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Transformation Optics based FDTD method for solving nonlinear Maxwell's equations.

Transformation optics (TO) is a special coordinate transformation technique that can be applied to create many interesting phenomenon, such as the well-known metamaterial invisibility cloak. A key feature of the transformation optics is the invariance of the Maxwell's equations after a coordinate transformation. Recently, we have developed a TO based FDTD method to numerically solve the Maxwell's equations with subgridding effect. The idea is to use TO to enlarge certain small sub-regions so that they look much larger in the transformed (virtual) space. Different from the subgridding methods that use small grid cells in small regions, the TO-FDTD solves the transformed problem on uniform grid using a recently developed stable anisotropic FDTD algorithm. In this talk, we will discuss the recent progress on TO based FDTD methods, including the extension to space-time domain and to dispersive and nonlinear media with application to optical pulse propagation. (Received January 30, 2015)