

Zheng Liu

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Website: <https://zhengliu-research.github.io/>

Education

- 2019- **Princeton University, Ph.D. Electrical and Computer Engineering**
- 2023 Advisor: Prof. Kaushik Sengupta (IEEE Fellow). **Bede Liu Best Ph.D Dissertation Award.**
- 13-15 **University of California, Los Angeles, M.S. Electrical Engineering**
- 09-13 **Peking University, Beijing, China, B.S. Electronics, B.A. Economics**

Research Interest

High frequency integrated circuits, systems and algorithms for next generation wireless communication, sensing and energy harvesting applications: 1) AI/ML enabled wireless chip inverse design methodology 2) Beamforming IC and antenna array architecture 3) RF/mmWave/THz broadband high-efficiency PAs and transceivers

Professional Experiences

- 1/2026- **Assistant Professor, Department of Electrical and Computer Engineering, University of Wisconsin-Madison**, Madison, WI, USA
- 10/2023- **RF/mmWave IC Research Engineer, Kilby Labs, Texas Instruments**, Dallas, TX, USA
- 12/2025
 - Led R&D of GaN-on-Si power amplifier and package design for TI's inaugural RF GaN product line for 6G-FR3, contributing to Design-Technology Co-Optimization for technology definition and improvement.
 - Developing 120GHz transceiver IC for integrated molecular clock system targeting atomic clock accuracy.
 - Liaison for university research program and contributing to proposal writing for new Kilby Labs initiatives.
- 02/2019- **Doctoral Researcher, Princeton University**, Princeton, NJ, USA
- 05/2023
 - First demonstration of using AI to discover beyond human intuition architectures for ultra-wideband mmWave PA performance and enable rapid on-demand synthesis (IMS 22, JSSC 23'). This work has become one of the foundational contributions to AI-enabled RFIC research.
 - Developed multi-hierarchy techniques (device + architecture) for broadband high-efficiency PAs across 30-110GHz in SiGe, CMOS and InP HBT technologies.
 - Developed a frequency-agile array system using algorithmically synthesized non-periodic sparse array architecture and co-designing ultra-wideband beamforming front-end IC with antenna array packaging.
- 05/2022 - **Cellular RF Engineering Intern, Apple, Inc**, San Diego, CA, USA
- 08/22
 - Investigated phased array receiver architecture enabled by phase shifter innovation in advanced CMOS.
- 05/2015 - **Senior Electrical Engineer, Skyworks Solutions, Inc**, Thousand Oaks, CA, USA
- 11/2018
 - Served as the core PA designer for an LTE Band 42 envelope-tracking push-pull PA engine, driving mass production with over **30 million units shipped for Apple's iPhone 8/X in the Japan market.**
 - Developed a 3.3 to 4.2 GHz linear Doherty PA for 5G N77 wireless communication. The design became **Skyworks's first 5G prototype in Sky5TM product portfolio. Shipped over 10 million parts.**

Academic Awards

- 02/2025 **2023 JSSC Best Paper Award (1 per year), IEEE Solid-State Circuits Society**
- 05/2023 **Bede Liu Best Ph.D Dissertation Award (1 annually in ECE), Princeton University**
- 06/2022 **Advanced Practice Paper Award (1st Author, Top 1/325) , IEEE IMS 2022**

07/2021 **Best Student Paper Awards (Two papers, Both 1st Author, Top 6/314), IEEE IMS 2021**
 08/2020 **Best Student Paper Award (Top 3/317) , IEEE IMS 2020**
 01/2022 **IEEE MTT-S Graduate Fellowship (10 awardees globally per year), IEEE**
 01/2022 **ADI Outstanding Student Designer Award, Analog Devices, Inc**
 05/2022 **Qualcomm Innovation Fellowship Finalist, Qualcomm, Inc**
 12/2021 **Yan Huo 94* Graduate Fellowship, Princeton University**
 04/2017 **Excellent Performance Award, Skyworks Solutions, Inc**

