

# Rishi Nandha Vanchinathan

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## EDUCATION

### Indian Institute of Technology, Madras (IIT Madras)

May 2026 (expected)

Integrated Masters (B.Tech + M.Tech) in Electrical Engineering

CGPA: 8.93/10 (As of 27 Sep 2025)

**Thesis:** CMOS RF Front-End for Wide-band Same-Channel Full-Duplex

**Courses:** Devices for AI and Neuromorphic Computing, Digital IC Design, Analog IC Design, RF IC Design

**Tools:** · Circuit Design: Cadence Virtuoso, EMX, Genus, Innovus

· System Design: Cadence Allegro, OrCAD, Ansys HFSS · Deep Learning: PyTorch, HuggingFace, LangChain

## CONFERENCE PRESENTATIONS & TAPE-OUTS

- [1] "Wide-band Full-Duplex Transceiver at 7 GHz in CMOS 65nm", submitted for fabrication, Dec. 2024 - ongoing.
- [2] Bharat 6G TeraHertz Testbed, "Multi-channel TeraHertz System," in *Indian Mobile Congress (IMC) 2024*, New Delhi, India, Oct. 2024.

## RESEARCH EXPERIENCE

### Wide-Band Same-Channel Full-Duplex Transceiver Chip at 7GHz

Dec 2024 - Ongoing

Supervisor: Prof. Sankaran Aniruddhan

ICS Group, IIT Madras

- Demonstrating single-antenna full-duplex at 7 GHz with 300 MHz (single-sided) bandwidth by extending the approach of Kumar et al. (TCAS-I, Oct-2018), originally reported at 2.4 GHz with 10 MHz bandwidth.
- Responsible for complete design flow including schematic design, layout in CMOS 65GP, electro-magnetics simulation, control-logic P&R and board-design for testing and characterization
- TX isolation of -48 dB over a 300 MHz bandwidth achieved in pre-silicon; Design submitted for tape-out

### High Speed Clock Distribution Boards for 5G-NR & 6G Research

May 2023 – Nov 2024

Supervisor: Prof. Radha Krishna Ganti

5G Testbed, IIT Madras

- Contributed as the RF clock boards designer for supporting 5G/6G research activities in the lab
- Designed multi-PLL clock trees for data protocols such as JESD204B in the lab's 5G-NR RRH
- Designed and assembled an RF board to provide reference clocks for TeraHertz Systems; supplied clocks at 100s of MHz for the lab's demonstration of a 270 GHz P2P Wireless Link at Indian Mobile Congress 2024.

## TECHNICAL PROJECTS

### Soft-Binary Neural Network for Inference with Passive RRAM Crossbars (Link)

Aug - Oct 2024

EE6347 Course Instructor: Prof. Bhaswar Chakrabarti

IIT Madras

- Extended the course project on using 1-bit passive RRAM arrays for inference of a neural network, by replacing the post-training quantization with training sigmoid weights that directly model the binary nature
- Observed reduced quantization error in shallow networks, benchmarked against Li et al. (2018).

### 8-Bit Carry-Save Multiplier With Pipelining in CMOS 22nm

Sep - Nov 2023

EE5311 Course Instructor: Prof. Janakiraman Viraraghavan

IIT Madras

- Designed custom transistor-level layout for a multiplier operating at 2.8 GHz with 0.32 ns critical delay
- Implemented pipelining using C2MOS D flip-flops, improving maximum frequency by 67%

### Fully Differential OpAmp with Common-Mode Feedback in CMOS 130nm

Feb - Apr 2024

EE5320 Course Instructor: Prof. Nagendra Krishnapura

IIT Madras

- Designed a 2-stage Miller op-amp in 130nm CMOS with a phase margin of 72 degrees
- Designed a common-mode feedback with 14 MHz bandwidth and 80 degrees phase margin

## Retrieval-Augmented Chatbot Assistant with a Locally Hosted LLM

Nov - Dec 2024

AI Club, Centre For Innovation (Student-Run Innovation Centre, IIT Madras)

IIT Madras

- Built a QA assistant that retrieves context through semantic search with BERT embeddings
- Implemented a pipeline that applies zero-shot classification, retrieves from a knowledge base of physics textbooks, and generates answers with a FLAN-T5 model

## TEACHING EXPERIENCE

### Teaching Assistant: Devices for AI & Neuromorphic Computing

Aug - Nov 2025

EE6347 Course Instructor: Prof. Bhaswar Chakrabarti

IIT Madras

- Conducted tutorials on compact modeling and simulation of FeFET, RRAM, and FeCAP devices
- Taught simulation and programming of 1-bit & 2-bit 1T-1R, 1T-1C, and 1S-1R synaptic arrays
- Delivered supplementary lectures on spiking neurons such as Leaky-Integrate-Fire (LiF)

## AWARDS, HONOURS & FUNDING

### Research supported by Ministry of Electronics & IT (MeitY), India

Fall 2025

Master's Thesis tapeout, supervised by Prof. Sankaran Aniruddhan (PI).

### Lab Group supported by Department of Telecommunications (DoT), India

Fall 2024

Undergraduate research at the IITM 5G Testbed, under the indigenous 5G program.

### Institute Day Certificate of Merit, IIT Madras

Apr 2022

Awarded for securing All India Rank 332 in IIT-JEE Advance 2021.

### Gold Medal, Online Physics Olympiad (OPhO)

Jun 2021

For placing 6th globally among international participants

## INDUSTRY EXPERIENCE

### Software Engineering Internship

May - Jul 2025

Microsoft [Windows + Devices]

Hyderabad, India

- Developed an MCP server enabling Agentic AI workflows to interface with legacy software components.
- Contributed to the open-source MCP TypeScript SDK, focusing on automation of engineering tasks

### Open-Source Contribution to IBM Qiskit

Feb - Apr 2025

Supervisor: Dhinakaran Vinayagamurthy, IBM Research

Remote

- Contributed a quantum dataset for benchmarking variational fast-forwarding (Model introduced in 2020)
- Verified fast-forwarding of atomic Hamiltonians with a Jordan-Wigner mapping on NISQ devices

## LEADERSHIP & VOLUNTEERING

### Executive Head & Technical Lead

Apr 2023 - Mar 2024

Sahaay - Social Innovation Club, IIT Madras

- Directed five student projects in animal welfare, assistive technology, and agricultural technology.
- Mentored two of the student teams on edge inference of neural networks such as YOLO and CNNs
- Conducted workshops for 54 freshmen on transfer learning, data augmentation, and model evaluation.
- Reorganized the club's practices, thereby broadening participation and increasing applications inflow.

### Department Committee Representative

Jul 2021 - Present

Electrical Engineering Department, IIT Madras

- Assisted the Head of Department with curriculum restructuring; Represented undergrads at town halls
- Assisted the Dean of Students of IIT Madras on measures & initiatives for women's safety in campus

### Mobile Application for Animal Distress Call Response

Aug 2024 - Present

- Collaborating with members from Animal Welfare Board of India and Blue Cross of India for developing a full-stack application for decentralizing animal distress call response