



Rishi Nandha V

B.Tech in Electrical Engineering, IIT Madras

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Education

Indian Institute of Technology, Madras (IITM)
B.Tech in Electrical Engineering (8.72 CGPA)

Chennai, India
Ongoing (Expected Graduation 2025)

Roles: R&D Associate at Indigenous 5G Test Bed | Social Innovation Club Head | Dpt. UG Council Representative

Coursework:

Multirate Digital Signal Processing	Fundamentals of Audio Engg"	Digital IC Design
Adaptive Signal Processing	RF IC Design	Analog IC Design
Convolution Neural Networks"	Analog Systems Lab	Digital Systems Lab

Languages: C, Python, C++, MATLAB, Dart, AVR and ARM Assembly, Verilog

" - coursera

Libraries & Frameworks: Numpy, Tensorflow 2, PyTorch, Pandas, Scipy, OpenCV 2, Simulink, Wave, Serial

Softwares: Energia, Electric VLSI, Cadence OrCAD, Virtuoso & Allegro, Ansys Electronics, PUTTY, Fusion 360

Other Relevant Skills: Sound Synthesis, Audio Clipping & Noise Reduction, Machine Learning for Audio Processing

Professional Experiences

1. R&D Project Associate: Design of RF Clocking Structure for 5G-NR Defense RRH

Dec 2023 - Present

Guide: Prof. Radhakrishna Ganti

5G Test Bed, IIT Madras

- o Analysed line coding & electrical specifications for JESD204B/C protocol used between FPGAs Banks and DFE RF Transceivers
- o Reviewed recent literature on modern RRHs to maximize scope & expandability of Clocking structure for future RRH systems
- o Designed Clocking Structure for External Synchronization with Global GPS using 2 PPLs-based ICs, Traces tuned upto $\pm 6.4\text{ps}$
- o Matched High-Speed traces with Planar-Waveguides for the RRH to be used in Indian National Defense, Optimized Thermals
- o Designed AC Trace Terminations, Chose XO's & XTALs and EM Simulated the 128-Port System for Coupling and S-Parameters

2. Research Internship: Design & Testing of an RF Clock Evaluation Board

May 2023 - Nov 2023

Guide: Prof. Radhakrishna Ganti

5G Test Bed, IIT Madras

- o Reviewed literature on Bode Noise Theorem, Quantization Noise, Noise-Shaping, Oversampling and Interference at High Speed
- o Characterized Interference & Phase Noise in ADCs on an RF Board and Reviewed literature on the usage of PPLs to filter noise
- o Designed a Schematic for the Evaluation Board using PLLs-based Si55xx. Programmed the IC using an external microcontroller
- o Designed Regulator Blocks with appropriate Bypass Capacitors, Communication Protocol Blocks, and Power Surge Protections
- o Created QFN Footprints and Appropriate Thermal Vias for maximum Thermal Efficiency. Simulated EM for the 4-layer Board
- o Achieved max -20 dB Return & -0.1 dB Insertion Loss for $\approx 1.5\text{GHz}$ using techniques such as Via Shielding & AC Termination

Technical Projects

1. Design of a 0.13 μm CMOS RF Analog Front End for 5GHz WLAN (802.11a)

Feb 2024 - Present

Guide: Prof. Sankaran Aniruddhan

IIT Madras

- o Designed and Simulated a Cascoded Common Source Low-Noise Amplifier with $S_{11} < -11\text{dB}$, $NF < 1.7\text{dB}$ & $IIP_3 = -7\text{dBm}$
- o Designed & Simulated Parasitics of CMOS Gilbert Mixer Cell that Modulates the LNA's Differential Signal with an $NF < 8.5\text{dB}$
- o Sketched out the complete Front-End including a Voltage Controlled Oscillator & a Power Amplifier, to be designed & simulated

