

Yipeng Huang

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Current Position

Princeton University

Postdoctoral research associate
Advisor: Dr. Margaret Martonosi

June 2018 -

Education

Columbia University

Ph.D., computer science
“Hybrid Analog-Digital Co-Processing for Scientific Computation”
Advisor: Dr. Simha Sethumadhavan

2018

M.Phil., computer science
M.S., computer science
B.S. *magna cum laude* in computer engineering, minor in economics

2015

2013

2011

Honors and Awards

- Heidelberg Laureate Forum 2017 participant
- IEEE Micro Top Picks from the 2017 Computer Architecture Conferences honorable mention
- IEEE Micro Top Picks from the 2016 Computer Architecture Conferences (one among 12)
- DARPA Small Business Technology Transfer Phase I grant to investigate analog computing applications
- Columbia University Computer Engineering Award of Excellence
- Nominated for The Columbia University George Vincent Wendell Memorial Medal

Publications

Conference Publications

Statistical Assertions for Validating Patterns and Finding Bugs in Quantum Programs

Yipeng Huang and Margaret Martonosi

ACM/IEEE International Symposium on Computer Architecture (ISCA), Phoenix, AZ, 2019.

Invited for submission to the ACM Transactions on Quantum Computing

Hybrid Analog-Digital Solution of Nonlinear Partial Differential Equations

Yipeng Huang, Ning Guo, Mingoo Seok, Yannis Tsividis, Kyle Mandli, and Simha Sethumadhavan

2017 IEEE/ACM International Symposium on Microarchitecture (MICRO), Boston, MA, 2017

IEEE Micro Top Picks from the 2017 Computer Architecture Conferences honorable mention

Evaluation of an Analog Accelerator for Linear Algebra

Yipeng Huang, Ning Guo, Mingoo Seok, Yannis Tsividis, and Simha Sethumadhavan

ACM/IEEE International Symposium on Computer Architecture (ISCA), Seoul, South Korea, 2016

IEEE Micro Top Picks from the 2016 Computer Architecture Conferences

RoboBench: Towards sustainable robotics system benchmarking

Jonathan Weisz, Yipeng Huang, Florian Lier, Simha Sethumadhavan, and Peter K. Allen
IEEE International Conference on Robotics and Automation (ICRA), Stockholm, Sweden, 2016

Continuous-time hybrid computation with programmable nonlinearities

Ning Guo, Yipeng Huang, Tao Mai, Sharvil Patil, Chi Cao, Mingoo Seok, Simha Sethumadhavan, and Yannis Tsividis
European Solid-State Circuits Conference (ESSCIRC), Graz, Austria, 2015
Invited for submission to the IEEE Journal of Solid-State Circuits

Journal Publications

Analog Computing in a Modern Context: A Linear Algebra Accelerator Case Study

Yipeng Huang, Ning Guo, Mingoo Seok, Yannis Tsividis, and Simha Sethumadhavan
IEEE Micro, Top Picks Special Issue, May/June 2017

Energy-Efficient Hybrid Analog/Digital Approximate Computation in Continuous Time

Ning Guo, Yipeng Huang, Tao Mai, Sharvil Patil, Chi Cao, Mingoo Seok, Simha Sethumadhavan, and Yannis Tsividis
IEEE Journal of Solid-State Circuits, vol. 51, no. 7, pp. 1514-1524, July 2016

Trustworthy hardware from untrusted components

Simha Sethumadhavan, Adam Waksman, Matthew Suozzo, Yipeng Huang, and Julianna Eum
Communications of the ACM 58, 9 (August 2015), 60-71

Workshop Papers

QDB: From Quantum Algorithms Towards Correct Quantum Programs

Yipeng Huang and Margaret Martonosi
2018 PLATEAU Workshop at ACM conference on Systems, Programming, Languages and Applications: Software for Humanity (SPLASH), Boston, MA, 2018

Dissertation

Hybrid Analog-Digital Co-Processing for Scientific Computation Ph.D. thesis. 2018.

Committee: Simha Sethumadhavan, Yannis Tsividis, Margaret Martonosi, Martha Kim, and Kyle Mandli

Selected Presentations

Invited Talks

Probabilistic Inference and Statistical Tests for Correct Quantum Programs

Sandia National Laboratories Assessing Performance of Quantum Computers workshop, Estes Park, CO, September 2019
Host: Robin Blume-Kohout

Knowledge Compilation-Based Exact Inference for Quantum Simulation

Quantum Resource Estimation workshop at ISCA / FCRC, Phoenix, AZ, June 2019
Hosts: Alexandru Paler, Simon Devitt, and Daniel Herr

Approximate Computing Across the (Quantum) Stack

Workshop on Approximate Computing Across the Stack at PLDI / FCRC, Phoenix, AZ, June 2019
Host: Ulya Karpuzcu

A Case Study in Analog Co-Processing for Solving Stochastic Differential Equations

