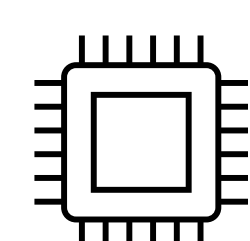


Integrated Circuit Design Engineer

Michael Acquaviva | EngSci 2T4 + PEY

Analog Devices in Toronto



Analog Devices Inc. (ADI) is a \$112B global leader in the design and manufacturing of analog, DSP, and mixed-signal integrated circuits (ICs).



In Toronto, the focus of ADI's Advanced Cores Group is the design of cutting-edge analog-to-digital converters (ADCs).

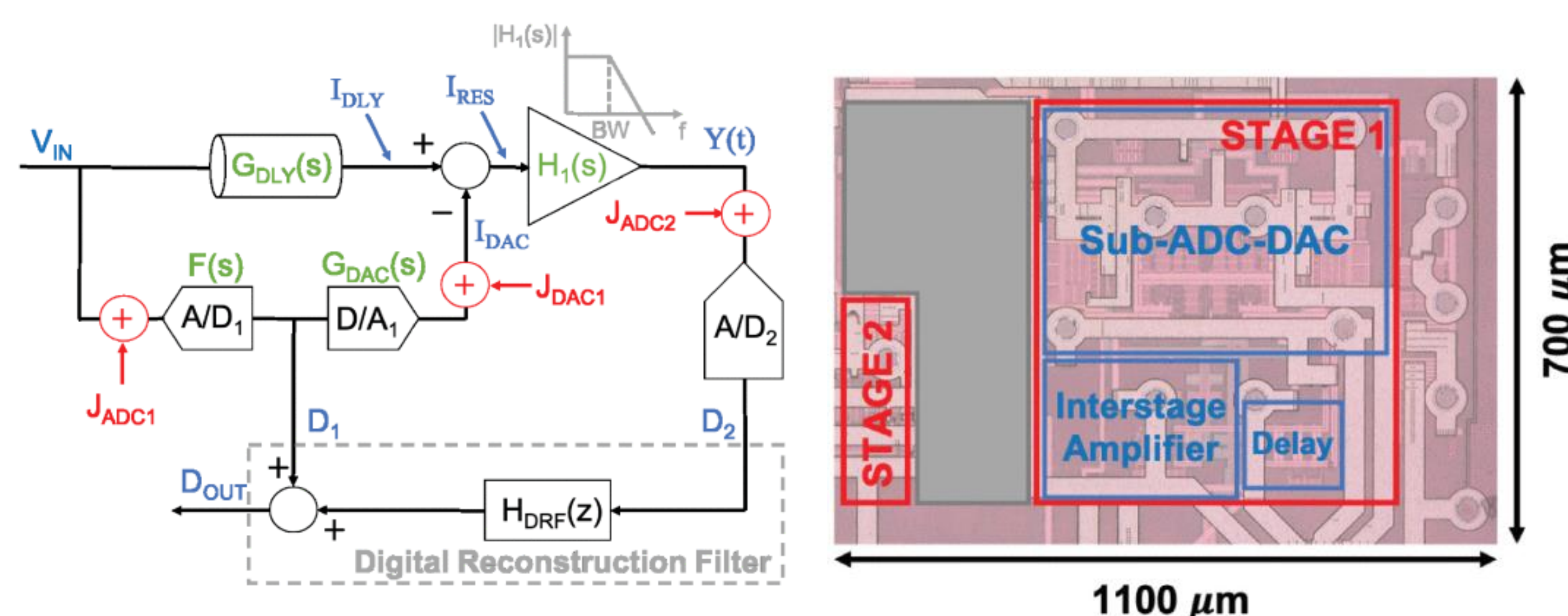


Figure 1: a continuous-time pipelined ADC architecture (left); the chip die micrograph after taping-out said ADC (right)¹.