2. Self Project: Vacuum Tube Triode Guitar Pre-Amplifier Pedal

Dec 2023 - Present

- o Designed a 2-stage Class-A Amplifier using a 12AT7 Tube. Characterized and chose DC Points for Max Harmonic Distortion
- o Manually Soldered into Circuit Boards, verified drop-out on Power, and rectified DC-Converter Pulse-Skipping by Decoupling
- o Tested the Pedal with a Guitar and a Hi-Z Speaker. Tuned the Potentiometers and designed 3rd order passive filter for Tone

3. Layout & Simulation of a CMOS 22nm 8-bit Carry Save Multiplier

Sep 2023 - Dec 2023

Guide: Prof. Janakiraman Viraraghavan

IIT Madras

- o Designed & Layouted a 22nm Technology 8-bit CSM to operate at 2.8 GHz Clock with a simulated parasitic delay of 0.32 ns
- o Characterized Delay in the Critical Path, simulated delay in the complete CSM and optimized it by scaling the standard cells
- o Designed Flipflops & Pipelined to improve the frequency by 67%. Made a Carry Select Vector Merge to reduce delay by 21%

4. SW-KRLS for Adaptive Filtering of Self Interference in MIMO 5G Transceivers

Sep 2023 - Nov 2023

Guide: Prof. Srikrishna Bashyam

IIT Madras

- o Simulated Kernel-RLS for a Fully-Duplexed TX-ORX pair for Robust Filtering despite Time-Variant Self-Interference Profiles
- o Demonstrated about 90% mitigation of Time-Variant Non-Linear Self-Interferences such as IMD2, IMD3, and TxH2 in $O(n^2)$
- o Compared Resilience with Time-Variance of Interference Patterns against other Sparsification Techniques such as ALD and FW

5. Audio Compression, Recovery & Transmission Parallelization with Filter Banks

Aug 2023 - Oct 2023

Course Project: EE6311 - Multirate Digital Signal Processing

IIT Madras

- o Implemented & Simulated Upsampling, Downsampling & Polyphase Filter Banks for Compression and Recovery of Digital Audio
- o Investigated Methods to recover clipped Audio using Spline-based Techniques & for the removal of Power-Hum and white noise
- o Designed filters and compared the resulting Spectrograms of fully recoverable and partially recoverable parallel transmissions

- 6. VASS.AI: Re-imagining Mobility for the Auditorily-Impaired** **Apr 2023 - Jul 2023**
Sahaay - Social Innovation Club *CFI, IIT Madras*
 o Implemented a CNN on Spectrograms and a Mel-Filter Bank for detecting Environmental Danger with Audio from a Mic-Array
 o Assisted in implementing Beamforming principles to Localize the Danger in the surrounding using the multiple audio channels
- 7. Composite Audio System to Generate a Buzz and Play it on a Speaker** **Jan 2023 - Apr 2023**
Course Project: EE2019 - Analog Systems Lab *IIT Madras*
 o Built a System with a Schmidt Oscillator, Pulse-Width Modulator, Band-pass Filters, DC-DC Buck Converter, Peak Detector and BJT Class-D Amplifier from fundamental components such as Opamp ICs, Comparator ICs, Transistors, Rs, Ls and Cs
 o Generated Non-Overlapping Clocks for Class-D Amplification using CMOS Inverter Buffers with Loading Capacitance. Stabilized the Closed-Loop System while taking parasitics of the breadboard into consideration. Compared results with Simulation Results
- 8. Project Vision: Re-imagining Mobility for the Visually-Impaired** **Jun 2022 - Mar 2023**
Sahaay - Social Innovation Club *CFI, IIT Madras*
 o Implemented Tiny YOLO v3 on a Jetson Nano to detect obstacles using a Stereo Camera's Depth Data and report it to user
 o Established wireless communication from a Raspberry Pi to an ESP32 using the MQTT Protocol for transferring detected data
 o Assisted in the design of a haptics-based Gripper attachment to the White-cane that communicates the depth map of obstacle
- 9. Automatic Waste Segregator: Fostering Waste Recyclability** **May 2022 - Jul 2022**
Sahaay - Social Innovation Club *CFI, IIT Madras*
 o Prepared a dataset of about 2000 Images of Solid Waste categorized into 6 different classes and trained CNN Models on them
 o Compared Accuracies achieved by variants such as ResNet, MobileNet, InceptionNet and EfficientNet with Transfer Learning
 o Scaled the model to deploy it on a limited development board. Augmented the Data-Set and increased base accuracy by 20%

