Numerical Analysis of Microstrip Square patch and Ring Antennas

Mohammad Zunoubi*
Department of Electrical and Computer Engineering
State University of New York
New Paltz, New York 12561-2499

**INTRODUCTION-** One of the most useful microstrip antenna structures is the rectangular patch. The antenna characteristics including resonant frequency, input impedance, and the quality factor have been studied both numerically and experimentally. By reconfiguring the rectangular patch to a ring, additional parameters are added to further control the aforementioned antenna's characteristics. The most comprehensive theoretical study of the rectangular microstrip antennas has been carried out by Bafrooei, P. M. and Shafai L., IEEE Trans. Antennas Propagat., Oct. 1999. A full wave approach using mixed potential integral formulation in conjunction with the method of moment is utilized to obtain antenna's characteristics. The objective of the present research is to develop a finite-difference time-domain technique to analyze both the rectangular microstrip patch and ring antennas. The proposed numerical analysis is simple, accurate and very efficient. By obtaining results for impedance bandwidth, resonant frequency, and cross polarization in the H-plane an optimum design for the antennas is proposed.

**FORMULATION AND NUMERICAL SOLUTION-** The geometry of the problem is depicted in Figure 1. Both rectangular patch and rectangular ring microstrip antennas are considered. The ring antenna is similar to a solid patch except that its central conducting part $W_2$ is removed. A 50-$\Omega$ coaxial cable is used to excite the antenna. Resonant frequency, input impedance, impedance bandwidth, cross polarization in the H-plane, and the effect of moving feed probe are all studied. Results are compared with the corresponding published theoretical and measured results. An optimum design for the rectangular microstrip antenna is presented. Results are obtained very accurately and efficiently.

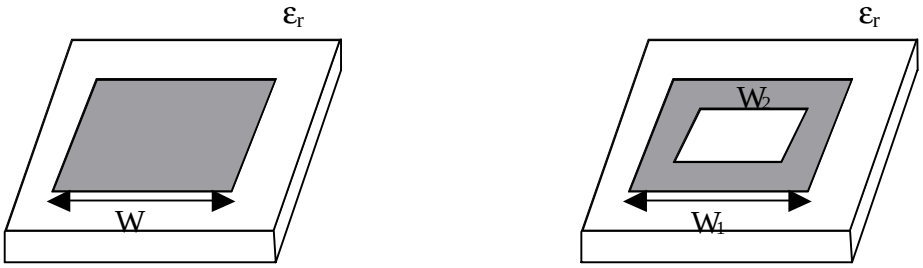


Figure 1. Geometry of printed microstrip patch and ring antennas.