

Consideration on Boundary Condition between Different Media in the CIP Electromagnetic Field Analysis

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The authors have investigated electromagnetic fields using the Constrained Interpolation Profile (CIP) Method. This method is a new technique of time domain numerical analysis, which is proposed recently by Yabe et al. as a solution to overcome numerical errors due to numerical dispersion and oscillation. A salient feature of the CIP method is that not only the electromagnetic fields themselves but also their spatial derivatives are used. The electromagnetic analysis in the uniform analytical domain has been reported and results clarify effectiveness of the CIP analysis. However, analysis in a non-uniform domain has not been sufficiently implemented.

In order to analyze electromagnetic fields in a non-uniform domain, it is important how to treat the boundary between different media exactly. Because the CIP analysis requires spatial derivatives, the boundary condition of spatial derivatives of electromagnetic fields must be given. With regard to this point, the CIP method is very different from other methods.

In this study, the electromagnetic field in the domain where different media exist is examined using the CIP method. We analyze 2-D TM-wave as an example of the multi-dimensional electromagnetic field analysis. There are shown the CIP formulation of the boundary conditions for the media having permittivity and conductivity, the treatment of the boundary between different media and the discretization of an analytical domain. The obtained calculation results indicate that our formulation and discretization are valid. Considering effectiveness of the CIP method, this analysis would be used more widely.