Zonghao (Chris) Li

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EDUCATION

Ph.D., Electrical Engineering January 2020 - Present
University of Toronto
Thesis: Applications of Machine Learning in the Design and Optimization of AMS ICs and Systems
Supervisor: Anthony Chan Carusone

M.Eng., Electrical Engineering September 2017 - September 2019
McGill University
Thesis: Chipless RFID for Wireless Sensing Applications
Supervisor: Sharmistha Bhadra

B.A.Sc., Electrical Engineering (with distinction) September 2013 - May 2017
University of British Columbia
Capstone Project: Spatial Tracking Algorithm for Magnetometer (2nd Placement)

Technical Skills

- Transistor-level design experience with analog/RF circuit blocks such as OTAs, LDOs, comparators, LNAs, mixers, VCOs, and data converters, using various commercial and open-source PDKs.

- Experience with passive RF/microwave circuits (inductors, t-coils, microstrip line, CPW, microwave resonators, filters, stub matching circuit) and antenna (patch, tapered slot) design with commercial and free EM simulation tools such as Cadence EMX, Ansys HFSS, ASITIC.

- Experience with various commercial EDA tools and SPICE simulators such as Cadence Virtuoso ADE Suite, Advanced Design System, Spectre, and HSPICE.

- Experience with various open-source EDA tools and SPICE simulators such as Xschem, Klayout, Magic, Berkley Analog Generator (BAG), LAYGO, Ngspice, and LTspice.

- Good knowledge of wireline communication systems and circuits such as CTLE, FFE, and DFE.

- Fluent with Python and Matlab programming languages and comfortable with applying them to model various systems and automate design flows (GitHub homepage: https://github.com/ChrisZonghaoLi).

- Experience with popular machine learning (ML) Python libraries such as PyTorch, TensorFlow, and Gymnasium.

- Good knowledge of fundamental ML concepts and algorithms, particularly reinforcement learning (RL).

RESEARCH PROJECTS

AMS IC Design with Reinforcement Learning January 2023 - Present

- Apply reinforcement learning (RL) techniques to optimize AMS circuits such as LDOs and dynamic comparators.
- Design and optimize the circuits in open-source SKY130 and GF180MCU PDKs.
- Generate final AMS circuit layout automatically, thereby allowing PEX simulations embedded inside the global optimization loop.
- Research results published in 2023 IEEE/ACM ICCAD, and a potential journal paper soon.

Optimizing the Photodetector/Analog Front-End Interface in Optical Communication Receivers
January 2022 - December 2022

- Address the optimization of the interface between the photodetector (PD) and the analog front-end (AFE) in highspeed, high-density optical communication receivers.
- Use genetic algorithm (GA) to optimize the entire optical receiver model under the PAM4 signalling at 64-Gbaud.
- Study the design trade-off between the transmission line dimension, T-coil dimension, TIA settings, and FFE/DFE tap length.

- Research results published in IEEE Transactions on Signal and Power Integrity.

T-coil Enhanced ESD Circuit Design Using Up-sampling Convolutional Neural Network January 2021 - December 2021

- Propose an up-sampling convolutional neural network and apply it to infer the T-coil S-parameter from DC-100GHz.
- Apply the proposed neural network to a T-coil enhanced ESD circuit optimization in a 22nm FD-SOI process to bypass EM simulation, achieving a 10x GA optimization speed improvement.
- Research results published in 2022 IEEE/MTT-S International Microwave Symposium.

Chipless RFID for Wireless Sensing Applications September 2017 - September 2019

- Design a chipless RFID tap using multi-resonators and ultra-wideband monopole antennas for the frequency signature encoding between 2-6 GHz.
- Design Vivaldi antennas for transceiving interrogation signals between 2-6 GHz.
- Use printing technologies to fabricate the chipless RFID tag on flexible substrates.
- Apply the chipless RFID tag to measure the chemical liquids and gases concentration.
- Research results published in various conferences including IEEE SENSORS, and a journal paper in Sensors and Actuators A: Physical.

PUBLICATIONS[1]

JOURNAL

- B. Radi, **Z. Li**, D. Patel and A. C. Carusone, "Optimizing the Photodetector/Analog Front-End Interface in Optical Communication Receivers," in IEEE Transactions on Signal and Power Integrity, vol. 2, pp. 111-121, 2023, doi: 10.1109/TSIPI.2023.3307669

- **Z. Li** and S. Bhadra, "A 3-bit fully inkjet-printed flexible chipless RFID for wireless concentration measurements of liquid solutions," Sens. Actuators A, Phys., vol. 299, Nov. 2019, Art. no. 111581.

