FDTD Analysis of the Impedance Behavior of Wideband Slot Antennas

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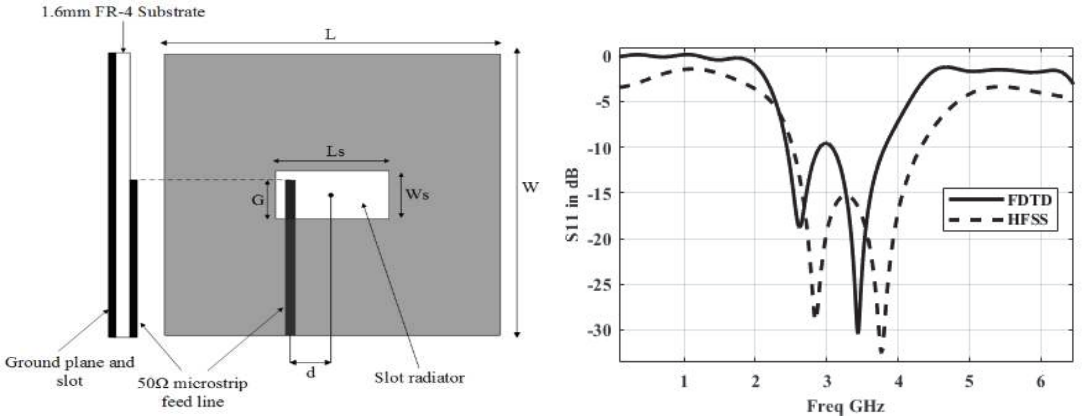
During the recent years, the usage of planar antennas in many applications like aviation, radar, military, commercial communications, etc., has increased due to their low profile, ease of integration and low cost [1]. As compared to patch antenna, slot antenna provides the wider bandwidth, low cross polarization and bidirectional radiation pattern. By offsetting the feed with respect to the slot, dual-resonances of similar polarization can be merged to enhance the bandwidth [2, 3].

In this paper, finite-difference time-domain (FDTD) method based on Yee algorithm [4] is used to analyze the impedance behavior of two wideband slot antennas. FDTD method is best suited for analyzing such antennas as a single iteration is sufficient to achieve the wideband frequency response. Wide bandwidth is achieved by using an offset microstrip feed as illustrated in figure 1(a). Antenna 1 exhibits a –10 dB impedance bandwidth of 49.92 % from 2.51 GHz to 4.18 GHz (S-band) and antenna2 having a bandwidth of 35.22 % from 5.94 GHz to 8.48 GHz (C-band). The reflection coefficient, input impedance and near-field patterns for the antennas are computed using FDTD method and the results are compared with those from the FEM based HFSS. The results show good agreement between the two methods in terms of the dual-resonance behavior and the impedance bandwidth. The reflection coefficient for antenna 1 is shown in figure 1(b).



(a) **(b)**

Figure 1.(a) Geometry of the offset-fed slot antenna (b) Computed Reflection Coefficients vs frequency for antenna 1

1. Y. Yashimura, "A microstrip slot antenna," IEEE Trans. Microwave Theory Tech.,**20**, Nov. 1972, pp. 760–762, doi:10.1109/TMTT.1972.1127868.
2. N. Behdad and K. Sarabandi, "A wide-band slot antenna design employing a fictitious short circuit concept," in *IEEE Transactions on Antennas and Propagation*, Jan. 2005, vol. 53, no. 1, pp. 475-482, doi: 10.1109/TAP.2004.838778.
3. Ritish Kumar, Piyush S and A.V. Praveen Kumar, "Offset fed slot antenna for broadband operation," IOP Conf. Series: Materials Science and Engineering, 3rd International Conference on Communication Systems (ICCS-2017) ,2018, vol. 331, doi:10.1088/1757-899X/331/1/012022.
4. Kane S. Yee, "Numerical Solution of initial Boundary Value Problems Involving Maxwell's Equations in Isotropic Media," IEEE transactions on antennas and propagation, 14,2, May 1966, pp. 302-307, doi: 10.1109/TAP.1966.1138693.