

AJAY SINGHVI

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RESEARCH INTERESTS

Analog and Mixed-Signal IC Design, System Architecture and Modeling, Signal Processing and Machine Learning Algorithms, Statistical and Data Analysis, Acoustic and Electromagnetic Sensing and Imaging

EDUCATION

Stanford University Stanford, CA, USA
Ph.D. in Electrical Engineering Fall 2024
Advisor: Amin Arbabian

Stanford University Stanford, CA, USA
M.S. in Electrical Engineering Fall 2018
GPA: 4.1/4.0

Birla Institute of Technology and Science Pilani Pilani, RJ, India
B.E. in Electrical and Electronics Engineering Spring 2015
GPA: 9.8/10.0

EXPERIENCE

RF/Analog/Mixed-Signal Electrical Engineer, Apple Inc. Nov 2024 - Present
- Architect and design custom analog and mixed-signal integrated circuit systems and on-chip measurement sensors, with a focus on how they can drive system-level optimization across modern SoC components including CPU, GPU, DDR, Chiplet PHYs.
- Involved throughout the design, verification, and measurement stack — including system specification and architecture, block and transistor-level circuit design, signal and data processing algorithms, silicon bringup, measurement data and yield analysis.

Graduate Research Assistant, Arbabian Lab, Stanford University Sept 2016 - Sept 2024
Advisor: Amin Arbabian
- Designed next-generation, highly sensitive, air-coupled multi-modal ultrasonic integrated circuit systems for imaging and communication applications. Work published in JSSC'22, ISSCC'22, T-UFFC'19 [J2, C6, J5].
- Developed signal processing and machine learning algorithms for high-fidelity image reconstruction with improved resolution. Work presented at ISCAS'22, IUS'22, IUS'21, IUS'20, Sensors'20 [C4, C8, C9, C11, C10]
- Built a first-of-its-kind non-contact thermoacoustic imaging system for high-throughput, non-invasive phenotyping of below-ground traits. Related work published in TCAS-II'22, ISCAS'22, IUS'21, IUS'20, Sensors'20, IUS'19, and T-UFFC'19 [J3, C7, C9, C11, C10, C12, J5]
- Devised an airborne sonar system leveraging the photoacoustic effect for high-throughput communication and sensing across the air-water interface. Related work published in Nature Comms. Eng '23, ISCAS'22, IUS22, ISSCC'22, and Access'20 [J1, C4, C8, C6, J4]

Hardware Engineering Consultant, Plato Systems, March 2021 - May 2021
- Consulted on form-factor compliant, power-supply management solutions with a focus on supply noise-suppression to generate artifact-free mm-wave radar output.

System Engineering Intern, Kilby Labs, Texas Instruments June 2018 - Aug 2018
- Architected and designed a noise, power, and area efficient analog front-end for a LiDAR system interface employing on-chip APD arrays
- The system included an APD sensor array, with distributed low noise amplifiers, calibration, and processing circuitry. [P2]

Research Intern, E^2S^2C Group, University of Southern California May 2014 - Aug 2015
Advisor: Peter Beerel
- Worked on the design of programmable, voltage scalable delay elements for bundled-data asynchronous VLSI systems. Work published in JETC'16, VLSID'15, and ISVLSI'15 [J6, C13, C14]

TECHNICAL SKILLS

Tools

Cadence Virtuoso/Spectre, Altium, Cadence Allegro PCB Designer, Keysight ADS, HFSS, GenAI Tools

Programming Languages

Python, SPICE, MATLAB

RELEVANT COURSEWORK

Analog Integrated Circuits, Semiconductor Devices, RF Integrated Circuits, Analog and Digital Interfaces, Digital System Design, Analog and Digital Communications, Deep Learning, Digital Signal Processing, Statistical Signal Processing, Adaptive Signal Processing, Biochips and Medical Imaging, 3D+ Imaging Sensors

