理工学研究所
国際交流・公開研究セミナー

Prof. Vladimir Okhmatovski (University of Manitoba, Canada)が来日される機会に, 最近その応用が注目されている電磁界解析における新しい積分方程式法についてご講演をお願いしました. 是非ご参集ください.

題　目：　Novel Single-Source Surface Integral Equation for Electromagnetics
講演者：　Prof. Vladimir Okhmatovski
(University of Manitoba, Canada)
日　時：　2016 年 8 月 27 日（土）　14:30～15:45
場　所：　中央大学 後楽園キャンパス 6 号館 7 階 6701 号室

アブストラクト:

A new single source integral equation for electromagnetics is discussed. The equation is derived from the classical volume electric field integral equation (V-EFIE) by representing the electric field inside the scatterer as a superposition of the waves emanating from its boundary and enforcement of the V-EFIE for the tangential component of the electric field on the boundary only. Due to the field translations occurring from the surface of the scatterer to its volume and subsequently back to it's surface the new equation is termed the Surface-Volume-Surface (SVS) EFIE. The SVS-EFIE has several advantages. While being rigorous in nature, it features only one unknown surface vector function compared to the traditional surface integral equation formulations such as PMCHWT and Muller formulations operating with two such functions. It requires only electric-field-type of Green's function instead of both electric and magnetic field types. Such formulation brings significant simplifications to solution of the scattering problems on the objects situated in multilayered media. The latter property is due to the absence of the derivatives acting on the multi-layered media Green's function kernel featured in the SVS-EFIE equation. Such derivatives are known to greatly amplify the numerical error resultant from numerical evaluation of the layered media Green's function and put significant restriction on the allowed error levels in evaluation of the pertinent Sommerfeld Integrals.

The SVS-EFIE equation has been developed for solution of 3D scattering problems on general penetrable objects. The SVS-EFIE has been also applied to the solution of the quasi-magnetostatic problems of current flow in complex interconnects in both homogeneous and multilayered media. Detailed description of the method of moment discretization and resultant matrices is discussed. Due to the presence of a product of surface-to-volume and volume-to-surface integral operators, the discretization of the novel SVS-EFIE requires both surface and volume meshes. In order to validate the presented technique, the numerical results are compared with both analytic Mie series solutions and reference solutions obtained with the finite-element method.

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