Experimental Microwave Imaging Using Ultra-Wideband Dielectric Resonator Antennas

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The aim of this paper is to investigate the use of a grounded strip-fed rectangular DRA in the experimental microwave shape reconstruction. The proposed strip-fed DRA has a measured center frequency of 5.65 GHz and a bandwidth of 51.3%. The overall dimensions of the antenna are 30mm×30mm×21.8mm. This high bandwidth and compact size as well as other advantages such as high efficiency due to low ohmic losses clearly indicate appropriateness of the proposed DRA for the microwave imaging applications.

In the experimental measurements, targets will be placed between two DRAs, one as a transmitter and the other as a receiver. The S_{21} will be measured using the HP 8510C Vector Network Analyzer (VNA). The transmitter antenna and receiver antenna will be rotated around the target. The measurements will be used in both parametric based and non-parametric based microwave reconstruction algorithms to reconstruct the shape of the target.

Microwave reconstruction algorithms are based on the complex electric fields. Therefore, the relation between the electric field at the receiver and the S_{21} measured at the port will be simulated using the Ansoft HFSS. In the first step, the transmitting DRA is modeled without the receiver. The complex electric field is calculated at the point where the receiver will be inserted. The receiver is then inserted into the simulation to calculate the S_{21}. The Complex Antenna Factor (CAF) is then calculated as the ratio between the simulated complex electric field and the simulated S_{21} at all frequencies and at all receiver directions. The measured complex S_{21} are converted into complex electric field values using the calculated CAF.

The accuracy of the reconstructed objects will be analyzed and results will be presented in the conference.