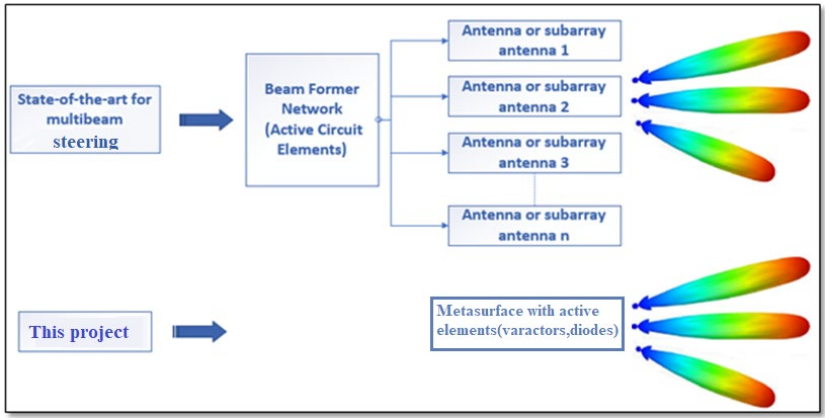
Designing Dynamic Beam Steering in Metasurface Antennas for Enhanced Performance in 5G/6G Communication Systems

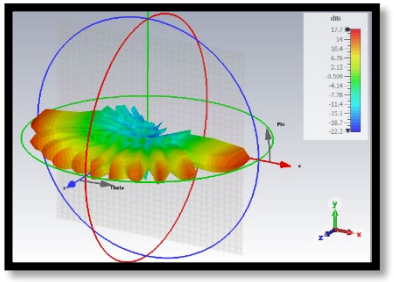
Bachelor/ Master Thesis

Background

Metasurface antennas with multibeam capabilities can manipulate electromagnetic waves in a precise and customizable way, making them a promising candidate for simplifying or even replacing the current complex MIMO structures in 5G/6G systems. This project aims to explore the use of active components (varactors, diodes) within the metasurface structure to enable dynamic beam steering. The project is built on our department's existing metasurface antenna designs and will investigate the integration of active components for beam steering. The project is open to motivated and enthusiastic Bachelor/Master students with backgrounds in electrical engineering, antenna design, or electromagnetic theory.



Multibeam Metasurface



Tasks

1. Conduct a literature review of active beamforming techniques for metasurface antennas, including the integration of tunable elements (varactors ,diodes) within the unit cells .
2. Use CST software to simulate and optimise multibeam metasurface antenna designs with active components for dynamic beam steering.
3. Fabricate and measure the performance of selected multi-beam metasurface antenna designs using a Vector Network Analyzer (VNA) and anechoic chamber.
4. Analyze the results and compare them to the project's objectives to identify areas for further optimisation.
5. Write a thesis report documenting the project's methodology, results, and conclusions.

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