IEEE International Conference on Digital Signal Processing, Shanghai, China, November 2018

Hosts: Arjuna Madanayake, Zhiping Lin, and Sankar Basu

Hybrid Analog-Digital Co-Processor for Scientific Computation

DARPA Accelerated Computation for Efficient Scientific Simulation (ACCESS) principal investigators' meeting
Arlington, VA, December 2016

Host: Vincent Tang

Selected Posters

Hybrid Analog-Digital Accelerator for Differential and Algebraic Equations

IEEE International Conference on Rebooting Computing, Tysons Corner, VA, November 2017

Hybrid Analog-Digital Solution of Nonlinear Partial Differential Equations

Heidelberg Laureate Forum, Heidelberg, Germany, September 2017

Grants

Hybrid Analog-Digital Co-Processor for Scientific Computation

I was the principal investigator for this Small Business Technology Transfer grant, in response to DARPA's Accelerated Computation for Efficient Scientific Simulation (ACCESS) program. Grant amount: \$100,000; DoD DARPA contract number D16PC00089

Press Mentions

Headline	Publication	Date
Researchers make steps toward debugging tools for quantum computers	phys.org	June 21, 2019
Not Your Fathers Analog Computer	IEEE Spectrum	Dec. 1, 2017
Maths on a boat: Yipeng Huang and analog computing	maths.org Plus magazine	Oct. 10, 2017
Back to analog computing: Columbia researchers merge analog and digital computing on a single chip	Columbia CS press release	Nov. 22, 2016

Academic Service

Venue	Role	Years
Programming Languages and Quantum Computing workshop at POPL	PC	2020
ACM International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS)	ERC	2020, 2019
IEEE/ACM International Symposium on Microarchitecture (MICRO)	ERC	2019
ACM/IEEE International Symposium on Computer Architecture (ISCA)	ERC	2019
IEEE International Symposium on High Performance Computer Architecture (HPCA)	External reviewer	2015, 2019
IEEE Computer Architecture Letters	Reviewer	2019
IEEE Micro Magazine	Reviewer	2017, 2018
IEEE Transactions on Circuits and Systems-I	Reviewer	2018, 2019
Columbia University Computer Science M.S. program admissions	Reviewer	2014

Teaching Experience

Course	Role	Primary instructor	Term
Quantum Undergraduate Research at IBM and Princeton (QURIP) mentor for Emma Dasgupta and Lia Yeh	Mentor	Margaret Martonosi	Summer 2019
Undergraduate research project mentor for Lusa Zhan	Mentor	Simha Sethumadhavan	Fall 2016
Masters research project mentor for Mingrui Liu	Mentor	Simha Sethumadhavan	Spring 2015
Masters research project mentor for Kenneth Harvey	Mentor	Simha Sethumadhavan	Spring 2015
Computer Hardware Design, graduate course in RTL design, validation, synthesis	Teaching assistant	Simha Sethumadhavan	Fall 2012, Fall 2014
Fundamentals of Computer Systems, undergraduate course in logic and architecture	Teaching assistant	Dan Rubenstein	Fall 2010
Object Oriented Design in Java	Teaching assistant	Bert Huang	Spring 2010

Professional Experience

Sendyne Research Intern	New York, NY Summer 2017
<ul style="list-style-type: none">Developed novel stochastic application-specific integrated circuit for financial modeling applications	
Allegory Labs, LLC Founder & Principal Investigator	New York, NY Nov. 2015 – May 2017
<ul style="list-style-type: none">Founded IP-backed startup via \$100K Small Business Technology Transfer federal government contractCollaborated with university subcontractor to research new class of analog numerical methodsIdentified & assessed commercial potential in modern big data & scientific computation applicationsCommunicated with DARPA in-person & in response to request for information & proposals	
Boeing Information Technology Career Foundation Program	Seattle, WA June 2011 – July 2012
<ul style="list-style-type: none">Built middleware to parallelize computational fluid dynamics & engineering geometry applications	
ZS Associates Business Information Specialist Intern	New York, NY Summer 2010
Hutchison Port Holdings Information Technology Intern	Hong Kong Summer 2009

Service, Leadership, and Professional Memberships

Organization	Role	Years
Summer Science Program	Admissions Committee	Spring 2019
FIRST Robotics Competition	Team Mentor	Spring 2014
Washington Aerospace Scholars Program	Summer Residency Mentor	2012 & 2013
Columbia Daily Spectator	Staff Director & Design Editor	2007 – 2010
ACM SIGARCH, SIGMICRO	Member	
IEEE Computer Society	Member	

Technical Tools & Languages

Quantum: IBM Qiskit, Google Cirq, Scaffold, ProjectQ

Hardware: SystemC, SystemVerilog, Synopsys, Cadence, Altera EDA tools for ASIC/FPGA

Software: Nvidia CUDA Thrust, Open MPI, Robot Operating System, C/C++, Java, Python, MATLAB, Docker