Journal Publications

- J1. **Zheng Liu** and K.Sengupta. “A 44-64 GHz mmWave Broadband Linear Doherty PA in Silicon with Quadrature Hybrid Combiner and Non-Foster Impedance Tuner”, IEEE Journal of Solid-State Circuits (**JSSC**), Aug, 2022
- J2. Emir Ali Karahan, **Zheng Liu*** and Kaushik Sengupta et al. “Deep-Learning-Based Inverse-Designed Millimeter-Wave Passives and Power Amplifiers”, IEEE Journal of Solid-State Circuits (**JSSC**), May, 2023 (**2023 JSSC Best Paper Award**, * Corresponding author)
- J3. **Zheng Liu** et al. “A 42-62 GHz Transformer-based Broadband mm-Wave InP PA with Second Harmonic Waveform Engineering and Enhanced Linearity”, IEEE Transactions on Microwave Theory and Techniques (**TMTT**). (**Invited**), Jan, 2021
- J4. **Zheng Liu**, E Karahan and K.Sengupta.“ A 36-91 GHz Broadband Beamforming Transmitter Architecture with Phase Error between 1.2-2.8° for Joint Communication and Sensing”, IEEE Transactions on Microwave Theory and Techniques (**TMTT**), Oct, 2023 (**TMTT featured article**)
- J5. Emir Karahan, **Zheng Liu**, Aggraj Gupta, Zijian Shao, Jonathan Zhou and Kaushik Sengupta “Deep-learning Enabled Generalized Inverse Synthesis of Multi-Port Radio-frequency and Sub-Terahertz Integrated Circuits”, **Nature Communications**, Dec, 2024.
- J6. **Zheng Liu** et al “Deep Learning enabled Inverse Design of 30-94 GHz Psat,3dB SiGe-based PA supporting Multi-Gbps Concurrent Multi-band Operation ”, IEEE Microwave and Wireless Component Letter, May 2022, (**IMS2022 Advanced Practice Paper Award (Top1/325)**, **Best student paper finalist**, **MWCL Special Issue of “Top 50 IMS 2021 Papers”**)
- J7. **Zheng Liu**, T.Sharma and K.Sengupta. “80-110 GHz Broadband Linear PA with 33% peak PAE and Comparison of Stacked Common-Base and Common-Emitter PA in InP”, IEEE Microwave and Wireless Component Letter, May 2021. (**IEEE IMS2021 Best student paper award (3rd place, Top6/314)**, **MWCL Special Issue of “Top IMS 2021 Papers”**)
- J8. **Zheng Liu** et al “A Compact SiGe Stacked Common-Base Dual-band PA with 20/18.8dBm Psat at 36/64 GHz Supporting Concurrent Modulation ”, IEEE Microwave and Wireless Component Letter, March 2022.(**MWCL Special Issue of “Top 50 IMS 2021 Papers”**)
- J9. **Zheng Liu**, Y.Yu and K.Sengupta. “A 44-64 GHz Broadband 90° Hybrid Doherty PA with Quasi Non-Foster Tuner in 0.13μm SiGe”, IEEE Microwave and Wireless Component Letter, May 2021. (**IEEE IMS2021 Best student paper award (3rd place, Top6/314)**, **MWCL Special Issue of “Top IMS 2021 Papers”**,)
- J10. **Zheng Liu**, T Sharma and K.Sengupta. “Stacked Common-base vs Common-emitter mmWave PA Cells and 68-105 GHz Broadband Asymmetrical PA in 250nm InP HBT”, IEEE Access, Feb,2023

- J11. Xiaolong Huang*, **Zheng Liu***, E.Karahan, K.Sengupta “Synthesized Design of Millimeter-Wave Low-Loss Wideband Bandpass Filter and Filtering Impedance Transformer in 90-nm BiCMOS Technology”, IEEE Journal of Microwave, 2025 (* co-first authors).
- J12. Z.Shao *, **Z. Liu***, and K.Sengupta, “A Millimeter-wave Wideband Sparse Array of Surface-Wave Immunity Laminated Resonant Elements“ Journal of Microwave, 2026 (* co-first authors)
- J13. Wynand Lambrechts, **Zheng Liu** et al. “Intelligent Integrated Circuits and Systems for 5G/6G Telecommunications” IEEE Access 2024
- J14. Sherif Ghozzy, Muhamed Allam, Emir Karahan, **Zheng Liu**, Kaushik Sengupta “Towards milliWatt-level Integrated sub-Terahertz Kramers-Kronig Receivers with Nonlinear Analog and Mixed-signal Computing”, IEEE Journal of Solid-State Circuits (under review).
- J15. **Zheng Liu**, Emir Ali Karahan, Zijian Shao, Sherif Ghozzy , Muhamed Allam, Xiaolong Huang and Kaushik Sengupta. “Frequency-agile 120 element Aperiodic Sparse Transmitter Phased Array across 36-98 GHz” (In preparation for high impact publications)
- J16. Xiaolong Huang and **Zheng Liu**. “Low-Cost W-Band Dual-Mode SIW Bandpass Filters Using Commercially Available Printed-Circuit-Board Technology”, Electronics 12.17 (2023): 3624.
- J17. Saurabh Sinha, Kaushik Sengupta and **Zheng Liu** et al. “Large Layout Models (L2Ms): Generative AI for Analog and Mixed-Signal Circuit Design Automation”, Submitted
- J18. K. Sengupta, J. Zhou, **Z. Liu** and E. A. Karahan, “AI Enabling Discovery and Design of Radio and High-Frequency Wireless Chips Beyond Human Intuition“ Computer, vol. 58, no. 8, pp. 117-122, Aug. 2025.

