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Analysis of electromagnetic scattering from buried cylinders using a multifilament current model

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The problem of transverse magnetic (TM) electromagnetic scattering from buried cylinders is analyzed by means of a multifilament current model. The basic idea is to use two sets of fictitious filamentary sources, with adjustable constant complex amplitudes, to simulate the fields in the various regions of the problem. One set, which is placed in the region originally occupied by the cylinder and assumed to radiate in the presence of the interface, is used for simulating the scattered field. This simulation of the scattered field would naturally require an evaluation of various Sommerfeld-type integrals in two dimensions. These integrals are calculated using a new procedure which combines simplicity and efficiency. The other set, which is placed outside the region originally occupied by the cylinder and assumed to radiate in a homogeneous unbounded space, is used for simulating the field inside the cylinder. The fields due to the filamentary sources are forced to satisfy the boundary conditions in the point-matching sense. This requirement is cast into a matrix equation, which is solved for the filamentary current amplitudes. The fields and field-related parameters of interest can be subsequently determined in a straightforward manner. The procedure is simple and general. A selection of illustrative examples is considered and compared with available data.