İTÜ | MATEMATİK BÖLÜMÜ

Semi-Analytical Electromagnetic Modeling with Fractional Boundary Conditions and Entire-Domain MoM Basis Functions

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This study introduces a semi-analytical electromagnetic formulation that incorporates fractional boundary conditions into an entire-domain Method of Moments (MoM) framework to model non-local and dispersive surface interactions. By replacing classical integer-order boundary operators with fractional-order representations, the approach captures memory effects and anomalous impedance behavior at material interfaces while maintaining analytical Green's function-based field expressions. Entire-domain basis functions are employed to reduce the number of unknowns and preserve global current behavior, enabling an efficient yet accurate solution without volumetric discretization. Validation on canonical scattering problems demonstrates improved agreement with dispersive responses compared to conventional formulations, highlighting the potential of the method for advanced material characterization and electromagnetic analysis.

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