Chenghao Feng

CONTACT INFORMATION

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RESEARCH INTERESTS

Silicon photonics, design, simulation, and testing of photonic integrated circuits (PIC) for digital computing and interconnect, photonic neuromorphic computing

EDUCATION

The University of Texas at Austin, Austin, TX

Ph.D. student, Department of Electrical and Computer Engineering (Aug. 2018-Present)

- Advisor: Ray T. Chen
- Co-advisor: David Z. Pan

Nanjing University, Nanjing, China

B.S. in Physics, (2014-2018)

EXPERIENCE

The University of Texas at Austin, Austin, TX, USA. **August, 2018 - present**

Graduate research assistant

- **Hardware-efficient photonic neural chip:** Worked on photonic neural chip tape-out for novel optical neural network(ONN) architectures using Advanced Micro Foundry (AMF); worked on the full-stack schematic design, layout, validation of photonic neural chips using Lumerical Interconnect, Synopsys optodesigner, and PyTorch; worked on optoelectronic co-packaging and controlling circuit design; built the programmable testing setup using Python APIs; tested the performance of the photonic neural chip. Proposed and demonstrated a hardware-efficient photonic neural network architecture.
- **Photonic neural network hardware-software co-design:** Collaborated on designing high-throughput and low-power photonic ONN architectures ; helped verify the functionality of photonic parts using Lumerical Interconnect.
- **Electronic-photonic digital computing chip:**,Worked on electronic-photonic digital computing chip tape-out for photonic logic functional units using AIM photonics; worked on the design, layout, validation, tape-out, performance evaluation, and high-speed measurement of the digital computing circuits. Proposed and demonstrated an electronic-photonic comparator and an electronic-photonic decoder/multiplexer that can outperform the state-of-the-art transistor-based circuits in speed and power consumption.
- **Electronic-photonic digital full adder:** Collaborated on the architecture design, high-speed measurement, and performance evaluation of an electronic-photonic full adder fabricated by AIM photonics. Collaborated on proposing and the idea of electronic-photonic arithmetic logic unit.
- **Modeling of high-speed silicon photonic modulators:** Modeled and analyzed high speed properties of cascaded EO microring/microdisk modulators in optical computing systems. Provided the solutions to increase the optical bandwidth of the microresonator-based modulators and the accuracy of the optical digital computing circuits.

Nanjing University, Nanjing, China. **August, 2017 - June, 2018**

Undergraduate research student

- **Arbitrary Complex Brag Grating Waveguide:** Developed and optimized codes to design the arbitrary complex Brag grating waveguide using inverse-design algorithms. Improved the

simulation time complexity and scaled down the size of the structure using MATLAB, Lumerical MODE, and Lumerical FDTD. Modeled the dispersion of silicon Brag grating waveguide and improved the simulation accuracy.

- **The Electrical Properties of a P-I-N-based optical Modulator :** Analyzed the impedance and modulation performance of a p-i-n-diode-based electrooptical modulator under high modulation frequency using Lumerical DEVICE and MODE.

Major Journal Publications

1. **Chenghao Feng**, Zhoufeng Ying, Zheng Zhao, Jiaqi Gu, David Z. Pan, and Ray T. Chen, "Toward high-speed and energy-efficient computing: A WDM-based scalable on-chip silicon integrated optical comparator", Laser and Photonics Reviews 2021, 15, 2000275
2. Zhoufeng Ying, **Chenghao Feng**, Zheng Zhao, et al. "Sequential logic and pipelining in chip-based electronic-photonic digital computing", IEEE Photonics Journal, 2020, 12(6): 1-11.
3. **Chenghao Feng**, Zhoufeng Ying, Zheng Zhao, Jiaqi Gu, David Z. Pan, and Ray T. Chen. "Wavelength-division-multiplexing (WDM)-based integrated electronic–photonic switching network (EPSN) for high-speed data processing and transportation" Nanophotonics, vol. 9, no. 15, 2020, pp. 4579-4588.
4. Zhoufeng Ying, **Chenghao Feng**, Zheng Zhao, et al. Electronic-photonic arithmetic logic unit for high-speed computing[J]. Nature communications, 2020, 11(1): 1-9.
5. **Chenghao Feng**, Zhoufeng Ying, Zheng Zhao, Rohan Mital, David Z. Pan and Ray T. Chen. "Analysis of microresonator-based logic gate for high-speed optical computing in integrated photonics", IEEE Journal of Selected Topics in Quantum Electronics, 2019, 26(2): 1-8.
6. Zhoufeng Ying, **Chenghao Feng**, Zheng Zhao, et al. "Integrated multi-operand electro-optic logic gates for optical computing", Applied Physics Letters, 2019, 115(17): 171104.
7. **Chenghao Feng**, Richard Soref, Ray T. Chen, et al. Efficient and accurate synthesis of complex Bragg grating waveguide in dispersive silicon structures[J]. JOSA B, 2018, 35(8): 1921-1927.

