Implementation of High Frequency Locality to Commercial MoM-based Simulator for 3-Dimensional Scattering Analysis

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The method of moments (MoM) is one of computation method to obtain a scattered field. An integral equation is constructed for unknown currents assumed over the whole surface of scatterer and is solved by matrix inversion. The number of unknown currents N therefore becomes larger in proportion to the electrical size of scatterer. Computational times for matrix filling and matrix inversion and a required capacity of computer memory are inherently proportional to N^2, N^3 and N^2, respectively. Since the electrical size of scatterer is proportional to square of frequency f, frequency dependencies of the computational times and memory capacity amount to $O(f^4)$, $O(f^6)$ and $O(f^4)$ respectively. For high frequency scattering analysis, the authors have proposed a different type of the MoM computation with the smaller matrix size named "Local-MoM" (K. Ito, et al., IEICE Trans. Electron., vol.E94-C, no.1, pp72-79, Jan. 2011) as one of techniques to suppress these tendencies.

The Local-MoM is a technique based upon the "locality of high frequency scattering phenomena"; only local areas near the scattering centers such as reflection and diffraction points contribute a scattered field at the observer. Reflecting this locality, in the Local-MoM computation, unknown currents are placed only on truncated local areas and also a matrix is constructed only for these local currents. "Fresnel zone number" is adopted as the criterion to determine the size and shape of local areas and as an argument of raised-cosine-shaped weighting function introduced to suppress the errors due to the truncation in localization. Since the number of unknown currents in the Local-MoM is smaller than that for the normal-MoM, computational cost can be suppressed especially in higher frequency.

Implementation of the Local-MoM procedure in existing commercial simulator WIPL-D for scattering analysis from a rectangular plate was reported to confirm the adaptability and affinity of the method. In this paper, we discuss and demonstrate the applicability of the Local-MoM by complicated models such as multiple or 3-dimensional scatterers scatterer consisting of 2 plates.

The detailed discussion on the computational cost will also be done with the numerical results in the presentation.

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