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Rigorous Full-Wave Analysis of Rectangular Microstrip Patch Antenna on Suspended and Composite Substrates

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Abstract In this paper, Galerkin's method in the Fourier transform domain is applied to the determination of the resonant frequencies and half-power bandwidth of rectangular microstrip patch on composite and suspended substrates. Using Galerkin's method in solving the integral equation numerically, the complex resonant frequency of the microstrip antenna on suspended and composite substrates is studied with sinusoidal functions as basis functions, which show fast numerical convergence. The validity of the solution is tested by comparison of the computed results with experimental data. Finally, numerical results for the effects of suspended and composite substrates on the resonant frequency and half-power bandwidth are also presented.

Keywords Microstrip patch · Full-wave analysis · Suspended and composite layers · Galerkin method.

1 Introduction

In high-performance spacecraft, aircraft, missile and satellite applications, where size, weight, cost, performance, ease of installation, and aerodynamic profile are constraints, and low profile antennas may be required [1–3]. Presently, there are many other government and commercial applications, such as mobile radio and wireless communications that have similar specifications. To meet these requirements, microstrip antennas can be used [4,5]. Since the bandwidth of microstrip antenna frequencies is very narrow [6], it is important to develop accurate algorithms for computation of those resonant frequencies [7].

The resonant frequency value of a microstrip patch antenna depends on the structural parameters and it is evident that if the resonant frequency is to be changed, a new antenna is needed. In order to achieve tunable resonant frequency characteristic, an adjustable air

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