



# Rishi Nandha V

B.Tech in Electrical Engineering, IIT Madras

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## Education

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

Chennai, India  
Ongoing (Expected Graduation 2026)

**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

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**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 RRH**

**Dec 2023 - Present**

Guide: Prof. Radhakrishna Ganti

5G Test Bed, IIT Madras

- Reviewed literature on modern RRHs to maximize future scope and expandability of Clocking for Advanced 5G / 6G Systems
- Analysed Encoding techniques and the required Clocking Structures for Protocols such as JESD204B and Synchronous Ethernet
- Designed Clock Structure for Synchronization with Global Clocks GPS/PPS/IEEE 1588 PTP using Dual-Reference DSPLLs
- Layout with Traces tuned up to  $\pm 6.4\text{ps}$  and AC Terminations. Simulated the 128-Port System for Coupling and S-Parameters
- Attended the National Communications Conference 2024 on the latest happenings in Wireless and Optical Communications

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

**May 2023 - Nov 2023**

Guide: Prof. Radhakrishna Ganti

5G Test Bed, IIT Madras

- Reviewed literature on Bode Noise Theorem, Quantization Noise, Noise-Shaping, Oversampling and Interference at High Speed
- Characterized the effect of Phase Noise in the Clocking of ADCs and reviewed literature on the usage of PPLs to filter jitter
- Fabricated a Clock Jitter Filtering Evaluation Board using PLLs with Impedance Matched and Delay Tuned Differential Traces
- Designed Regulator Blocks, Communication Protocol Blocks, Power Surge Protections, Thermal Pads and AC Terminations
- Simulated Electromagnetics of the Design and achieved -20 dB Return & -0.1 dB Insertion Loss for Frequencies up to  $\approx 5\text{GHz}$

## Technical Projects

**1. Design of a  $0.13\mu\text{m}$  CMOS RF Analog Front End for 5GHz WLAN (802.11a)**

**Feb 2024 - Present**

Guide: Prof. Sankaran Aniruddhan

IIT Madras

- Designed and Simulated a Cascoded Common Source Low-Noise Amplifier with  $S_{11} < -11\text{dB}$ ,  $\text{NF} < 1.7\text{dB}$  &  $\text{IIP}_3 = -7\text{dBm}$
- Designed a Differential Gilbert Mixer with an  $\text{IIP}_3 = -4\text{dBm}$ . Achieved Gain 34dB and NF 4.4dB for the LNA+Mixer Integration
- Sketched out the Complete Front-End including Voltage Controlled Oscillator & Power Amplifier, to be designed & simulated

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

**Dec 2023 - Present**

- Designed a 2-stage Class-A Amplifier using a 12AT7 Tube. Characterized and chose DC Points for Max Harmonic Distortion
- Manually Soldered into Circuit Boards, Verified Power Integrity, & Filtered Switching Converter Feedthrough with an LC Shunt
- 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

- Designed & Layouted a 22nm Technology 8-bit CSM to operate at 2.8 GHz Clock with a simulated parasitic delay of 0.32 ns
- Characterized Delay in the Critical Path, simulated delay in the complete CSM and optimized it by scaling the standard cells
- 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

- Simulated Kernel-RLS for a Fully-Duplexed TX-ORX pair for Robust Filtering despite Time-Variant Self-Interference Profiles
- Demonstrated about 90% mitigation of Time-Variant Non-Linear Self-Interferences such as IMD2, IMD3, and TxH2 in  $O(n^2)$
- 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

- Implemented & Simulated Upsampling, Downsampling & Polyphase Filter Banks for Compression and Recovery of Digital Audio
- Investigated Methods to recover clipped Audio using Spline-based Techniques & for the removal of Power-Hum and white noise
- 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 Created a dataset of  $\approx 3000$  images of Solid Waste; trained variants of CNN Models on them such as ResNet & InceptionNet  
 o Deployed it on a development board. Augmented the Dataset with transforms & noise to increased base accuracy by 35%+  
 o Compared Class-wise Accuracies & F1 Scores; achieved 92.8% Validation Accuracy with Transfer Learning on MobileNetV2

## 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 7<sup>th</sup> in O category out of 147 teams and an overall 13<sup>th</sup> 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 6<sup>th</sup> 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 26, 2024

Rishi Nandha V