FDTD Scheme for Light Scattering by Dielectric Particles with Large Complex Refractive Index

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Numerical solution for light scattering by highly refractive dielectric particles is examined with the finite-difference time domain (FDTD) technique. In the FDTD, the computational domain is truncated using the perfectly matched layer (PML) absorbing boundary condition (Sun et al. 1999). It is found that for dielectric particles with large refractive index, the FDTD simulation is sensitive to the treatment of particle edge. In this study, we have introduced an effective particle edge treatment to reduce the FDTD errors. Using this treatment for particles with large refractive index (e.g., 7.15 i + 2.92 i), the errors in the extinction and absorption efficiencies due to the FDTD technique are typically around ~2%. The error in the scattering phase function is generally smaller than ~5%. We conclude that the present PML FDTD scheme with the new edge treatment can produce accurate results for dielectric particles of arbitrary shapes with large complex refractive index. See Sun and Fu (1999) for more details.

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References

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