Conference Publications

- C1. **Zheng Liu**, Emir Karahan and K.Sengupta. “A 36-91 GHz 35 dB Gain Tx Phased-Array Beam-former with Low RMS Phase Error of 1.24-2.8° Supporting 10.8 Gbps 64QAM in 90 nm SiGe”, IEEE 49th European Solid-State Circuits Conference (ESSCIRC), Sept, 2023.
- C2. **Zheng Liu**, T.Sharma, K.Sengupta “Transformer-Based Broadband High Efficiency mm-Wave InP Power Amplifier with Linearity Enhancement ”, IEEE IMS 2020 (**Late Breaking News paper**)
- C3. **Zheng Liu**, E.Emir, K.Sengupta “A 30-97 GHz Psat,3dB Broadband PA with 18.5-21.5dBm Psat and 18-26% PAE in 90nm SiGe Supporting Concurrent Multi-Band Operation ”, IEEE European Microwave Integrated Circuits Conference 2022.
- C4. **Zheng Liu** and K.Sengupta. “A 30-88 GHz Phase Shifter with Broadband 90° Hybrid- Marchand Balun Network and Common-base Buffer Achieving 1.34-3.1° RMS Phase Error in 90 nm SiGe”, IEEE IMS 2023.
- C5. Sherif Ghozzy, Muhamed Allam, Emir Karahan, **Zheng Liu**, Kaushik Sengupta “A mmWave/Sub-THz Synthesizer-free Coherent Receiver With Phase Reconstruction Through Analog Kramer-Kronig Processing”, International Solid-State Circuits Conference (**ISSCC**) 2024.
- C6. Jonathan Zhou, Emir Ali Karahan, **Zheng Liu**, Kaushik Sengupta “AI-enabled Design Space Discovery and End-to-end Synthesis for RFICs with Reinforcement Learning and Inverse Methods Demonstrating mmWave/sub-THz PAs between 30-120 GHz”, International Solid-State Circuits Conference (**ISSCC**) 2025.

- C7. T.Sharma*, **Zheng Liu***, C.R.Chappidi, H.Saeidi, S.Venkatesh, K.Sengupta “Broadband PA Architectures with Asymmetrical Combining and Stacked PA Cells across 50-70GHz and 64-110GHz in 250nm InP”, IEEE IMS 2020 (Equally contributing authors)
- C8. C.R.Chappidi, T.Sharma, **Zheng Liu**, K.Sengupta “Load Modulated Balanced mm-Wave CMOS PA with Integrated Linearity Enhancement for 5G Applications”, IEEE IMS 2020.(**Best student paper award (2nd place, Top2/317)**)
- C9. Xiaolong Huang, **Zheng Liu**, E.Karahan, K.Sengupta “A Millimeter-Wave Low-Loss On-chip Filter Design Using A Wideband Synthesis Method in 90-nm SiGe BiCMOS Process” IEEE IMS 2024 (**Advanced Practice Paper Award Finalist**)
- C10. E. A. Karahan, **Zheng Liu**, and K. Sengupta, “Deep Learning Enabled Generalized Synthesis of Multi-Port Electromagnetic Structures and Circuits for mmWave Power Amplifiers” IEEE IMS 2024 (**MWCL Special Issue of “Top 50 IMS 2024 Papers”**, give up the opportunity)
- C11. Kun Chen, **Zheng Liu**, Xuelin Hong, Ruinan Chang, Weimin Sun “Balun Modeling for Differential Amplifiers”, WCECS 2019
- C12. Eric C. Blow, Chaoran Huang, **Zheng Liu**, Samuel J. Markoff, Paul R. Prucnal “Silicon Photonic Weights for Microwave Photonic Canceller”, CLEO 2020
- C13. XY zhou, WS Chan, T Sharma, J Xia, **Zheng Liu**, SC Chen, WJ Feng. “High Efficiency, Extended Back-off Range Doherty Power Amplifier Using A Three Port Harmonic Injection Network” IEEE APMC 2020
- C14. XY zhou, WS Chan, WJ Feng, XH F, T Sharma, **Zheng Liu**. “Bandwidth Enhanced Doherty Power Amplifier Based on Coupled Phase Compensation Network With Specific Optimal Impedance” IEEE IWS 2020
- C15. E. A. Karahan, J. Zhou, **Zheng Liu**, Z. Shao, S. Fisher and K. Sengupta, “Deep Learning Enabled Design of RF/mmWave IC and Antennas“ 2024 IEEE MWSCAS
- C16. K. Sengupta, E. A. Karahan and **Zheng Liu**, ”Deep Learning enabled mmWave PA and Antenna Design,” 2022 IEEE RFIT.(**Invited**)
- C17. K. Sengupta, E. A. Karahan, Jonathan. Zhou and **Zheng Liu**, ”AI-enabled RF-to-THz IC Design Space Discovery and Inverse Design Flow,” 2025 IEEE International Symposium on Circuits and Systems (ISCAS) (**Invited**)

