Seminar

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Institute for Plasma Research

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Title: Design and Development of Reconfigurable Intelligent Surface for Dynamic Control of Electromagnetic Wave

Speaker: Dr. B Anil Babu
Institute for Plasma Research, Gandhinagar

Date: 13th May 2025 (Tuesday)

Time: 02:00 PM

Venue: Seminar Hall, IPR

Abstract

Reconfigurable Intelligent Surfaces (RIS) have emerged as a transformative technology in the manipulation and control of electromagnetic waves [1]. This talk presents the design, modelling, and experimental validation of advanced RIS architectures aimed at enabling dynamic control over EM wavefronts in real-time. The research focus is on RIS configurations by incorporating tunable materials (such as liquid crystals, Plasma, varactors, or phase-change materials) [2] and integrated control circuits to achieve adaptable beamforming, beam steering, focusing, and polarization conversion, etc.

In this presentation, A high flexibility enabled single-layered, tunable, and polarization insensitive RIS for mm-Wave dynamic beamforming applications is going to be discussed using a combination of full-wave electromagnetic simulations, analytical modelling, and prototype fabrication. The beamforming functionality with a sidelobe level tuning range of -5.5 to -12.7 dB is achieved and demonstrated using an 8x8 RIS array model with high flexibility in reconfiguring the phase shift values. Particularly, the research is focused on design strategies and challenges that balance RIS performance and scalability [3]. This talk concludes with a discussion on the design challenges, constraints, and future research directions aimed at enhancing the robustness and multifunctionality of RIS technologies.

References:

[1]. C. Pan et al., "Reconfigurable Intelligent Surfaces for 6G Systems: Principles, Applications, and Research Directions," in IEEE Communications Magazine, vol. 59, no. 6, pp. 14-20, June 2021, doi: 10.1109/MCOM.001.2001076.

[2]. B. Rana, S. -S. Cho and I. -P. Hong, "Review Paper on Hardware of Reconfigurable Intelligent Surfaces," in IEEE Access, vol. 11, pp. 29614-29634, 2023, doi: 10.1109/ACCESS.2023.3261547.

[3]. H. Yang, Q. Hu, Y. Rao, W. Zhong and X. Y. Zhang, "High-Flexibility Low-Complexity Reprogrammable Phase-Continuous Metasurface," in IEEE Transactions on Antennas and Propagation, vol. 72, no. 9, pp. 7146-7153, Sept. 2024, doi: 10.1109/TAP.2024.3437231.