Kundan Surse

Scientist at Indian Space Research Organization (ISRO).

kundansurse@sac.isro.gov.in
kundansurse67@gmail.com
Kundan Surse
+91 9096645713
Gujarat, India

Education

Indian Institute of Space Science and Technology (IIST), Thiruvananthapuram — July 2018 – Jun 2022

Bachelor of Technology in **Electronics and Communication Engineering** with specialization in **Avionics**, Major in **RF and Microwave Technology**. **CGPA** - 8.76/10

Thesis : Development of Third harmonic feedback enabled T/R module for far-field WPT application. — Oct 2021-Jun 2022, **GPA** - 10/10

Sant Gadge Baba Amravati University, Maharashtra, India. — July 2016 – Jun 2018

Higher Secondary School (Electronics) — **Percentage** - 85%

Deepchand Chaudhari Highschool, Maharashtra, India. — May 2016

Secondary School — **Percentage** - 94%

Work Experience

Indian Space Research Organization (ISRO) — Nov 2022 – Present

Working as **Scientist-SC at Space Application Center (SAC-ISRO), Ahmedabad.**
In this role, I serve as an RF Design Engineer, my group contributes to the design and testing of active RF circuits such as RF Amplifiers, Mixers, LNAs, and Frequency Multipliers for development of communication satellites. Over the past year, I successfully delivered an IF amplifier at 1.76 GHz for High-throughput communication satellite and actively participating in the Technology Demonstration Project of Receive Active Beamforming RFIC at Ka & Q-band for Leo Communications Satellite.

Research Interest

Semiconductor Spin Qubits, Quantum Communication, Qubit-Quantum Network Interface, Active RF and Microwave Circuits, RFIC Technology.

Research Experience

Development of Electro-Optic Control for Miniaturised Satellite QKD Transmitter — Aug 2023

Abhishek Khanna, Space Application center(ISRO), Ahmedabad.

- Involved in the development of **Satellite based Decoy enabled Quantum Key Distribution Transmitter**. In which to eliminate the use of eight lasers for generation of four signal polarization states and four decoy polarization states incorporated the Mach-Zehnder Intensity Modulator(MZM) and Polarization Modulator(PM) scheme for BB84 protocol.
- Incorporating Decoy level, Photon number splitting (PNS) attack has been eliminated and with the single laser operation, laser profile distinguishability has also been eliminated.
- The system level simulation has been carried out on Optisystem Software and Matlab, and the results are validated on experimental setup using IMC-1550-20-PM MZM device with study of its nonlinear operating points for bias stabilization.

Active Quenching Circuit for Avalanche Photo-Diode to detect single photon for QKD Experiment.

Prof. R. P. Singh, Physical Research Laboratory, Ahmedabad.

- Involved in the development of High frequency Active quenching circuit to increase Key rate in QKD experiment. It intends to detect 100 MHz Signal of single photons with high accuracy.
- Requirement of High voltage-high frequency transistor and Parasitic effects, challenges the operation at 100 MHz.
- It has be targeted with GaN transistor and proper optimization of design.

Receive Active Beamforming RFIC at Ka & Q-band for Leo Communications Satellite Jan 2023-Present
Space Application center(ISRO), Ahmedabad.

- Involved in the Technology Demonstration Project of 8-Channel Receive Active Beamforming RFIC at Ka & Q-band for Leo Communications Satellite. Which has LNAs, Digital Phase shifter, Digital Attenuator, Power divider in SBC13s4 a 130nm foundry process provided by TowerJazz.
- Investigating robust architecture of digital phase shifter, LNA and digital attenuator to meet radiation hardened and fault tolerant beamforming IC.
- It also has a serial to parallel (SIPO) converter digital logic circuits to operate 8-channel of 6-bit digital phase shifter and 6-bit digital attenuator.

Development of Third harmonic feedback enabled T/R module for far field WPT application Jun 2022
Dr. Chinmoy Saha, IIST Thiruvananthapuram.

- This is the Bachelors thesis spanned over 1 year resulting in a significant thesis of about 72 pages which has been awrded the S grade (10/10) Highest attainable grade.
- In this project I designed the T/R module architecture for feedback enabled far-field wireless power transfer at 2.4 GHz to demonstrate the capabilities of 28GHz. Here, the T/R module transmit the power at 2.45 GHz and receives the feedback power at 7.35 GHz for direction estimation and precise alignment between the T/R module and the power seeking node (PSN).
- Third harmonic feedback enabled tracking is investigated for tracking the PSN and beam alignment to eliminate alignment loss and to increase overall efficiency. It can also be adopted in a moving receiver as well as multi-receiver environment.
- This T/R module architecture incorporates digital phase shifter and power amplifier in transit path at 2.45 GHz and gain block, digital attenuator, analog phase shifter along with RF power detector in receive path at 7.35 GHz. System level simulation is performed in SystemVue software and T/R module is designed in Advanced Design Software (ADS) by Keysight.

