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Diplomarbeit / Masterarbeit

A u f g a b e der Masterarbeit

im Studienprogramm

International Studies in Engineering (ISE)

für: Herrn Davut Demirel

gestellt von: Prof. Dr.-Ing. K. Solbach
Fachbereich Ingenieurwissenschaften - Hochfrequenztechnik

Thema: Scanning Antenna With Rotating Septum

Description:

In the recent past, very small radar sets for automobile-traffic applications have been available in the market, which monitor the road ahead, with e.g., three narrow beams from an electronically switchable multi-beam antenna. The operational experience with these models has shown that the monitoring angular range needs to be increased and realized with narrower antenna beams. Hence, presently, concepts are being developed worldwide to realize scanning antennas with greater angular coverage at low cost, compatible with price standards in the automobile industry. One concept is to be investigated in this thesis work, based on the principle of a mechanically fixed antenna with moving parts, in particular a rotating axis which carries a metal septum.

Assignment:

In the assignment, a new and very simple scanning-antenna concept is to be investigated and a demonstrator antenna is to be designed and tested. The antenna comprises a rectangular metal waveguide supporting the H_{10} mode and an array of broadside offset slots allowing the traveling wave to radiate a sharp beam. The main beam direction depends on the spacing of slots in relation to the waveguide wavelength. Beam scanning is achieved by keeping the slot spacing fixed and altering the wavelength due to the rotation of a metallic septum (fin) inside the waveguide: Depending on the dimensions and the angular position of the metallic septum, the electric field of the H_{10} -mode is disturbed more or less, thus changing its cut-off wavelength and its wavelength at the operating frequency.

The thesis work shall include the following steps:

- (a) In order to determine a practicable arrangement, determine the dependence of rectangular waveguide wavelength with dimensioning and angular position of the septum through field simulation using the High Frequency Structure Simulator (HFSS) available in the department.
- (b) Perform the dimensioning of a traveling wave slotted array for a frequency of 10 GHz and using a standard rectangular waveguide and broadside resonant slots.
- (c) Predict the scanning range of the slot array equipped with the rotating septum by using approximate traveling wave antenna array theory.
- (d) Perform the mechanical design of a complete antenna arrangement with the slot array and adapters for mechanical support of the rotating axis.
- (e) Evaluate the characteristics of the scanning antenna by measurements of radiation patterns and two-port scattering parameters as a function of the septum angle and over a frequency range of 8 to 12 GHz.

At the End of the thesis work, a public presentation of results is to be given.