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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Report of Technical Talk-I

Topic: "RFIC- Design and Challenges"

Resource Person: Dr. Sandeep kumar, Assistant Professor, Dept of ECE, NITK, Surathkal

Date: 20-10-2023 Time: 11:00AM to **1:00 PM.**

Department of ECE conducted the first technical talk of the odd semester 2023-24 on **"RFIC- Design and Challenges"** by Dr. Sandeep kumar, Assistant Professor, Dept of ECE, NITK, Surathkal on 20/10/2023 . Dr. Sandeep Kumar is an Assistant Professor in the Department of Electronics and communication engineering at NIT Surathkal, Karnataka. Prior to join this institute, he was Research professor and Post-doctoral researcher in Nano circuit design Lab, Inje University, South Korea. He received his Ph.D. in Electronics Engineering from Indian Institute of Technology (IIT), Dhanbad, Jharkhand in 2016. He has published more than 50 publications in referred SCI journals and more than 22 international conferences and several book chapters in IEEE, IET publishers etc., He is the technical reviewer for various

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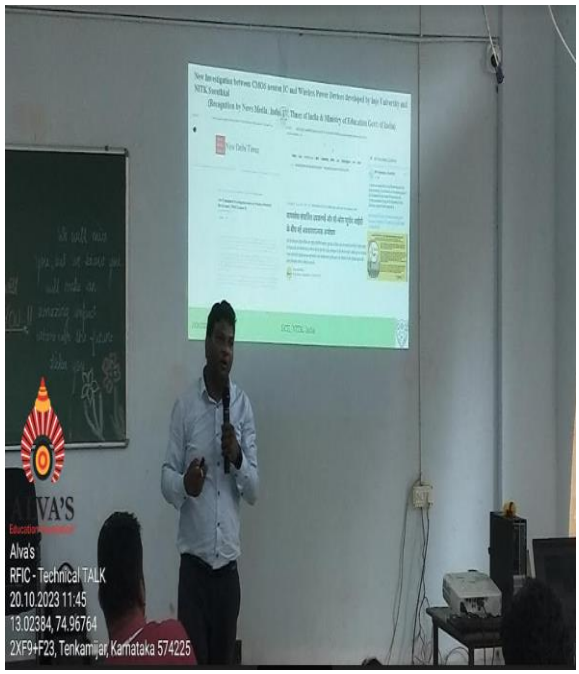
International SCI indexed journals of repute like IEEE Transactions, IEEE Letters, IET Electronics Letters, IET Communications, Springer Wireless Personal Communications, etc.



Resource person pointed that RFIC is in use from cell phones and wireless internet access to radar and navigation systems. He said that world is becoming more connected using radio frequency (RF) transmissions. Since the technology continues to improve, radio frequency integrated circuits (RFICs) have become complex chips both by themselves and integrated into very large system-on-chip (SoC) solutions. An RFIC is designed to operate at high frequencies, typically in the range of several hundred MHz to several GHz. A pure analog ASIC or IC operates in the analog domain. It is usually smaller in size than a typical digital ASIC. An RFIC is distinguished by integrated circuitry such as transmitters, receivers, PLLs, modulators, frequency multipliers, RF amplifers, RF power amplifiers, mixers, inductors, transformers, baluns etc. He described that the objective of a radio circuit design is to transmit and receive signals between the source and destination with acceptable quality and without incurring a high cost. This can be achieved by designing a circuit using proven design methods. An RFIC typically consists of amplifiers, filters, mixers, oscillators, and modulators/demodulators onto a single chip.

