

Aufgabe der Abschlussarbeit im ISE Bachelorstudiengang

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Thema: Analysis and Synthesis of Series-Fed Patch Array Antennas using Bloch-Floquet Boundaries

Description:

Series fed array antennas are widely used in various applications, as there are for example Radar, Remote-Sensing, Space and Satellite Communications. This thesis shall focus on series fed array antennas using microstrip technology, i.e. patch antennas on a substrate which are serially connected by microstrip transmission lines. The patch together with the transmission line can be considered as an antenna cell (unit cell) to form the overall antenna. Such a configuration can be operated as a 1) resonant antenna or as a 2) travelling wave/leaky wave antenna.

- 1) The resonant antenna is essentially narrow band. It operates with a standing wave due to the reflection at the antenna's end.
- 2) The travelling wave antenna has a termination at its end to support wave propagation in only one direction and suppress a reflection at the antenna's end. Therefore, the travelling wave antenna has a broader bandwidth of operation and a beam scanning with changing frequency can be achieved. There are two novel broadside radiation concepts, which are so far based on a "true" periodicity (cells are all identical) of the antenna cells. In both concepts, broadside scanning with frequency variation could be achieved by optimizing the unit cell for a frequency independent attenuation constant in the leaky wave structure. This approach only supports a fixed amplitude distribution with an exponential decay and doesn't allow changing the amplitude distribution in order to design for certain radiation patterns.

Task:

Based on the assumption of an infinite antenna structure, Bloch-Floquet boundaries (periodic boundaries) shall be used to characterize antenna elements (unit cells) to predict the overall antenna characteristics (impedance, bandwidth, radiation) for resonant and leaky wave antennas. First, some general aspects should be covered:

- Definition and comparison of resonant and leaky wave antennas
- Introduction of periodic modeling using Bloch-Floquet (Theory)

For the **resonator antenna 1**), a systematic and straight forward design procedure to synthesize radiation patterns of series fed microstrip array antennas shall be presented. Feeding strategies are to be discussed. Simulation results have to be validated with measurements.

- design a resonant antenna with a given amplitude tapering distribution
- investigation of the optimum feeding position
- farfield and s-parameter measurement of the final prototype

For the **leaky wave antenna 2**), the broadside scanning concepts (resistive antenna and transformer antenna) shall be proven.

- Design two broadside scanning antennas with both concepts
- Validate with measurements (farfield and s-parameters).

These concepts shall be investigated if a quasi periodic approach (cell's can be different) is also possible which allows to synthesize the amplitude distribution of the antenna according to a given specific amplitude tapering distribution.

Über das Thema ist am Ende der Arbeit im Fachgebiet ein Vortrag zu halten.