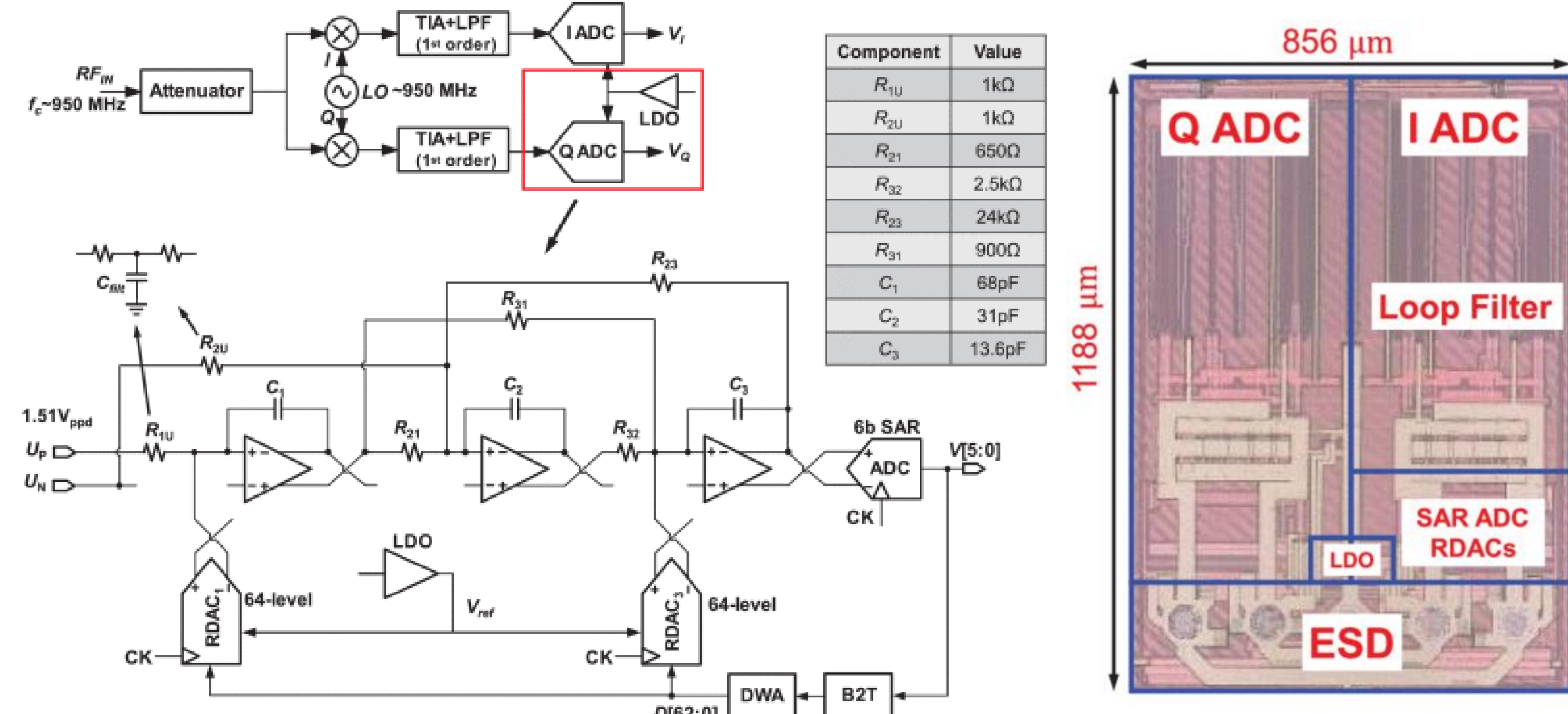
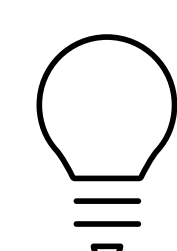


Figure 2: a dual-channel continuous-time $\Delta\Sigma$ ADC architecture (left); the chip die micrograph after taping out said ADC (right)².



The two chips above were designed and taped-out by the Toronto team in the past 5 years. They have been featured in various IEEE publications. Generations of UofT's PEY students have contributed to their design.

Role & Responsibilities



At ADI, Toronto PEY students are involved in many different aspects of IC design. Tasks fall into three main categories: (a) circuit design, (b) layout, and (c) verification.