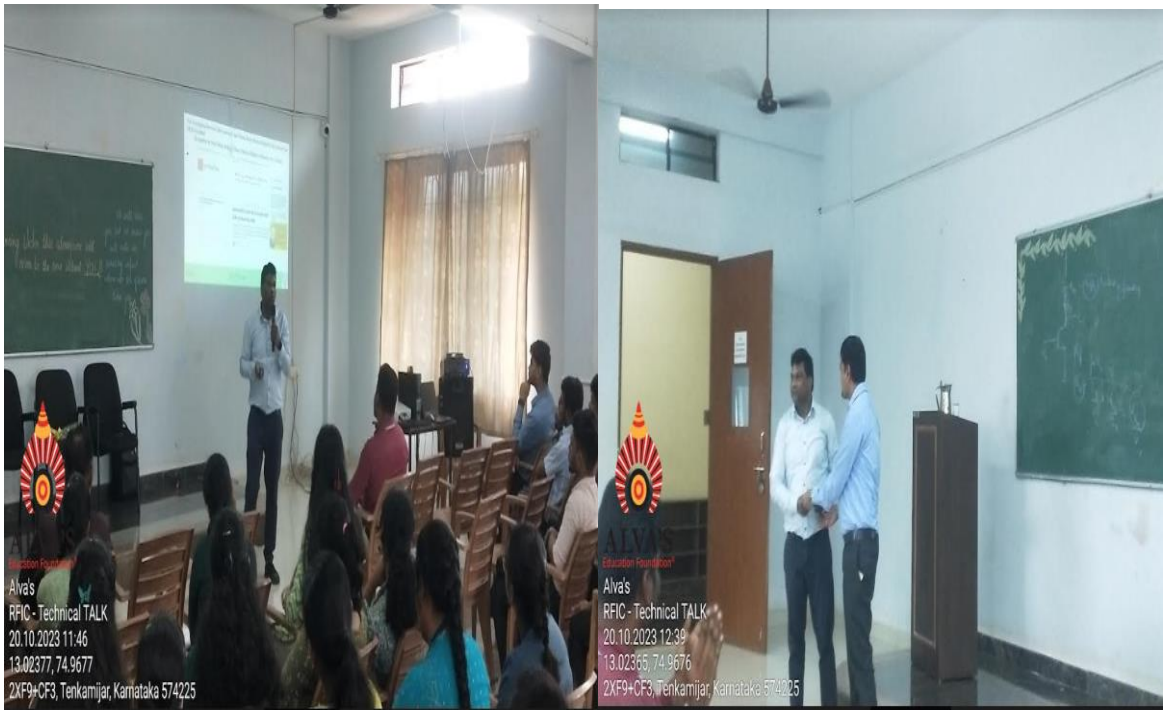
A modern RFIC development flow must shorten the turnaround time for each design iteration while still achieving the best possible circuit performance. Therefore, design and simulation go hand in hand in an iterative process. A design is tweaked multiple times according to the output of the simulation. It is a long process, and designers sometimes compromise on the circuit performance to deliver according to very aggressive project schedules. In order to achieve performance with no compromises, RFIC designers need advanced electronic design automation (EDA) tools and excellent simulation capabilities with a specific focus on IC design.

The demand for faster and more reliable wireless connectivity such as 5G, which requires more complex and sophisticated RFICs, is driving the development of new RF technologies. To address these challenges, designers can use advanced design methods, comprehensive simulation tools, and optimized algorithms to streamline the design process and reduce time to market.

Following advantages of RFICs were discussed:

1. Wireless communication and connectivity: RFICs are widely used for wireless communication in mobile phones, Internet of Things (IoT) devices, home appliances, and more. RFIC-enabled devices have become an integral part of day-to-day life. Compact integration, power management, and high-speed data transfer are some of its biggest advantages.
2. Automotive radar systems: RFICs are used in automotive radar systems for applications like collision avoidance, adaptive cruise control, and parking assistance. Due to its compact form factor, it can be easily mounted in vehicles to provide enhanced safety.
3. Wireless sensor networks: RFICs are utilized in wireless sensor networks for applications like environmental monitoring, smart agriculture, and industrial automation. Wireless connectivity between sensor nodes eliminates extensive cabling and infrastructure. Using RFIC-based applications provides flexibility and scalability, since it's easy to expand or reconfigure RFIC-based networks.

4. Satellite communication: RFICs are used in satellite communication systems for tasks such as signal amplification, frequency conversion, and modulation. wide coverage, high data transfer rates, and efficient signal processing are some of the many benefits.



The event concluded successfully, leaving the students inspired and equipped with knowledge to embrace the advancements in these exciting fields. Finally Dr.Ganesh Associate Professor, department of ECE gave momento to the resource person and expressed gratitude for giving such an informative talk to the students.