TEACHING EXPERIENCE

Teaching Assistant, Stanford University

EE214A - Fundamentals of Analog Integrated Circuit Design, Stanford University	Fall 2016
EE214B - Advanced Analog Integrated Circuit Design, Stanford University	Winter 2017
EE214A - Fundamentals of Analog Integrated Circuit Design, Stanford University	Fall 2017
EE292Q (now EE219) - 3D+ Imaging Sensors, Stanford University	Spring 2022
EE214A - Fundamentals of Analog Integrated Circuit Design, Stanford University	Fall 2023

Guest Lectures, Stanford University

EE214A - Fundamentals of Analog Integrated Circuit Design	Fall 2018-23
EE219 - 3D+ Imaging Sensors	Spring 2024

AWARDS

James F. Gibbons Outstanding Student Teaching Award, Stanford University	2022
Analog Devices Outstanding Student Designer Award	2020
L. K. Maheshwari Best Graduating Student Award, BITS Pilani	2014
Silver Medallist and Salutatorian, BITS Pilani	2014
OP Jindal Scholarship for Engineering and Management Students	2011, 2012, 2014
Merit Scholarship, BITS Pilani	2011, 2012, 2013, 2014

PEER-REVIEWED JOURNAL PUBLICATIONS

- [J1] Aidan Fitzpatrick, Roshan P Mathews, **Ajay Singhvi**, and Amin Arbabian. [Multi-modal sensor fusion towards three-dimensional airborne sonar imaging in hydrodynamic conditions](#). *Nature Communications Engineering*, 2(1):16, 2023.
- [J2] Christopher Sutardja, **Ajay Singhvi**, Aidan Fitzpatrick, Andreia Cathelin, and Amin Arbabian. [Multi-Watt-Level 4.9-GHz Silicon Power Amplifier for Portable Thermoacoustic Imaging](#). *IEEE Journal of Solid-State Circuits*, 57(5):1421–1431, 2022.
- [J3] **Ajay Singhvi**, Aidan Fitzpatrick, Johannes Daniel Scharwies, José R. Dinnyen, and Amin Arbabian. [A Thermoacoustic Imaging System for Non-Invasive and Non-Destructive Root Phenotyping](#). *IEEE Transactions on Circuits and Systems II: Express Briefs*, 69(5):2493–2497, 2022.
- [J4] Aidan Fitzpatrick, **Ajay Singhvi**, and Amin Arbabian. [An Airborne Sonar System for Underwater Remote Sensing and Imaging](#). *IEEE Access*, 8:189945–189959, 2020.
- [J5] **Ajay Singhvi***, Kevin C. Boyle*, Mojtaba Fallahpour, Butrus T. Khuri-Yakub, and Amin Arbabian (* = co-primary authors). [A Microwave-Induced Thermoacoustic Imaging System with Non-Contact Ultrasound Detection](#). *IEEE Transactions on Ultrasonics, Ferroelectrics, and Frequency Control*, 66(10):1587–1599, 2019.
- [J6] **Ajay Singhvi**, Matheus T. Moreira, Ramy N. Tadros, Ney L.V. Calazans, and Peter A. Beerel. [A Fine-Grain, Uniform, Energy-Efficient Delay Element for 2-Phase Bundled-Data Circuits](#). *ACM Journal on Emerging Technologies in Computing Systems (JETC)*, 13(2):1–23, 2016.

