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An Absorbing Boundary Condition for Limited Bandwidth Applications as an Alternative to The PML in Dispersive Media

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1 Extended Abstract

In the FDTD method, the truncation of the computational space is challenging when the space is filled with dispersive media. Engquist-Majda ABC [1] or Higdon ABC [2] can not be used in such media. The PML ABC [3] is used nowadays in the problems where the space is filled with the dispersive media. In spite of high computational cost and complexity of the PML ABC, it shows an accurate results even when the spectrum of the problem covers several decades of frequency. In bioelectromagnetics, the bandwidth of interest covers only a fraction of a decade. This rises the need to a simpler ABC to replace the PML in the dispersive media when a wide bandwidth is not required.

In this paper an operator ABC is proposed to absorb the travelling waves in the dispersive media. Unlike Higdon operator, the derivation of the reported operator considers a general medium, *i.e.*, it takes into account the attenuation and dispersion caused by the medium. The reported ABC is a promising alternative for the PML in the bioelectromagnetics problems with computational cost similar to that in Higdon ABC. The operator is frequency dependant and thus it offers zero reflection coefficient, in theory, at a particular frequency. At other frequencies, the ABC produces some reflection. Nevertheless, it delivers a sufficient accuracy for larger bandwidth than that is needed in the bioelectromagnetics problems. Furthermore, the operator bandwidth can be extended by using the HABC principle [4] in which several operators can be combined.

The simulations show that the ABC is effective in Debye media which is well presented in the human body. In human skin tissue, which is one of the most dispersive tissues, the reflection is less than 0.25% in the whole two decades of bandwidth. Whereas it is less than 0.01% in a one decade of bandwidth.

In the conference, we will present a brief derivation for operator ABC along with the implementation of the HABC using the proposed operator. Furthermore, the results of two numerical simulations will be reported to demonstrate the effectiveness of the proposed ABC in the dispersive media.

References

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