

Nian-Ze Lee

Curriculum Vitae

2023-08-24

Coordinates

Affiliation:	Ludwig-Maximilians-Universität München Software and Computational Systems Lab Oettingenstr. 67, Munich, Germany	Webpage:	nianzelee.github.io/
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Citizenship:	Taiwanese	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 data structures and algorithms, formal methods, mathematical logic, and system modeling. My goal is to invent new approaches and apply them to real-world challenges. I also put emphasis on 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
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.
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Awards and Honors

2022	Best Master Lecture <i>Methods in Software Engineering</i> , instructor: Prof. Gidon Ernst
2021	Lam Research Ph.D. Thesis Award Dissertation title: <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

Grants

2023	LMUexcellent PostDoc Support Fund Travel funding, € 6.5 K
2023	German Research Foundation (DFG) , submitted in July Research funding, requested € 300 K (1 Ph.D. position)
2019-2020	German Academic Exchange Service (DAAD) Joint scholarship with National Science and Technology Council, € 15 K

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://gitlab.com/sosy-lab/software/cpachecker>
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

Selected Peer-Reviewed Publications

h-index: 8, more than 15 peer-reviewed publications in top-tier conferences and journals

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

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. CPA-DF: A tool for configurable interval analysis to boost program verification. In *Proceedings of the IEEE/ACM International Conference on Automated Software Engineering*, 2023. Accepted, preliminary version available on <https://doi.org/10.5281/zenodo.7963094>.
3. 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).
4. 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).
5. 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).
6. Nian-Ze Lee, Paolo Arcaini, Shaukat Ali, and Fuyuki Ishikawa. Stability analysis for safety of automotive multi-product lines: A search-based approach. In *Proceedings of the Genetic and Evolutionary Computation Conference*, pages 1241–1249. ACM, 2019. doi: [10.1145/3321707.3321755](https://doi.org/10.1145/3321707.3321755).
7. 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).
8. Nian-Ze Lee, Yen-Shi Wang, and Jie-Hong R. Jiang. Solving exist-random quantified stochastic Boolean satisfiability via clause selection. In *Proceedings of the International Joint Conference on Artificial Intelligence*, pages 1339–1345. IJCAI Organization, 2018. doi: [10.24963/ijcai.2018/186](https://doi.org/10.24963/ijcai.2018/186).
9. Ai Quoc Dao, Nian-Ze Lee, Li-Cheng Chen, Mark Po-Hung Lin, Jie-Hong R. Jiang, Alan Mishchenko, and Robert K. Brayton. Efficient computation of ECO patch functions. In *Proceedings of the Annual Design Automation Conference*, pages 51:1–51:6. ACM, 2018. doi: [10.1145/3195970.3196039](https://doi.org/10.1145/3195970.3196039).
10. Nian-Ze Lee, Yen-Shi Wang, and Jie-Hong R. Jiang. Solving stochastic Boolean satisfiability under random-exist quantification. In *Proceedings of the International Joint Conference on Artificial Intelligence*, pages 688–694. IJCAI Organization, 2017. doi: [10.24963/ijcai.2017/96](https://doi.org/10.24963/ijcai.2017/96).

Student Supervision

2021-	Po-Chun Chien, DFG RTG ConVeY Ph.D. student, LMU Munich Topic: Bridging hardware and software verification
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
2023	Salih Ates, Bachelor Thesis , LMU Munich Topic: Improving array encoding in hardware-to-software translation
2018-2019	Siang-Yun Lee, Bachelor Project , National Taiwan University Topic: Threshold logic synthesis
2017-2018	Yen-Shi Wang, Bachelor Project , National Taiwan University Topic: Stochastic satisfiability solving

University Activities

Teaching Assistant at LMU Munich, since 2020

Graduate courses:

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

Undergraduate courses:

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

Graduate seminars:

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

Undergraduate seminars:

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

Teaching Assistant at National Taiwan University, 2016-2021

Graduate courses:

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

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

Undergraduate courses:

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

Professional Activities

Conference/Workshop Organizer

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

Journal Referee

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.