JAN KAISER

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I'm an electrical and computer engineer with expertise in physics-based and conventional computing, machine learning and software engineering. I received my Ph.D. from Purdue University in 2022. My thesis was about a probabilistic computing architecture for statistical machine learning and optimization. I co-founded a physics-based computing start-up and am currently working on software tools for chip design in the PrimeTime team at Synopsys as R&D Engineer.

Education

Purdue University, IN, USA

- Ph.D. in Electrical and Computer Engineering, May 2022
- *Thesis title:* "Probabilistic Computing: From Devices to Systems"
- Advisors: Prof. Supriyo Datta, Prof. Mark Lundstrom

Ruhr-University University, Germany

- Master of Science in Electrical Engineering, October 2017, top 1% of class
- *Thesis title:* "Simulation of the Current Transport in Memristive Nanostructures"
- Advisors: Prof. Thomas Mussenbrock

- Bachelor of Science in Electrical Engineering, July 2015,top 1% of class
- *Thesis title:* "Investigation of Ballistic Mean Free Path in Nanoscale Waveguide Crossings"
- Advisors: Prof. Ulrich Kunze

Industry experience

Staff R&D Engineer, Synopsys, 2024 - Present
I'm working in the PrimeTime team on static timing analysis.

Senior Software Engineer, Lattice Semiconductor, 2023 - 2024
I performed runtime and performance analysis for Lattice's EDA software tools utilizing tools like Valgrind and VTune. I identified bottlenecks and improved runtime of Lattice's static timing analysis tool in the place and route flow by 40%. I also benchmarked in-house timing tools against open-source tools and dealt with timely customer issues and requests.

Cofounder, Ludwig Computing, 2022 - 2023
I co-founded a physics-based computing start-up, Ludwig Computing, with current and past academics from Purdue University based on my PhD research. During the last months of my PhD, we got accepted into the Berkeley Cohort 2022 of the Activate Entrepreneurial Fellowship. At Ludwig, I lead the technical development and prototyping of a phyics-based computing architecture targeting 1000x performance increase in Generative AI and combinatorial optimization problems. I also was involved in conducting 100+ customer interviews in NSF I-corps. During my time a Ludwig, I orchestrated a successful implementation of a full-stack demo, integrating FPGA prototypes with a Python UI for combinatorial optimization leveraging the Monte Carlo method.

Research Intern, IBM, 2020
I conducted characterization of stochastic bitstreams generated by magnetic nanodevices utilizing over 1000 different test setups. The data was analyzed with Python's pandas library. The randomness of the bitstreams was characterized using the NIST random number generator test suite. I also developed detailed models of the measured magnet dynamics by solving the underlying stochastic differential equation (LLG). This lead to publication **4** below.

Research Assistant, Fraunhofer IMS, 2012-2014
I conducted experimental testing of transmission properties of transponder systems in metallic environments. This involved circuit prototyping, setting up test stations and measuring conductances of coils. For data collection, I used an analog Front-End together with an FPGA and a Network Analyzer.

Awards & Scholarship

Activate Entrepreneurial Fellowship, Activate Berkeley, 2022
Competitive 2 year fellowship to help commercialize academic research.

Ross-Fellowship, Purdue University, 2018
A recruitment for outstanding PhD-track students to graduate programs at Purdue. Each fellowship provides a four-year award package.

Faculty Award, Ruhr-University Bochum, 2018
Award for top 1% placement in class for Master degrees in the ETIT faculty

Infineon-Prize, Ruhr-University Bochum, 2017
Award for top 1% placement in class for Bachelor degrees in the ETIT faculty

PROMOS-scholarship, German Academic Exchange Service (DAAD), 2015
Scholarship for Academic Exchange to Purdue University, IN

Selected Publications

1. **Kaiser, Jan**, Supriyo Datta, and Behtash Behin-Aein. "Computing with p-bits: Ising Solvers and beyond", IEDM, 21.4.1-21.4.4. (2022)
2. **Kaiser, Jan**, William A. Borders, Kerem Y. Camsari, Shunsuke Fukami, Hideo Ohno, and Supriyo Datta. "Hardware-aware in-situ Boltzmann machine learning using stochastic magnetic tunnel junctions." Phys. Rev. Applied 17, 014016 (2022). [**Editor's Suggestions**]
3. **Kaiser, Jan** and Supriyo Datta "Probabilistic computing with p-bits." Appl. Phys. Lett. 119, 150503 (2021). [**Editor's Choice Article**]
4. Safranski, Christopher, **Jan Kaiser**, Philip Trouilloud, Pouya Hashemi, Guohan Hu, and Jonathan Z. Sun. "Demonstration of nanosecond operation in stochastic magnetic tunnel junctions." Nano Lett. 2021, 21, 5, 2040–2045, (2021).
5. Rafatul Faria, **Jan Kaiser**, Kerem Y Camsari, Supriyo Datta. "Hardware design for autonomous bayesian networks." Frontiers in computational neuroscience, (2021)
6. **Kaiser, Jan**, Rafatul Faria, Kerem Y Camsari, Supriyo Datta. " Probabilistic Circuits for Autonomous Learning: A simulation study." Frontiers in computational neuroscience, (2020)
7. **Kaiser, Jan**, Avinash Rustagi, Kerem Y. Camsari, Jonathan Z. Sun, Supriyo Datta, and Pramey Upadhyaya. "Subnanosecond Fluctuations in Low-Barrier Nanomagnets." Phys. Rev. Applied 12, 054056 (2019).

8. Dirkmann Sven, **Jan Kaiser**, Christian Wenger, Thomas Mussenbrock. "Filament growth and resistive switching in hafnium oxide memristive devices." ACS applied materials & interfaces, (2018)

9. **Kaiser, Jan**, Tianli Feng, Jesse Maassen, Xufeng Wang, Xiulin Ruan, Mark Lundstrom. "Thermal transport at the nanoscale: A Fourier's law vs. phonon Boltzmann equation study." Journal of Applied Physics 121 (4), (2017)

Contact

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