An Improved Algorithm for Surface Field Calculations on Large Dielectric Covered Circular Cylinders using Asymptotic Techniques

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The analysis and design of conformal antennas is becoming more important as various commercial and military applications for this class of devices become prominent. Although a variety of methods have been proposed, most of them tend to be applicable for electrically small structures.

In a couple of previous papers (V. B. Ertürk and R. G. Rojas, *Trans. AP*, Oct. 2000 and P. Persson and R. G. Rojas, *Radio Science*, in print) an asymptotic Green's function technique has been presented for the calculation of surface fields on a PEC circular cylinder covered with a dielectric layer. The sources may be either waveguide fed apertures or microstrip antennas. The method presented in these papers is an efficient high frequency approximation and, thus, valid for large cylinders in terms of wavelengths. However, the method can be improved even further by modifying the algorithm.

The new method involves a deformation of the integration contour. But this deformation cannot be done arbitrarily since the positions of the Green's function poles $\left[n_m(k_z)=n'_m(k_z)-jn''_m(k_z)\right]$ must be considered. And, as will be explained, some non-trivial positions of the poles make the contour deformation more critical than expected. It turns out that the pole positions in the n-plane may move from the second/fourth quadrants to the third/first quadrants when evaluating the SDP integral at points away from the saddle point $\left(k_z \in \mathbb{C}\right)$. However, by following the pole location trajectories, it is possible to find rules for how to navigate safely through the area in which poles can be found. With this information, the integration path can be safely deformed. Thus, the difficulties with highly oscillating and slowly decaying integrands in the old algorithm can be removed. As a result, a much faster and more accurate method is obtained. In addition, a physical interpretation of the poles (surface waves, leaky waves, etc.) can be obtained not only for real k_z but for $k_z \in \mathbb{C}$ as well.