DAMPING OF SPURIOUS WAVE REFLECTIONS FROM COARSE-FINE ADAPTIVE MESH REFINEMENT GRID BOUNDARIES*

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Adaptive mesh refinement (AMR) is an efficient technique for solving systems of partial differential equations numerically. The underlying algorithm determines where and when a base spatial and temporal grid must be resolved further in order to achieve the desired precision and accuracy in the numerical solution. However, propagating wave solutions prove problematic for AMR. A wave traveling from a finely resolved region into a coarsely resolved region encounters a numerical impedance mismatch, resulting in spurious reflections off of the coarse-fine grid boundary. These reflected waves then become trapped inside the fine region.

Here, we present a scheme for damping these spurious reflections. We demonstrate its application to the scalar wave equation. and discuss a possible implementation for Maxwell's Equations. This scheme is based in part on perfectly matched layer (PML) methods, which in contrast to our technique are designed to damp all outgoing waves[1,2].

1. J.-P. Berenger, “Three-Dimensional Perfectly Matched Layer for the Absorption of Electromagnetic Waves,” Journal of Computational Plasma Physics 127, pp. 363-379 (1996)
2. J.-L. Vay, “Asymmetric Perfectly Matched Layer for the Absorption of Waves,” Journal of Computational Plasma Physics 183, pp. 367-399 (2002)

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