for Hardware Model Checking”, R&D Seasonal Seminar, SoC Center, National Taiwan University, September 2025

“Publish or Perish? A Rookie Scholar’s Guide to Graduate School”, Institute Seminar, Graduate Institute of Electronics Engineering, National Taiwan University, May 2025

“Why Do I Choose an Academic Career?”, Bachelor’s Seminar, Department of Electrical Engineering, National Taiwan University, May 2025

“Formal Methods and Analysis for Computing and Engineering”, EDA Group Seminar, Graduate Institute of Electronics Engineering, National Taiwan University, February 2025

“Exploring the Interplay of Hardware and Software Verification for Emerging Computing Paradigms”, Keynote Speech at Software-Engineering Alumni Seminar, LMU Munich, September 2024

“Bridging Hardware and Software Formal Verification for Reliable Computing Systems”, Interview of Tenure-Track Assistant Professorship for “Reliable Software and Distributed Systems”, School of Electrical, Information, and Media Engineering, University of Wuppertal, January 2024

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

Workshop Presentation

- “Verifying Firmware Modules for Confidential Computing with CPAchecker”, 9th International Workshop on CPAchecker, September 2024
- “Bridging Hardware and Software Formal Verification for Reliable Computing Systems”, 5th Workshop on Cooperative Software Verification, April 2024
- “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
Contributor
- BENCHEXEC**: Reliable benchmarking and resource measurement
Contributor
- BTOR2C**: Translation from word-level circuits to C programs
Principal designer, implementer, and maintainer
- BTOR2-CERT**: Certifying hardware verification using software analysis
Principal designer and maintainer
- BTOR2-SELECT**: Algorithm selection for hardware model checking
Contributor
- CPACHECKER**: Configurable software verification
Contributor, conceptual extensions, and implementation of interpolation-based analyses
- CPV**: Circuit-based program verification
Principal designer and maintainer
- HARNESSFORGE**: Creation of Verification Tasks from Source-Code Repositories
Principal designer and maintainer
- MoXIchecker**: Extensible model checking for the MoXI verification language
Principal designer and maintainer
- RESSAT** and **ERSSAT**: Stochastic satisfiability solvers
Principal designer, implementer, and maintainer
- TLCOLLAPSEVERIFY**: Optimization and verification of threshold logic circuits
Principal designer, implementer, and maintainer

Thesis Committees

Ph.D. Dissertation

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| 2025 | I-Ching Tseng
Department of Computer Science and Information Engineering,
National Taiwan University
Dissertation title:
<i>Enhancing Robustness of Cyber-Physical Systems through Contract-Based Design</i> |
| 2025 | Jan Onderka
Faculty of Information Technology,
Czech Technical University in Prague
Dissertation title:
<i>Abstraction-Based Machine-Code Program Verification</i> |

Master's Thesis

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| 2025 | Wei-Hsu Chen
Graduate Institute of Electrical Engineering,
National Taiwan University
Thesis title:
<i>An Adaptive Multi-Timeframe Property Directed Reachability Algorithm</i> |
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2025	Hung-Ling Liu Graduate Institute of Electrical Engineering, National Taiwan University Thesis title: <i>Formal Methods for PSPACE-Complete Motion Planning: A Sokoban Case Study</i>
2025	Long-Hin Fung Department of Computer Science and Information Engineering, National Taiwan University Thesis title: <i>Solving and Counting Skolem Functions for 2-DQBF via Symbolic Reachability Analysis</i>
2025	Zih-Ming Li Department of Computer Science and Information Engineering, National Taiwan University Thesis title: <i>A Hybrid-Automata-Based Verification Framework for Compatibility of Autonomous Multi-Vehicle Systems</i>

Student Mentoring

2021-	Po-Chun Chien, DFG Research Training Group ConVeY and Grant Bridge Ph.D. student, LMU Munich Topic: Bridging hardware and software verification
2024-2025	Zhengyang Lu, Google Summer of Code Ph.D. student, University of Waterloo Topic: Algorithm selection for hardware model checking
2023-2024	Marek Jankola, DFG Research Training Group ConVeY Ph.D. student, LMU Munich Topic: Transferring interpolation-based hardware verification to software
2023-2024	Ádám Zófia, Erasmus Program Ph.D. student, Budapest University of Technology and Economics Topic: Witness validation for programs translated from hardware models
2023	Bastiaan Laarakker, Google Summer of Code Master student, University of Amsterdam Topic: Backward bounded model checking in CPACHECKER

Teaching Activities

Statistics: I have instructed or assisted 7 graduate courses, 3 graduate seminars, 3 undergraduate courses, and 1 undergraduate seminar, and supervised 3 Bachelor's theses/projects at LMU Munich and NTU since 2016. My teaching skills are well received by students at LMU Munich and have contributed to the success of the graduate course *Methods in Software Engineering*, which was awarded the **Best Master Lecture** in Summer 2022 at the Institute of Informatics. Below are my recent courses. The complete list of my teaching experiences can be found on my personal website.

Graduate Course

Formal Methods, Spring 2025

Software Verification, Summer 2024, with Marek Jankola, instructor: Prof. Dirk Beyer

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

Graduate Seminar

Algorithms for Model Checking, Summer 2024, with Po-Chun Chien

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

Undergraduate Course

Computer Architecture, Fall 2025

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 Organization

Artifact-Evaluation Committee Chair, 32nd International Symposium on Model Checking Software, 2026
(co-chair: Laura Bussi)

Artifact-Evaluation Committee Chair, 31st International Symposium on Model Checking Software, 2025
(co-chair: Prof. Julie Cailler)

Organizer, 8th International Workshop on CPAchecker (co-organizer: Prof. Marie-Christine Jakobs)

Journal Referee

Integration, The VLSI Journal, Elsevier, 2025

IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems, 2024

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. Conference on Verification, Model Checking, and Abstract Interpretation (VMCAI), 2026

Asia and South Pacific Design Automation Conference (ASP-DAC), 2026

Int. Conference on Computer Aided Verification (CAV), 2025

ACM Int. Conference on the Foundations of Software Engineering (FSE), 2025

Int. Symposium on Automated Technology for Verification and Analysis (ATVA), Artifact Evaluation, 2024

Int. Conference on Computer Design (ICCD), 2023

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

AAAI Conference 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. Conference on Automated Software Engineering (ASE), 2022

AAAI Conference on Artificial Intelligence (AAAI), 2021

Design Automation Conference (DAC), 2021

Int. Conference on Computer-Aided Design (ICCAD), 2021

Administrative Services

Admission Exams

Committee Member, application reviews for enrolling Master's students at the EDA group, GIEE, NTU, 2026

Committee Member, oral exams for enrolling Ph.D. students at the EDA group, GIEE, NTU, 2025

Committee Member, oral exams for enrolling Master's students at the EDA group, GIEE, NTU, 2025

Committee Service

Member, Curriculum Committee, Department of Electrical Engineering, NTU, 2025

References

1. Dirk Beyer, Professor, LMU Munich, 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.