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Simulating Anisotropic Dielectrics for Photonic Crystal Accelerator Structures G.R. WERNER, C.A. BAUER, Univ. of Colorado, J.R. CARY, Univ. of Colorado, Tech-X Corporation — The selective reflection of photonic crystals offers many potential benefits for accelerator structures, including the elimination of high order modes and wake fields. In addition, photonic crystals can be made out of dielectrics that can outperform metals at high frequencies. Compared to traditional metal accelerator cavities, dielectric photonic crystal structures have many more parameters to optimize—while the large number of possible configurations may allow greater optimization, those configurations will need to be explored via computer simulation. Although isotropic dielectrics are fairly easy to simulate, anisotropic dielectrics present more difficulty—and the "best" dielectrics tend to be pure crystals (like sapphire) with anisotropic dielectric tensors. Simulating anisotropic dielectrics may also be important for improving accuracy when simulating oblique interfaces between isotropic dielectrics. We present an algorithm to evolve Maxwells equations in the presence of three-dimensional anisotropic dielectrics; the algorithm reduces to the standard Yee algorithm in an isotropic dielectric; moreover, we show that this algorithm supports only eigenmodes with real frequencies, unlike some other seemingly reasonable choices, which lead to instabilities in non-uniform anisotropic dielectrics. This work was supported by the U.S. DOE grant DE-FG02-04ER41317 and Air Force Office of Scientific Research grant FA9550-04-C-0041.

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