Major Conference papers

1. Jiaqi Gu, Hanqing Zhu, **Chenghao Feng**, et al. " L2ight: Enabling On-Chip Learning for Optical Neural Networks via Efficient in-situ Subspace Optimization", Conference on Neural Information Processing Systems (NeurIPS), Dec. 7-10, 2021.(accepted)
2. Jiaqi Gu, Hanqing Zhu, **Chenghao Feng**, et al. " Towards Memory-Efficient Neural Networks via Multi-Level in situ Generation", in International Conference on Computer Vision (ICCV), Oct. 10-17, 2021.
3. **Chenghao Feng**, Jiaqi Gu, Hanqing Zhu, et al. "Experimental Demonstration of a WDM-based Integrated Optical Decoder for Compact Optical Computing," in Conference on Lasers and Electro-Optics, Optical Society of America, 2021, SW3C.3.
4. Jiaqi Gu, **Chenghao Feng**, Zheng Zhao, et al. " Efficient On-Chip Learning for Optical Neural Networks Through Power-Aware Sparse Zeroth-Order Optimization", in Association for the Advancement of Artificial Intelligence (AAAI), Virtual Conference, Feb. 02-09, 2021.
5. **Chenghao Feng**, Jiaqi Gu, Zhoufeng Ying, et al. "Scalable fast-Fourier-transform-based (FFT-based) integrated optical neural network for compact and energy-efficient deep learning", Proc. SPIE 11690, Smart Photonic and Optoelectronic Integrated Circuits XXIII, 116900I (March 2021)
6. **Chenghao Feng**, Zhoufeng Ying, Zheng Zhao,et al. "Wavelength-division-multiplexing-based electronic-photonic integrated circuits for high-performance data processing and transportation", Proc. SPIE 11690, Smart Photonic and Optoelectronic Integrated Circuits XXIII, 116900R (March 2021)
7. **Chenghao Feng**, Zheng Zhao, Zhoufeng Ying, et al. "Compact design of on-chip elman optical recurrent neural network",CLEO: Applications and Technology. Optical Society of America, 2020: JTh2B. 8.

8. **Chenghao Feng**, Zhoufeng Ying, Zheng Zhao, et al. "Integrated WDM-based optical comparator for high-speed computing", 2020 Conference on Lasers and Electro-Optics (CLEO). IEEE, 2020: 1-2.
9. **Chenghao Feng**, Zhoufeng Ying, Zheng Zhao, et al. "Wavelength-division-multiplexing-based electronic-photonic network for high-speed computing", Proc. SPIE 11284, Smart Photonic and Optoelectronic Integrated Circuits XXII, 112840H (9 March 2020)
10. **Chenghao Feng**, Zhoufeng Ying, Zheng Zhao, et al. "Power and accuracy co-optimization of an optical full adder via optimization algorithms",2019 IEEE Photonics Conference (IPC). IEEE, 2019: 1-2.

Honors and Awards

Provost's International Graduate Excellence Fellowship. UT Austin	2018 - 2021
Zheng Gang Scholarship. Nanjing University	2017
Dalian Institute of Chemical Physics, Chinese Academy of Sciences' Scholarship.	2016
Top-notch Program Scholarship. Nanjing University	2015 - 2017

Related Courses

EE 383V-1 Nanophotonics; EE 383P-8 Optical Communications; EE 396K-21 Nanoscale Device Physics/Technology; EE 382M-7 VLSI I; EE 382N-14 High-speed computing arithmetic I; EE 380L-10 Data mining; EE 383V Modern Optics; EE 382N-1 Computer Architecture; ME 397 Intelligent nano-world; EE 381V Unconventional computation.

Skills

- **Programming Languages**: Python (PyTorch), C, Matlab, Verilog
- **Simulation Tools**: Lumerical Solutions, Synopsys Optism
- **EDA Tools**: Synopsys Optodesigner, Klayout, Cadense Virtuoso, Synopsys Design Compiler
- **Experiment**: High-speed testing, large-scale-photonic-circuit control and testing, basic skills of fabrication such as E-beam lithography and plasma-etching.