- [C1] Megan Zeng, William Meng, Aidan Fitzpatrick, **Ajay Singhvi**, Felipe Monteiro, Max Yates, Alexander Suen, and Amin Arbabian. [Underwater Imaging with an Air-Coupled Piezoelectric Micromachined Ultrasonic Transducer Phased Array](#). In *2025 IEEE International Ultrasonics Symposium (IUS)*, pages 1–4. IEEE, 2025.
- [C2] Aidan Fitzpatrick, **Ajay Singhvi**, Jordy Mukania, Brion Ye, Eastan Giebler, and Amin Arbabian. [Three-Dimensional Mapping of Water Surface Waves Using Air-Coupled Sonar](#). In *OCEANS 2023-MTS/IEEE US Gulf Coast*, pages 1–7. IEEE, 2023.
- [C3] Jingzhi Zhang, **Ajay Singhvi**, Sherif S Ahmed, and Amin Arbabian. [A W-Band Transceiver Array with 2.4 GHz LO Synchronization Enabling Full Scalability for FMCW Radar](#). In *2023 IEEE International Solid-State Circuits Conference (ISSCC)*, pages 282–284. IEEE, 2023.
- [C4] Aidan Fitzpatrick*, **Ajay Singhvi***, and Amin Arbabian (* = **co-primary authors**). [Dynamic Tuning of Sensitivity and Bandwidth of High-Q Transducers via Nested Phase Modulations](#). In *2022 IEEE International Symposium on Circuits and Systems (ISCAS)*, pages 1–4. IEEE, 2022.
- [C5] William L Meng, Aidan Fitzpatrick, **Ajay Singhvi**, and Amin Arbabian. [Laser Scanning for Single-Shot Frequency Diverse Photoacoustic Excitation](#). In *2022 IEEE International Ultrasonics Symposium (IUS)*, pages 1–4. IEEE, 2022.
- [C6] **Ajay Singhvi**, Aidan Fitzpatrick, and Amin Arbabian. [An Electronically Tunable Multi-Frequency Air-Coupled CMUT Receiver Array with sub-100 \$\mu\$ Pa Minimum Detectable Pressure Achieving a 28kb/s Wireless Uplink Across a Water-Air Interface](#). In *2022 IEEE International Solid-State Circuits Conference (ISSCC)*, volume 65, pages 498–500. IEEE, 2022.
- [C7] **Ajay Singhvi**, Aidan Fitzpatrick, Johannes Daniel Scharwies, José R. Dinneney, and Amin Arbabian. [A Thermoacoustic Imaging System for Non-Invasive and Non-Destructive Root Phenotyping](#). In *2022 IEEE International Symposium on Circuits and Systems (ISCAS)*, pages 1–4. IEEE, 2022.
- [C8] Max L Wang*, **Ajay Singhvi***, Gift Nyikayaramba*, Boris Murmann, and Amin Arbabian (* = **co-primary authors**). [Adaptive Beamforming for Wireless Powering of a Network of Ultrasonic Implants](#). In *2022 IEEE International Ultrasonics Symposium (IUS)*, pages 1–4. IEEE, 2022.
- [C9] **Ajay Singhvi***, Max L. Wang*, Aidan Fitzpatrick*, and Amin Arbabian (* = **co-primary authors**). [Multi-Task Learning for Simultaneous Speed-of-Sound Mapping and Image Reconstruction Using Non-Contact Thermoacoustics](#). In *2021 IEEE International Ultrasonics Symposium (IUS)*, pages 1–5. IEEE, 2021.
- [C10] Aidan Fitzpatrick, **Ajay Singhvi**, and Amin Arbabian. [Spatial Reconstruction of Soil Moisture Content using Non-Contact Thermoacoustic Imaging](#). In *2020 IEEE SENSORS*, pages 1–4. IEEE, 2020.
- [C11] **Ajay Singhvi**, Aidan Fitzpatrick, and Amin Arbabian. [Resolution Enhanced Non-Contact Thermoacoustic Imaging using Coded Pulse Excitation](#). In *2020 IEEE International Ultrasonics Symposium (IUS)*, pages 1–4. IEEE, 2020.
- [C12] **Ajay Singhvi**, Bo Ma, Johannes Daniel Scharwies, José R. Dinneney, Butrus T. Khuri-Yakub, and Amin Arbabian. [Non-Contact Thermoacoustic Sensing and Characterization of Plant Root Traits](#). In *2019 IEEE International Ultrasonics Symposium (IUS)*, pages 1992–1995. IEEE, 2019.
- [C13] Guilherme Heck, Leandro S. Heck, **Ajay Singhvi**, Matheus T. Moreira, Peter A. Beerel, and Ney L.V. Calazans. [Analysis and Optimization of Programmable Delay Elements for 2-Phase Bundled-Data Circuits](#). In *2015 28th international conference on VLSI design*, pages 321–326. IEEE, 2015.
- [C14] **Ajay Singhvi**, Matheus T. Moreira, Ramy N. Tadros, Ney L.V. Calazans, and Peter A. Beerel. [A Fine-Grained, Uniform, Energy-Efficient Delay Element for FD-SOI Technologies](#). In *2015 IEEE Computer Society Annual Symposium on VLSI*, pages 27–32. IEEE, 2015.