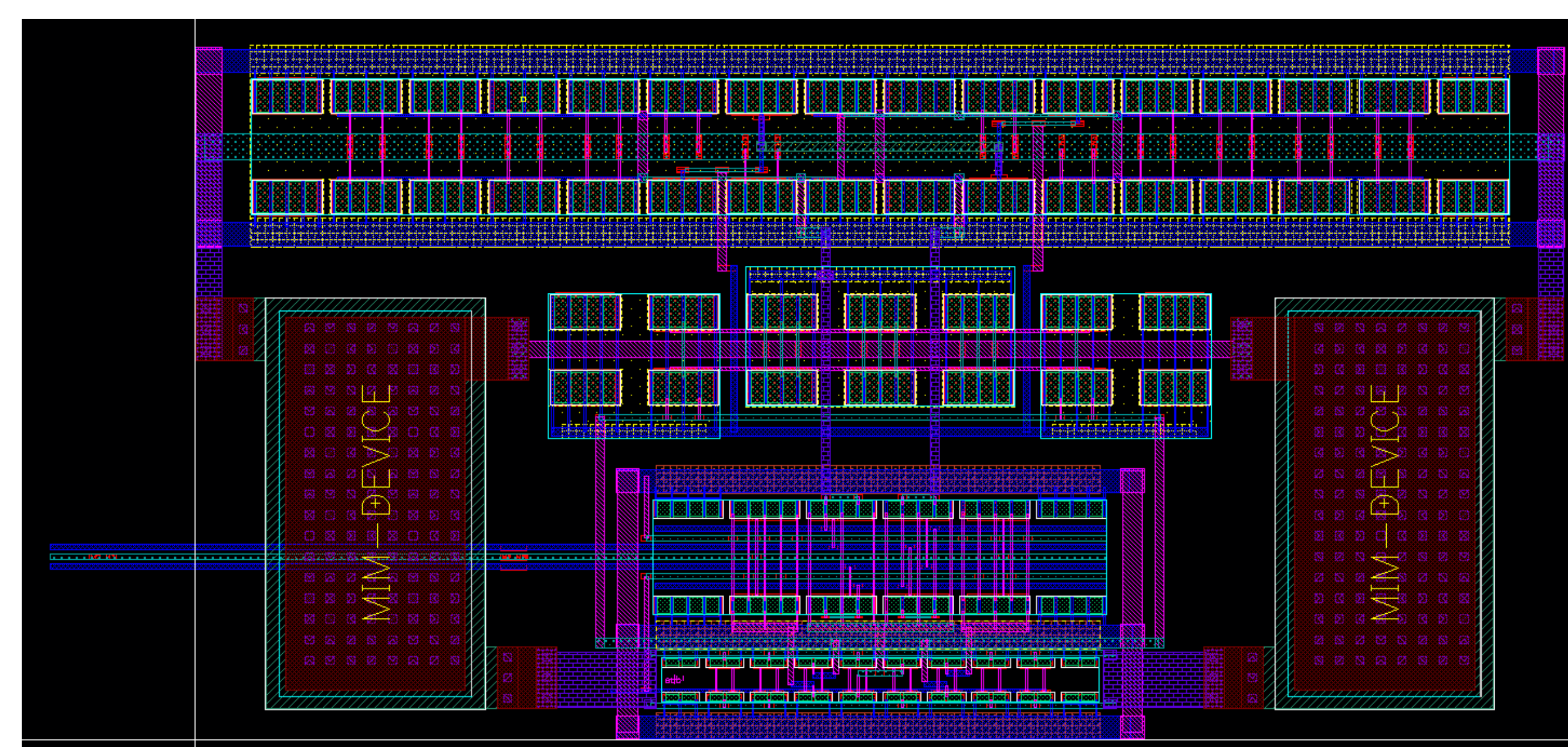


Figure 3: An operational transconductance amplifier (OTA) layout, designed by Columbia University, shown in CAD software. Analog Devices PEY students would produce layouts for a variety of circuits in different process nodes³.

- ✓ **Schematic design:** the first step in the circuit design process involves using a combination of active and passive devices to implement a given functionality.
- ✓ **Layout:** given a schematic, the physical placement of the devices on silicon is determined and metal interconnects are drawn.
- ✓ **Verification:** simulations are run to determine the performance and functionality of the circuit. Post-layout parasitic capacitance and resistance can alter the behavior of circuits. These effects are modelled and accounted for.
- ✓ **Design review:** at each stage in the design process, ideas, decisions, and verification results are presented to colleagues. This is a great opportunity to receive feedback and explore new ideas.

Recruitment Process



PEY students at ADI possess a variety of technical and soft skills. The interview process contains technical aspects, but candidates typically have an aptitude for research and learning.

Soft Skills

- Communicating and presenting technical ideas, design decisions, schematics, and system-level diagrams
- The ability to manage multiple projects at once
- Questioning and learning from others' work

Analog Circuit Design

- An understanding of MOSFET operation
- s-domain analysis of RLC circuits
- OP-amps and active filter theory and analysis
- Sources of noise, matching, and non-idealities
- Transmission line and electromagnetic theory

Digital Circuit Design

- Proficiency using Verilog or other HDLs
- Knowledge of flip-flops, latches, logic gates, SRAM, adders, and other digital circuits
- Knowledge of clocking and timing
- An understanding of binary, hex, 2's complement, and Boolean algebra

Networking Opportunities



Analog Devices Inc. often publishes novel architectures and approaches in IEEE journals and conferences like ISSCC. Getting involved in the Circuits and Systems Society is a great way to build your network!

¹H. Shibata *et al.*, "A 6.4-GS/s 1-GHz BW Continuous-Time Pipelined ADC With Time-Interleaved Sub-ADC-DAC Achieving 61.7-dB SNDR in 16-nm FinFET," in *IEEE Journal of Solid-State Circuits*, vol. 59, no. 4, pp. 1158-1170, April 2024

²S. Patil *et al.*, "A 1-MHz-Bandwidth Continuous-Time Delta-Sigma ADC Achieving >90dB SFDR and >80dB Antialiasing Using Reference-Switched Resistive Feedback DACs," *2023 IEEE Custom Integrated Circuits Conference (CICC)*, 2023

³J. Oliver *et al.*, "EE6350 VLSI Design Lab," *Columbia University Department of Electrical Engineering*, 2014.