Xu, Hao, “Analysis and Design of Microstrip Antennas with Improved Performance”

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This dissertation covers four separate topics. One topic is the investigation of the probe inductance of a microstrip antenna. The other three topics involve investigations of three different designs of microstrip antennas that have improved performance. Probe inductance is important for determining the resonance of microstrip antennas, especially for thicker substrates. Four different theoretical models are explored, which treat with varying degrees of rigor the vertical variation of the field within the substrate, using an infinite parallel-plate waveguide model. A simple image correction term is used to extend the results to an actual rectangular microstrip antenna. Two of the three antenna designs, proposed in Chapter 3 and Chapter 4, are based on the Reduced Surface Wave (RSW) concept and, as a result, are characterized by radiation patterns with very low radiation along the horizon. In Chapter 3, a stacked-patch RSW antenna is examined in an effort to reduce the size of the RSW antenna. The stacked-patch design decreases the diameter of the usual RSW antenna from about 0.6 0 to about 0.45 0. The bandwidth and radiation efficiency are reduced, however. In Chapter 4 two types of RSW antenna are proposed for increasing the bandwidth of the RSW antenna. One design is a shorted annular ring (SAR) RSW antenna surrounded by a fence. The second design is a cavity-backed slot antenna. The second design can increase the bandwidth to about 20% while still maintaining less than -20 dB of horizon radiation. In Chapter 5 a miniaturized microstrip antenna for obtaining monopole-like patterns is investigated. The antenna is a circular microstrip patch that is loaded with shorting vias and fed in the center. For the cavity-backed slot antenna in Chapter 4 and the miniaturized circular patch antenna in Chapter 5, antennas were fabricated and measurements were performed. Good agreement was obtained in both cases between the simulations and measurements.