Scattering by a Vertical Tree Trunk over a Flat Ground: A Comparison between Analytical and Numerical Approach

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Most microwave models of forests neglect the near field interaction of the trunk and the surface of the ground. In this paper we investigate this interaction and compare the result with the standard analytical approach. Plane wave scattering by a vertical trunk over a flat lossy ground is considered.

The problem is first treated numerically. Using a surface integral equation formulation, the method of moments is used to determine the equivalent surface currents on the finite cylinder. The procedure exploits the rotational symmetry of the cylinder, and employs a dyadic Green's function for the half space. From the equivalent surface currents the bistatic scattering coefficient is evaluated. In the analytical approach, the contribution from the ground is taken into account in the computation of the scattering coefficient in the form of a double bounce effect between the cylinder and the flat ground.

The numerical results are compared to the approximate analytical approach for frequencies from 200 MHz to 2 GHz. It is seen that the approximate approach losses accuracy as the frequency decreases. However, it is noted that the approximate analytical method is computationally much faster.