Comparison of Luebbers and Maloney implementations of complex objects composed with thin sheets in the FDTD grid

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The Maloney and Luebbers subcell methods can be used to implement dielectric or conducting sheets thinner than the cell size in the FDTD grid. The two methods differ in the treatment of the field components situated half a cell from the thin sheet. For a sheet of infinite size stricken by an incident plane wave, it has been shown by theory and experiments that the Luebbers method suffers from discrepancy at the wide incidence angle, while the Maloney method is exact at any incidence angle (J.P. Bérenger and F. Costen, IEEE Trans. on AP, Early Access, 2018). The comparison of Maloney and Luebbers methods has been later extended to dispersive sheets, more specifically, sheets made with the Debye media used in Bio-electromagnetism to model the Human Body tissues (A. Alkandari et al, AP-S/USNC-URSI Symposium, FR-UB.5P, Boston, 2018).

This paper presents the further comparison of the two aforesaid methods in more realistic situations with objects of finite size composed of several thin sheets such as dielectric, conducting or Debye medium sheets. Comparisons with objects composed with both PEC surfaces and thin sheets are also presented. The results from numerical experiments show that the difference between the Luebbers and Maloney methods is affected by the problem to be solved, especially the geometry and size of the thin sheets, the physical parameters of the sheets (permittivity, conductivity, relaxation time), and such other parameters as the location of the observation, for instance, inside or outside an enclosure. The interest of using the Maloney method, which is accurate in any situation, but is more complex to implement in a general purpose computer code, is discussed, with a special emphasize on the case of sheets made with Human Body media.

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