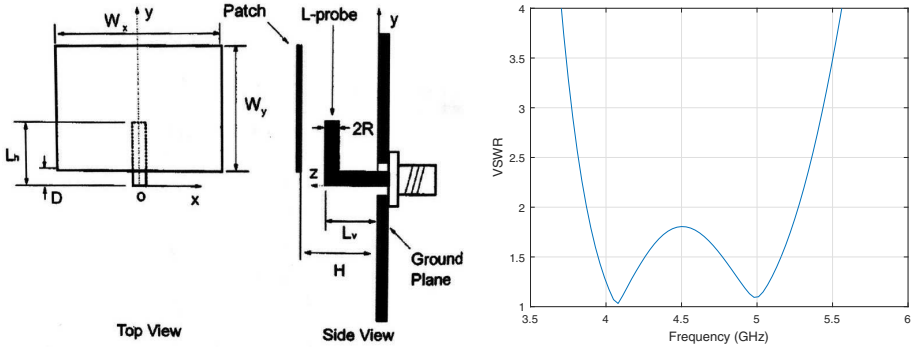
Analytical Models for L-Probe fed Microstrip Antennas

Bidisha Barman*, Deb Chatterjee, and Anthony N. Caruso
University of Missouri at Kansas City, KC, MO 64110,USA

Proximity-coupled microstrip patch antennas have been shown to exhibit wideband behavior (Lee et. al., *Microstrip Patch Antennas*, 2018). The L-probe feed topology, in particular, also enhances impedance bandwidth of other patch shapes and is critical in realizing such a feature. Full-wave analytical models for L-probe excited patches can be developed using the



(a) (b)

Figure 1: The dimensions of the L-probe fed rectangular patch on an infinite grounded substrate ($\epsilon_r \approx 1$) shown in (a) are: $W_x = 30$, $W_y = 25$, $H = 6.6$, $L_v = 4.95$, $L_h = 10.5$, $D = 2$ and $R = 0.1$–all units in mm; (b) 2:1 VSWR bandwidth of the antenna in (a) is 30%.

Theory of Characteristic Modes (TCM), following the information gleaned from a similar analysis of probe-fed U-Slot microstrip patch (Khan and Chatterjee, *IEEE Trans. Antennas Propagat.*, pp. 2758–2770, July 2016). The main aspect of TCM is the calculation of the *modal significance* that reads for the n^{th} eigencurrent mode as:

$$MS_n = \frac{1}{|1 + \jmath\lambda_n|}, \tag{1}$$

where λ_n is the eigenvalue for the n^{th} eigencurrent. This eigenvalue is obtained from a full-wave analysis via Method of Moments (MoM), involving evaluation of Sommerfeld integrals in the multilayer Green's function. The n^{th} eigencurrent is considered *dominant* if its corresponding $\lambda_n \approx 0$ which means its $MS_n \to 1$.

Parametric analysis with and without the L-probe via the TCM approach will be examined to identify the contributing modes that significantly enhance the bandwidth. The relationship of these eigencurrent modes to radiation patterns and polarization shall be explored. Additionally, alternate full-wave models that can significantly reduce the computation speed while maintaining the same accuracy shall be discussed.