CONFERENCE

- **Z. Li** and A. C. Carusone, "Design and Optimization of Low-Dropout Voltage Regulator Using Relational Graph Neural Network and Reinforcement Learning in Open-Source SKY130 Process," 2023 IEEE/ACM International Conference on Computer Aided Design (ICCAD), San Francisco, CA, USA, 2023, pp. 01-09, doi: 10.1109/ICCAD57390.2023.10323720.

- **Z. Li** and A. C. Carusone, "Design and Optimization of T-Coil-Enhanced ESD Circuit with Upsampling Convolutional Neural Network," 2022 IEEE/MTT-S International Microwave Symposium - IMS 2022, Denver, CO, USA, 2022, pp. 495-497, doi: 10.1109/IMS37962.2022.9865341.

- **Z. Li** and S. Bhadra, "A Flexible Printed Chipless RFID Tag for Concentration Measurements of Liquid Solutions," 2019 IEEE SENSORS, Montreal, QC, Canada, 2019, pp. 1-4, doi: 10.1109/SENSORS43011.2019.8956830.

- **Z. Li** and S. Bhadra, "A Fully Inkjet-Printed Flexible Microwave Multiresonator Circuit for Concentration Measurements of Liquid Solutions," 2019 IEEE International Flexible Electronics Technology Conference (IFETC), Vancouver, BC, Canada, 2019, pp. 1-5, doi: 10.1109/IFETC46817.2019.9073772.

- **Z. Li** and S. Bhadra, "A Flexible Printed Complementary Split-Ring Resonator Based Chipless RFID," 2018 18th International Symposium on Antenna Technology and Applied Electromagnetics (ANTEM), Waterloo, ON, Canada, 2018, pp. 1-2, doi: 10.1109/ANTEM.2018.8572905.

TEACHING EXPERIENCE

ECE430/ECE1352 Analog Integrated Circuit I Fall terms 2022, 2023
University of Toronto

- Responsible for conducting labs that expose students to real-world analog IC design flow with Cadence Virtuoso in GF22nm FD-SOI. Labs involve the design of many practical analog IC blocks in transistor levels.
- Responsible for delivering tutorials to students which cover a wide range of textbook problems.
- Grade student lab reports, quizzes, and exam papers; provide feedback.

ECE231 Introductory Electronics Winter terms 2021, 2022, 2023
University of Toronto

[1] Google Scholar: https://scholar.google.ca/citations?view_op=list_works&hl=en&hl=en&user=akgjF0IAAAAJ&sortby=pubdate

- Evaluate student performance during the online and in-person lab sessions; help students with their simulations in LTspice, and Multisim, and grade their lab reports.
- Responsible for delivering tutorials to students which cover a wide range of textbook problems.
- Grade student lab reports, quizzes, and exam papers; provide feedback.

ECE21 Circuit Analysis Fall terms 2021, 2022, 2023
University of Toronto

- Evaluate student performance during the online and in-person lab sessions; help students with their simulations in LTspice, and Multisim, and grade their lab reports.
- Responsible for delivering tutorials to students which cover a wide range of textbook problems.
- Grade student lab reports, quizzes, and exam papers; provide feedback.

VOLUNTEERING EXPERIENCE

IEEE ISSCC Saratoga Group February 2023, 2024
Responsible for the conference's operation and organization, including the audio/video recording, post-processing, and helping attendees register their programs.

AIESEC Language School Assistant July - September 2019
2-month English teaching assistant in a local language center in Tangier, Morocco. I was responsible for designing, delivering, and promoting English language education for kids from 6-14 in local communities.

McGill University Grads Connect Facilitator September 2018
I helped new incoming graduate students engage with each other and familiarize themselves with the school by playing a series of ice-breaking games on a 1-day campus trip.

Kelowna Gospel Mission January - May 2014
I helped new incoming graduate students engage with each other and familiarize themselves with the school by playing a series of ice-breaking games on a 1-day campus trip.

AWARDS

IEEE VLSI Symposium Code-a-Chip Student Competition Award 2023
McGill Graduate Excellence Fellowship 2018
UBC International Student Faculty Award 2016
UBC International Undergraduate Student Research Award 2016
UBC Vice-Chancellor Scholarship for International Students 2015, 2016
UBC Dean's Honor List of the Faculty of Applied Science 2013 - 2017