Ashwin Sathish Kumar

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EDUCATION

BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI
Integrated M.Sc Mathematics + B.E. Electronics & Instrumentation
Aug 2020 - Jun 2025 | Cumulative GPA: 8.50 / 10

RESEARCH

MULTI-USER RIS OPTIMIZATION | MATLAB, C#

- Designed 300 GHz multi-user RIS framework in SiMoNe with constrained optimization for enhanced directive gains. Implemented bilinear interpolation for path gain estimation using 65,341-point codebook. Achieved 5° angular resolution supporting 5 concurrent users, efficiently, in NLoS conditions.

VIRTUAL 5G TESTBEDS | Flask, Docker, Wireshark

- Developed containerized 5G testbed using Open5GS and UERANSIM with REST API for slice control. Demonstrated eMBB 4K streaming (4.19 Mbps), URLLC remote surgery (9.32ms latency), and mMTC sensor network (6 UEs, 165 Kbps throughput).

LIDAR-ENABLED RIS SYSTEMS | Python

- Developed spatially-aware beamforming model integrating LiDAR with RIS systems, achieving $\sim 10.5\%$ signal rate improvement. Demonstrated grouped RIS array superiority over full-CSI models with 10x faster phase shift optimization convergence.

PHOTONIC CRYSTAL SPR SENSORS | MATLAB, COMSOL

- Designed Si-$PtSe_2$ stacked photonic crystal SPR sensor with Al as plasmonic metal using Fourier Modal Method and COMSOL Wave Optics. Achieved 101.1°/RIU sensitivity and 1094.79 Quality Factor at 1550nm.

METAMATERIAL-ENHANCED BIOSENSORS | MATLAB

- Engineered AI-based SPR sensor with MDM configuration using BTO, metamaterials, TiO_2, and MoS_2 for cancer detection. Achieved 101.2°/RIU sensitivity and 5060 RIU^{-1} figure of merit (50x benchmark improvement) at 1550nm.

PROJECTS

1. Compressive Image Fusion: L1-magic toolbox in MATLAB for infrared-visible image fusion in compressive domain. Convergence on star/double-star/star-circle patterns at M/N=0.52, log(PSNR)=3.8.

2. Analog & Digital IC Design: Telescopic opamp-based difference amplifier in LTspice; achieved 100dB DC gain, 6.15MHz UGB, 1.5μW power. 3-bit DFF ripple counter using static CMOS logic in Microwind with TSMC 180nm technology ($4.1\mu m^2$ area, 0.3mW power).

3. FDTD Modelling: 3D FDTD simulation in MATLAB with staircase approximations and Mur's 2nd order boundary conditions for concrete-rebar structures. Corrosion analysis via UWB pulse excitation and Fourier-based delay estimation.

EXPERIENCE

VISITING STUDENT
TU Braunschweig Jan - May 2025

Conducted master's thesis under **Prof. Thomas Kürner** on 'Development and Implementation of a Simulation Concept for Multi-User RIS-aided Communication'.

VISITING STUDENT
Hochschule Offenburg Jul - Dec 2024

Conducted bachelor's thesis under **Prof. Axel Sikora** on 'Conceptualization and Implementation of 5G Use-cases in a Virtual Network'.

CONFERENCES

1. **A. S. Kumar** and S. Joshi, "LiDAR-Enabled Spatial Awareness for Beamforming in IRS-Assisted Wireless Communication System," *IEEE International Conference on Advanced Networks and Telecommunications Systems (ANTS)*, Guwahati, India, 2024, pp. 1-6, doi: 10.1109/ANTS63515.2024.10898544

2. **A. Sathish Kumar**, D. Mahanta, P. Arora, "High-resolution aluminum-based plasmonic devices using metamaterials for cancer cell detection," Proc. SPIE PC12990, Metamaterials XIV (6 June 2024); https://doi.org/10.1117/12.3021474

AWARDS

Baden Württemberg Stipendium
BW-Stiftung, Germany Aug 2024

SSD Surge Hackathon Winner
Micron Technology, Hyderabad Mar 2024

DADB Scholarship
German Academy of Digital Education Jan 2024

INSPIRE Scholarship
Dept. of Science & Technology, India Jun 2021

CERTIFICATIONS

1. Industrial IoT & 5G (2024)
5 ECTS credits | *Hochschule Offenburg*

2. 5G Technology (2023)
Score: 93.3% | *DADB (German Academy of Digital Education) & BITS Pilani*

3. Applied Deep Learning (2022)
Hewlett Packard Enterprise (HPE)