Positions of Responsibility

- 1. Club Head, Sahaay - Social Innovation Club** **May 2023 - Present**
Sahaay, CFI - Centre for Innovation *Co-Curricular Sphere, IIT Madras*
 o Head of the Social Innovation Club of IIT Madras managing over 75 Members and a budget of about 2 lakhs INR ($\approx 240\$$)
 o Reformed the Club's Member Selection Process & Publicity Practices to achieve an increase upto 400% in the member-count
 o Reformed the Club Structure, Member Accountability & Project Workflow Guidelines to achieve 100% success-rate in projects
 o Collaborating with an Animal Welfare NGO to Deploy a Mobile App in our City to Reform Animal Distress Call Response
 o Supervising six different projects for Social causes including Assistive Technology, Animal Welfare, Agri-tech & Waste Mgmt
- 2. Band Leader, Music Contingent** **Jun 2023 - Present**
Music Club, Sangam *Culturals Sphere, IIT Madras*
 o Led the Official University Rock Band of about 12 Members in College Fests & Semi-Professional Shows as their Bass Guitarist
 o Used Technical Background to maximize the efficiency of the Band with Audio Equipment in Live-Settings and hence success-rate
 o Pioneered Reform in Audition Process to encourage Sincere Musicians to improve and & re-audition by taking up menteeship
- 3. Coordinator, Sahaay - Social Innovation Club** **Jun 2022 - Apr 2023**
Sahaay, CFI - Centre for Innovation *Co-Curricular Sphere, IIT Madras*
 o Managed a 5-member interdisciplinary project. Pitched the USP, PoC & Segment Analysis at G20 Conference & CSR Summit
 o Lectured a paid workshop program with over 100 registrations on Python, Numpy & CNN for Social Innovation Tech. Projects
- 4. Musical Events Coordinator** **Jun 2022 - Apr 2023**
Music Club, Sangam *Culturals Sphere, IIT Madras*
 o Organized Events at the IIT Madras College Fest including the Audio Equipment setup and invitation of participants & judges
 o Transitioned 15+ music events into offline mode post-COVID with an attendance of over 500+, handling a budget of INR 2L+

Scholastic Achievements

- 1. Online Physics Brawl 2021** **Nov 2021**
 Secured 7th in O category out of 147 teams and an overall 13th out of about 800 teams from all around the world as a **team of 5** under the team name "Laplace's Demon"
- 2. JEE Advanced 2021** **Oct 2021**
 Secured an **All India Rank 332** among about **0.14 million** candidates
- 3. Online Physics Olympiad 2021** **Aug 2021**
 Finished in **Gold Tier** and secured 6th rank out of about 600 teams from all around the world as a **team of 3** under the team name "Laplace's Demon"

Culturals Activities & Social Volunteering

- o Guitarist & Bassist in Institute Band. Won/Earned over INR2L+ in over 7+ Fests and Semi-Professional Shows (2022-24)
- o Part of the Student Volunteer Group that helped the academic restructuring of the Department B.Tech Semesters (2023)
- o Part of Student Volunteer Group that led movement for preventive measures for Women's Safety on Campus (2022)
- o Mixed, Composed & Mastered Music with Online Groups & Orchestras using professional Audio Tools and published (2021)
- o Produced music for promotional video of the "Unity" Clinical Study about techniques against risks of COVID-19 (2020)

Declaration

I do hereby declare that all the details furnished above are true to the best of my knowledge and belief.

Place: Chennai, Tamil Nadu, India

Date: March 4, 2024

Rishi Nandha V