Method of Moment Solution of Surface-Volume-Surface Electric Field Integral Equation for 2D TM and TE Scattering on a Penetrable Cylinders of Arbitrary Cross-Section

F. Sheikh Hosseini Lori*(1), A. Menshov(2), and V. Okhmatovski (1),
(1) University of Manitoba, Winnipeg, Canada R3T5V6, http://umanitoba.ca/ece
(2) University of Texas at Austin, Austin, TX 78712 USA

In this work a new method of moment solution is presented for a novel Surface–Volume–Surface Electric Field Integral Equation (SVS-EFIE) (A. Menshov, *et.al., IEEE Trans. Microwave Theory Tech.*, 1, 2013, pp. 341-350). The SVS-EFIE is derived from surface integral equation by representing the electric field inside each cross section segment as a superposition of cylindrical waves emanating from the cross section's boundary. The SVS-EFIE has several advantages. While being rigorous in nature, it features half of the degrees of freedom compared to traditional formulations such as PMCHWT IE and it requires only electric-field-type of Green's function instead of both electric and magnetic field types (A. Menshov, *et.al., IEEE Trans. Microwave Theory Tech.*, 11, 2014, pp. 2563-2573).

The equations are developed for solution of 2D scattering problems on penetrable cylinders under both TM and TE polarizations. Detailed description of the method of moment discretization and resultant matrices are also presented. Due to the presence of a product of surface-to-volume and volume-to-surface integral operators, the discretization of the novel surface-volume-surface IE requires both surface and volume meshes. In order to validate the presented technique, the numerical results are compared with the reference solutions (J.H. Richmond, *IEEE Trans. Antennas Propag*., 3, 1965, pp. 334-341) and (J.H. Richmond., *IEEE Trans. Antennas Propag.*, 4, 1966, pp. 460-464).