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Design of a C-Band Phased Array Antenna.

ABSTRACT - Masterthesis

A phased array antenna is an antenna system that can be reconfigured in various ways to produce different beam patterns. These systems can be made to adapt to different needs and application areas by controlling the number of antennas used, their geometrical arrangements, and by incorporating phase shifters and amplifier circuits in various types of feed network arrangements. These systems are known to have very good performances providing high gains and directivity, beamforming and beam steering capabilities. They are used in a number of applications such as in radars, communications links, radio astronomy, remote sensing, etc.

The term 'Phased' along with antenna arrays is used out of an obvious reason, that these systems make use of phase shifting elements. Phase shifters are crucial components in a phased array antenna system, such that their performance determines beam steering properties of the antenna. Beam steering is achieved by an electronic control of the phase shifters.

Phased array antenna systems can be implemented in numerous ways. This thesis designs a phased array antenna system with the intention of displaying the system's beam steering capabilities. The desired frequency band of operation is the C-band (4-8 GHz). The components used to make up the system are antenna arrays, phase shifters and a power divider network.

The system is designed with a modular approach allowing easier attachment or detachment of individual components, keeping cost effectiveness and simplicity in mind during the design process. The components are implemented using Microstrip line technology.

Patch antennas using an inset feed are designed because of their direct match properties and are a compact consideration for arrays. A number of such identical elements are then grouped in a planar array form. For a deflection of the beam pattern across a single plane, the phase shifters are distributed linearly among the antenna elements. Phase shifters are designed using delay lines and PIN diodes because of their ease of design and cascade-ability. The system is designed to be fed from a parallel network from the source.

The PIN diodes used for the thesis, Infineon BAR64, simply introduced unacceptable levels of insertion loss at 5 GHz. However, the design is verified practically for a frequency of 2 GHz.

Expected results are obtained.