Patents

- P1. **Zheng Liu** and Siraj Akhtar “Broadband Power Amplifier Combiner”, U.S. patent application, 18,651,514
- P2. C.R.Chappidi, T.Sharma, **Zheng Liu**, K.Sengupta. “Load Modulated Balanced Power Amplifier Integrated Circuit Including Transformer-Based Hybrid Splitter/Combiner” U.S. patent granted, 11,949,390.
- P3. **Zheng Liu**, Emir Karahan, K.Sengupta. “Machine learning enabled inverse design of power amplifier” U.S. patent application, 18,073,482.
- P4. **Zheng Liu**, K.Sengupta. “Topologies and methods for ultra-broadband/multi-band planar phased array antenna with reduced side lobe levels across wide range of beam steering ” U.S. patent application, 63,325,706

- P5. **Zheng Liu**, K.Sengupta. “Broadband and multi-band planar antenna array architectures” U.S. patent application, 18,886,714.
- P6. **Zheng Liu**, Siraj Akhtar. “Compact Tunable Hybrid Coupler” U.S. patent application, 19,209,223
- P7. **Zheng Liu** “Impedance Inverter with Harmonic Control” U.S. patent application, 19,550,017
- P8. **Zheng Liu**, Siraj Akhtar. “Power Dependent Tuning of An Amplifier System” U.S. patent application 19/439,156
- P9. Siraj Akhtar and **Zheng Liu**. “Joint Radiometer and Depth Profiler” U.S. patent application (to be filed)
- P10. Emir Karahan, **Zheng Liu**, Jonathan Zhou and Kaushik Sengupta “Deep Learning Enabled Generalized Synthesis of Multi-Port Electromagnetic Structures and Circuits for Radio-Frequency Systems”, U.S. patent application, 63,660,874
- P11. Zijian Shao, **Zheng Liu**, Emir Karahan and Kaushik Sengupta “A Dual-Port Antenna Architecture for Ultra-wideband Phased Array Applications”, U.S. patent application, 63,660,874
- P12. **Zheng Liu**, Siraj Akhtar, Brian Ginsburg. “Machine Learning Based Reconfigurable Filters and Phase Shifters” U.S. patent application 63/950,559

Ph.D Thesis

- 1. “Universal Spectrally Agile and Energy Efficient Non-Periodic Arrays and Transmitter Architectures at Millimeter-Wave Band” Princeton University, May, 2023

Teaching and Mentoring

- Fall 26 **Electronic Circuits II (ELE342), UW-Madison, ECE**
Core undergraduate course
- Spring 26 **Electronics Circuits (ECE342), UW-Madison**
Co-instructor of the core undergraduate course with 130 enrolled students.
- Spring 26 **Advanced Communications Circuits Design (ECE547), UW-Madison**
Guest lectures of the graduate course on power amplifier fundamentals and practical design.
- Spring 26 **Advanced Independent Study (ECE699), UW-Madison**
Guide M.S student research on RFIC.
- Fall 20 **Wireless and High Speed Integrated Circuits and Systems (ELE582), Princeton**
Teaching assistant. Engaged in the conceptualization, guidance, and evaluation of the final graduate student high-speed circuit design project. Received a nomination for a graduate school teaching award.
- Spring 21 **Electronic Circuits: Devices to ICs (ELE304), Princeton**
Teaching assistant. Migrated the design project platform to a web-based Linux environment to facilitate seamless and expedited remote student access during the pandemic.
- 2020– **Mentor of Graduate Students**
- Present Henry Czupryna: *AI-enabled Doherty Radiator*
Ion Kolkhuis Tanke: *Symmetrical Doherty PA*
Mingcong Cao: *AI-generated mmWave switchable filter*
Yufeng Wang: *Manual and inverse design of on-chip transformer for mmWave application*
Emir Ali Karahan: *mmWave RFIC in HBT Technology, guiding his first tapeout and mmWave measurement.*
Tyler Blundo: *Reconfigurable Metasurfaces with integrated sensing, guiding optimization and PCB design.*
- 2026– **Mentor of Undergraduate Students**
- Present Yuchen Niu: *Large array board SPI control*
Yuyue Hao: *Harmonic controlled Doherty PA combiner layout* Yucheng Huang: *Physics and AI-hybrid rapid EM surrogate model*