Dual-Band Shared Aperture Antenna (SAA) Array for Feedback-Enabled WPT Application Jun 2022
Dr. Chinmoy Saha, IIST Thiruvananthapuram.

- Designed a novel dual-band shared aperture antenna (SAA) array radiating at 2.45 GHz and 7.35 GHz in CST Microwave Studio. In order to make a compact design with low mutual coupling, a shared aperture antenna (SAA) configuration is employed. For miniaturising the antenna structure a patch radiating at 7.35 GHz is placed inside the loop antenna radiating at 2.45 GHz.
- This antenna array exhibits gains of 8.832 and 15.58 dBi at 2.45 GHz and 7.35 GHz respectively with efficiencies of −2.312 dB and −1.131 dB. Both the loop and patch array are fed by coaxial feed for the ease of integration with back-end electronics.

Academic Achievement

2022 IEEE AP-S Undergraduate Summer Research Scholarship May 2022
Dr. Chinmoy Saha, IIST Thiruvananthapuram.

- 2022 IEEE Antennas and Propagation Society's Summer Research Scholarship is awarded for the project proposal "T/R Module Development for Far Field Wireless Power Transfer at 28 GHz" by IEEE Antennas and Propagation Society.
- The highly competitive international recognition carries a scholarship of 3000 USD and invitation to present the work in 2023 IEEE International Symposium on Antennas and Propagation and USNC-URSI Radio Science Meeting held in Portland, OR, USA in July, 2023.
- This project aims to deliver power efficiently to the power seeking node (PSN) with eliminating pointing loss using third harmonic receiver tracking system. The novel idea of efficiently using third harmonic receiver tracking technology for far filed wireless power transfer made the recipient of this recognition.

Department of Space (DoS Govt. of India) Assistanceship July 2018 - Jun 2022
IIST Thiruvananthapuram.

- Recipient of Department of Space (DoS Govt. of India) Assistanceship in all the Eight semesters.

- Department of Space, Govt. of India provide assistanceship to the meritorious students of IIST Thiruvananthapuram who maintain GPA above 7.5/10 in all the semester. Which supports all tuition fees with book grants, mess & accommodation charges.

IEEE APS and MTTS Kerala Chapter Best Thesis Award 2022 Dec 2022
Dr. Chinmoy Saha, IIST Thiruvananthapuram.

- This Award is awarded by the by IEEE APS and MTTS conference held in Thiruvananthapuram, India to the Btech thesis titled Design and development of T/R module for far field wireless power transfer.

SAMADHAN 2020 - MHRD mega online Challenge March 2020
Dr. Immanuel Raja, IIST Thiruvananthapuram.

- For LiFi-enabled ECG front-end project, shortlisted in top 15 teams from Educators and researcher Group allover India on Track-2 for MHRD mega online Challenge SAMADHAN 2020.
- This was a team project, in which I developed the ECG front-end to efficiently acquire ECG signal with minimum distortions.

Joint Entrance Examination (JEE Advance) May 2018

- Ranked 4525^{th} nationwide amongst 10 lakh students in Joint Entrance Examination for IITs.

INSPIRE Scholarship April 2018

- Innovation in Science Pursuit for Inspired Research - Scholarship for Higher Education (INSPIRE-SHE) is awarded to the student who stands in top 1 % of Higher Secondary School Board Examination. Which valued at Rs. 80,000 per year for five years.
- I stand in top 1 % in Higher Secondary Examination, which made me eligible for this scholarship.

Publications

Conference Paper :

Design of T/R module for far field WPT application with third harmonic receiver tracking system 2023
Kundan Surse, Gopika R., Chinmoy Saha, Yahia M M Antar.
The article got published in 2023 IEEE International Symposium on Antennas and Propagation and USNC-URSI Radio Science Meeting (USNC-URSI), Portland, OR, USA.
Abstract : Appendix.

Third Harmonic Receiver Tracking for Far Field Wireless Power Transfer Feb 2023
Kundan Surse, Rutuj Gharate Gopika R., Chinmoy Saha.
The article got published in 2022 IEEE 19th India Council International Conference (INDICON), Kochi, India.
Abstract : Appendix.

Dual-Band Shared Aperture Antenna (SAA) Array for Feedback-Enabled WPT Application Feb 2023
Kundan Surse, Gopika R., Chinmoy Saha.
The article got published in 2022 IEEE Microwaves, Antennas, and Propagation Conference (MAPCON), Banglore, India.
Abstract : Appendix.

Workshops & Conferences

INSQT Workshop 4 : The International Network in Space Quantum Technologies March 2024
Physical Research Laboratory, Ahmedabad, India.

IITP : ISRO Induction Training Programme July 2023
Space Application Center(SAC) Ahmedabad & Satish Dhawan Space Center (SDSC-Shar) Shriharikota.

IEEE International Symposium on Antennas and Propagation and USNC-URSI Radio Science Meeting.
Portland, OR, USA

INDICON 2022 : IEEE 19th India Council International Conference Nov 2022
Kochi, India.

