UNIVERSITÄT DUISBURG ESSEN

Fachgebiet Hochfrequenztechnik

H F T

Fachbereich Ingenieurwissenschaften
Abteilung Elektrotechnik und Informationstechnik
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Diplomarbeit / Masterarbeit

Aufgabe der Abschlussarbeit im ISE Bachelor/Masterstudiengang

für: Herrn Wu Yingbin

gestellt von: Prof. Dr.-Ing. K. Solbach
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Aufgabenstellung: Modelling of a Patch-Antenna

Description of Problem:

In a previous thesis by Tran and presentation by Solbach and Tran (Solbach, K.; Tran, D. T.: Improved Patch Antenna Network Model, GeMiC 2006, Karlsruhe, 28-30 March 2006), a patch antenna was realized and its measured reflection coefficient as a function of frequency was modelled in an equivalent circuit. The particular model values of transmission line, patch-slot radiation conductances and probe inductance were found in approx. agreement with accepted models, see e.g. the lecture manuscript "Antennas", chapter 5. Except that a translation of the frequency response locus appears which is represented by the probe inductance and an additional resistor in series. In a preliminary measurement of efficiency, this new resistive element was identified as a resistance representing radiation from the probe (in contrast to radiation from the patch). Comparison of resistances found for patch antennas of various height showed impressive conformance with the radiation resistance of a Hertzian monopole, which would require uniform current along the probe.

The thesis is to answer questions which are still open:

(a) What is the ratio of loss resistance and radiation resistance and is the current along the probe really uniform?
(b) What will the probe model be, if we use a dielectric substrate to support the patch rather than air as in the above mentioned experiments?
(c) Can we explain the distortion and non-symmetry of the E-plane radiation pattern by a superposition of the radiation from the patch-slots and from the probe?
(d) Can we develop a new type of patch antenna from a combination of the radiating probe and a circular patch smaller than half-wavelength which is placed symmetrically to the probe top?

The thesis shall resolve the above questions based on new measurements of input reflection coefficient (Vectorial Network Analyzer), radiator efficiency ("Wheeler Cap"-technique) and radiation pattern (anechoic chamber) as well as simulation of the equivalent network (Advanced Design System, ADS) and field theoretical modelling (HFSS).

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