Accepted Manuscript

Computational Electrodynamics in Material Media with Constraint-Preservation, Multidimensional Riemann Solvers and Sub-Cell Resolution – Part I, Second-Order FVTD Schemes

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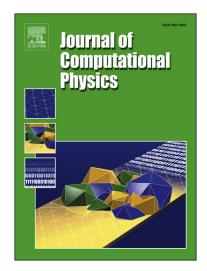
PII: S0021-9991(17)30532-6

DOI: http://dx.doi.org/10.1016/j.jcp.2017.07.024

Reference: YJCPH 7471

To appear in: Journal of Computational Physics

Received date: 9 February 2017 Revised date: 10 July 2017 Accepted date: 11 July 2017



Please cite this article in press as: D.S. Balsara et al., Computational Electrodynamics in Material Media with Constraint-Preservation, Multidimensional Riemann Solvers and Sub-Cell Resolution – Part I, Second-Order FVTD Schemes, *J. Comput. Phys.* (2017), http://dx.doi.org/10.1016/j.jcp.2017.07.024

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Highlights

- From the FDTD method, we retain a spatial staggering strategy for the primal variables. This provides a beneficial constraint preservation for the electric displacement and magnetic induction vector fields.
- We use the multi-dimensionally upwinded Riemann solvers developed by the first author.
- We use the ADER predictor step to endow our method with sub-cell resolving capabilities so that the method can be stiffly stable and resolve significant sub-cell variation in the material properties within a zone.

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