Analysis of electromagnetic scattering from metallic and penetrable cylinders with edges using a multifilament current model

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Abstract: A method of moments solution is presented for the problem of electromagnetic scattering from homogeneous cylinders with edges. Transverse magnetic (TM) and transverse electric (TE) cases for metallic and penetrable cylinders are also treated. The moment solution uses a recently suggested multifilament current model to simulate the fields, special attention being paid to the accommodation of edges when using this model. An alternative hybrid method that uses a combination of a few on-surface pulse functions to negotiate the field behavior near the edges together with a filamentary current model whose field can represent the smooth field constituent on the boundary very well is also presented. Results of both methods are given and compared with available known solutions based on a standard moment method solution that employs surface pulse functions.

complex amplitudes, which are used to simulate the fields in that situation. The field scattered by the cylinder is simulated by a set of filamentary currents located inside the cylinder, while the field inside the cylinder is simulated by filamentary curents placed outside it. Only the scattered field need be simulated in the metallic case, so one set of sources, located inside the cylinder, is employed. Forcing the boundary conditions in some sense at a finite number of points on the surface of the cylinder, a matrix equation is obtained for the unknown complex amplitudes of the filamentary sources. Once these amplitudes are determined, the fields and related parameters of interest can be evaluated in a straightforward manner.

In this paper we follow the same technique, but take special care to treat the edges. This is effected by locating extra filamentary sources in the vicinity of the edges. The fields of these sources can bear the required singular edge behavior very well and thereby enhance the accuracy of the numerical solution. An alternative approach using a standard pulse surface distribution near the edges