MAPCON 2022 : EEE Microwaves, Antennas, and Propagation Conference Dec 2022
Bangalore, India.

Academic Course Projects

Scene Text Recognition.
As a project of Machine learning course, implemented the SCENE text recognition pipeline from scratch on Jupyter notebook, And trained the model on different data set on NVIDIA Ge-Force 940MX.

Electroencephalography Front End
As a third sem analog electronics project first simulated the 6th order Chebyshev low pass filters with notch filter on NI-Multisim, and then implemented on the breedboard.

Photo Stylization Using WCT in Deep Learning.
Tried to implement the papers on the Photo- WCT for photo stylization using deep learning with the help of pretrained VGG model.

Adaptive Echo Cancellation
Developed the code for the LMS filter for adaptive echo cancellation, as a Digital Signal Processing lab project and demonstrated the results with audio files.

Snake Game Using Verilog and Analog TV
Using Xilinx software developed the verilog code for the snake game with the understanding of Analog TV display.

Designed and Successfully Tested RC Plane
As a hobby Designed the RC plane with poly-carbonate sheet, with the Fly-sky FS-CT6B Manuel controller, and learned the skills to fly an UAV.

Skills and Experience

Software	Cadence virtuoso, Keysight ADS, CST Microwave Studio, Matlab, LTSpice, Optisystem, Auto-CAD.
Hardware/Equipment	Vector Network Analyzer (VNA), Power Meter, Spectrum Analyser, Signal Generator, Arbitrary waveform Generator(AWG), Digital Storage Oscilloscope(DSO).
Programming Languages	Matlab, Python, C/C++, TensorFlow.

Extracurricular

Sports	Swimming, Badminton.
Music	Sitar(Indian Classical musical instrument).

References

Sr. Prof. R. P. Singh
Professor, Head-Atomic, Molecular and Optical Physics Division, Physical Research Laboratory, Ahmedabad.
Email : rpsingh@prl.res.in

Prof. Chinmoy Saha
Professor, Indian Institute of Space Science and Technology, Thiruvananthapuram.
Email : chinmoy.rpe@gmail.com , chinmoysaha@iist.ac.in

Dr. Immanuel Raja
Assistant Professor, Indian Institute of Space Science and Technology, Thiruvananthapuram.
Email : immanuelraja@iist.ac.in

Conference Paper :

Design of T/R module for far field WPT application with third harmonic receiver tracking system 2023

Kundan Surse, Gopika R., Chinmoy Saha, Yahia M M Antar.

The article got published in 2023 IEEE International Symposium on Antennas and Propagation and USNC-URSI Radio Science Meeting (USNC-URSI), Portland, OR, USA.

Abstract : An advanced T/R module architecture for farfield wireless power transfer (WPT) application is proposed in this paper. In order to eliminate the alignment mismatch and correspondingly to increase the overall efficiency, third harmonic receiver tracking feature is employed in the proposed T/R module. Here, the T/R module transmit the power at 2.45 GHz and receives the feedback power at 7.35 GHz for direction estimation and precise alignment between the T/R module and the power seeking node (PSN). To realize compact PCB of the T/R module, coplanar waveguide matching is incorporated. Proposed architecture is simulated in SystemVue software and the complete link budget analysis shows that the realized WPT system can be used for indoor applications up to 2 meters.

Third Harmonic Receiver Tracking for Far Field Wireless Power Transfer Feb 2023

Kundan Surse, Rutuj Gharate Gopika R., Chinmoy Saha.

The article got published in 2022 IEEE 19th India Council International Conference (INDICON), Kochi, India.

Abstract : A novel closed-loop wireless power transfer system for short-range indoor application is proposed in this article. Precise position estimation of the receiver using the third harmonic as the feedback signal towards the transmitter, proposed herein, yields a better tracking accuracy which in turn can contribute to enhanced overall efficiency of the WPT system. Proposed concept addresses and mitigates the critical challenge of antenna alignment mismatch in the far-field WPT system. The proposed concept may be adapted and extended to a moving receiver as well as multi-receiver environment. Verification of the concept using practical measurements are currently under progress and will be presented in the conference.

Dual-Band Shared Aperture Antenna (SAA) Array for Feedback-Enabled WPT Application Feb 2023

Kundan Surse, Gopika R., Chinmoy Saha.

The article got published in 2022 IEEE Microwaves, Antennas, and Propagation Conference (MAPCON), Banglore, India.

Abstract : A novel dual-band shared aperture antenna (SAA) array radiating at 2.45 GHz and 7.35 GHz is proposed in this paper. In order to make a compact design with low mutual coupling, a shared aperture antenna (SAA) configuration is employed. For miniaturising the antenna structure a patch radiating at 7.35 GHz is placed inside the loop antenna radiating at 2.45 GHz. The proposed antenna exhibits gains of 8.832 and 15.58 dBi at 2.45 GHz and 7.35 GHz respectively with efficiencies of −2.312 dB and −1.131 dB. Both the loop and patch array are fed by coaxial feed for the ease of integration with back-end electronics.