THESIS

- [T1] **Ajay Singhvi**. [Overcoming the sensitivity-bandwidth limit for next-generation air-coupled ultrasonic and thermoacoustic sensing](#). *Stanford University*, August 2024.

PATENTS

- [P1] [Apparatuses and methods involving transducers and their tuning](#), 2025. US Patent Application 18/728,419.
[P2] [Sensor array with distributed low noise amplifier](#), 2020. US Patent 10,879,856.

INVITED TALKS, POSTER PRESENTATIONS, AND DEMONSTRATIONS

- ROOTS: Non-Contact Thermoacoustic Below-Ground Sensing
- Bayer US - Crop Science, Virtual Event. June 2022, Feb 2021
 - ARPA-E Energy Innovation Summit, Virtual Event. May 2021
 - ARPA-E Energy Innovation Summit, Denver, CO. July 2019
 - ARPA-E Energy Innovation Summit, Washington, DC. Mar 2018
- Airborne SONAR: Non-Contact Photoacoustic Underwater Sensing
- Ocean IoT: Technologies, Industries, Sustainability, MIT, Virtual Event. Nov 2021
 - Internet of Robotic Things Research Seminar, University of Washington, Virtual Event. Jan 2021
- Non-Contact Thermoacoustic and Photoacoustic Imaging
- Stanford SystemX Fall Conference, Virtual Event. Nov 2021
 - Stanford SystemX Fall Conference, Stanford, CA. Nov 2019
 - Stanford SystemX Fall Conference, Stanford, CA. Nov 2018
 - Stanford SystemX Fall Conference, Stanford, CA. Nov 2017
 - Stanford SystemX Spring IoE Workshop, Stanford, CA. May 2017
 - Stanford SystemX Spring Conference, Stanford, CA. May 2016

RESEARCH PRESS COVERAGE

- Non-Contact Thermoacoustic Imaging
- [Stanford News](#) Nov 2018
 - [Stanford School of Engineering](#) Nov 2015
 - [Stanford School of Engineering](#) Nov 2015
 - [Engadget](#) Nov 2015
 - [CNET](#) Nov 2015
- Airborne SONAR
- [Forbes](#) Feb 2021
 - [The Economist](#) Jan 2021
 - [IEEE Spectrum](#) Dec 2020
 - [Stanford News](#) Nov 2020

SERVICE

- IEEE Symposium on VLSI Technology and Circuits (VLSI), Reviewer
IEEE Symposium on Radio Frequency Integrated Circuits (RFIC), Reviewer
IEEE International Symposium on Circuits and Systems (ISCAS), Reviewer
IEEE Biomedical Circuits and Systems Conferences (BioCAS), Reviewer
Physics in Medicine and Biology, Reviewer
Physica Scripta, Reviewer
Plant Methods, Reviewer
IEEE Transactions on Biomedical Circuits and Systems, Reviewer
IEEE Transactions on Medical Imaging, Reviewer
IEEE Solid-State Circuits Letters, Reviewer
Medical Physics, Reviewer and Associate Editor