

## **A Simple, Nearly Perfectly Matched Layer for General Electromagnetic Media**

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A new implementation of the perfectly matched layer (PML) absorbing boundary condition is presented [Cummer, IEEE Microwave and Wireless Components Lett., in press, 2003]. This formulation is designed such that the partial differential equations in the PML are identical to those in the regular medium for any linear electromagnetic material. Only simple first order ordinary differential equations that relate various field components are added to the PML system of equations. This property makes this method particularly simple to implement, especially in complex dispersive and anisotropic materials, because explicit partial difference equations (which can be tedious to derive) do not need to be rederived for the PML.

We call this method the nearly perfectly matched layer (NPML) because it employs variable changes that are not strictly exact when the PML conductivity is spatially varying, as it normally is for maximum absorbing performance. Such inexact coordinate stretching has been used in other apparently effective PML formulations [Tentzeris et al., IEEE Trans. Antennas Propagat., 1999]. Comparisons of the NPML with the convolutional PML [Roden and Gedney, Microwave Opt. Tech. Lett., 2000] in a dispersive dielectric show that the NPML is as effective an absorber as exact PML formulations, and we also demonstrate its performance in truncating a domain containing anisotropic and dispersive magnetized plasma. This indicates that the details of the numerical implementation, rather than the exactness of the analytical formulation, dominate the absorbing performance when the PML layer parameters are nearly optimal. We further analyze the NPML formulation to demonstrate why it performs numerically as well as an exact PML, despite its theoretical inexactness.