2016- Mentor of Industry Internship Students

2025 Zhengliu Zhou (Ph.D student from UCLA): *Development of transformer 3D parametric geometry model in HFSS at Skyworks.*

Xing Hu (Ph.D student from UC Davis): *Optimization of UHB transformer on IPD technology for PA output matching at Skyworks.*

Yuhan Zheng (Ph.D student from Ohio State): *Load modulated balanced PA development using GaN-on-Si technology at TI Kilby Labs.*

Sherif Ghoszy (Ph.D student from Princeton): *AI-enabled Doherty combiner and wideband radar for skin depth profiler at TI Kilby Labs.*

Technical Skills

Technical Skills **Circuit design tools:** Cadence Virtuoso, Keysight ADS, Altium Designer. **EM design tools:** HFSS, Momentum simulator, EMX, RFpro. **Programming:** Matlab, Python, SCPI

Lab Skills Experiences with various mmWave/RF validation and instruments including probing system, active/passive load-pull system, spectrum analyzer, VNA and calibration, vector signal analyzer, stability test, far-field antenna measurement in anechoic chamber.

Press/Media Coverage

AI enabled wireless chip design, [Designing the future: AI innovation accelerated through university collaboration](#)

JSSC Best Paper Award, [Sengupta group wins best journal paper of the year award for AI-designed chips](#)

Deep learning for RF chip design, [Deep learning approach to wireless chip design wins best paper at International Microwave Symposium](#)

AI enabled chip design, [AI Designs Computer Chips We Can't Understand — But They Work Really Well](#)

IEEE Fellowship, [Flexible designs for high-speed wireless systems earn IEEE honors for two grad students](#)

Yan Huo 94* Fellowship, [Yan Huo *94 fellowship powers advances in wireless sensing, networked systems and 2D electrons](#)

Best Thesis Award, [2023 Graduate Awards](#)

Efficient 5G device, [Researchers win best student paper for work making 5G devices more efficient](#)

IEEE T-MTT Featured Article, [Frequency agile beamformer work is selected as featured article in IEEE T-MTT journal](#)

Professional/Community Service

Associate Editor, *IEEE Microwave and Wireless Technology Letters*

Technical Committee Member, [IEEE Microwave Theory & Technology Society \(MTT-S\) Technical Committee \(TC-14 on Microwave and mmWave Integrated Circuits Committee\)](#)

Subcommittee chair for AI/ML for RF to mmWave, *2027 IEEE International Microwave Symposium (IMS)*

Subcommittee vice chair for RFSA10. AI/ML for RF to mmWave, *2026 IEEE International Microwave Symposium (IMS)*

Technical Program Committee (TPRC), *2025-2027 IEEE International Microwave Symposium (IMS)*

Technical Program Committee (TPC), *2026 IEEE/ACM International Conference on Computer-Aided Design (ICCAD)*

Reviewer, Multiple *IEEE Journals* including: *IEEE Journal of Solid-State Circuits*, *IEEE Transactions on Microwave Theory and Techniques*, *IEEE Transactions on Circuits and Systems I*, *IEEE Solid-State Circuits Letters*, *IEEE Transactions on Terahertz Science and Technology*, *IEEE Journal of Microwaves*, *IEEE Microwave and Wireless Components Letters*, *IEEE Transactions on Components, Packaging and Manufacturing Technology*, *IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems*, *IEEE Access*, *IEEE Journal on Emerging and Selected Topics in Circuits and Systems*

Deputy Reviewer, 2025 *IEEE International Solid State Circuits Conference (ISSCC)*-RF subcommittee

Judge, 2025 *IEEE Internatioal Microwave Symposium (IMS)* Student Paper Competition

Senior Member, *IEEE*