Numerical Analysis for the Optimal Control of the Full Time-Dependent Maxwell Equations

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In this talk an optimal control problem of the full time-dependent Maxwell equations and its numerical analysis are presented. We aim at finding the optimal current density and its time-dependent amplitude which steer the electric and magnetic fields to the desired ones. The mathematical analysis of the control problem which includes existence and regularity results is briefly discussed. Then, by choosing the lowest order edge elements of Nédélecs first family for the current density and continuous $\mathbb{P}_1$-elements for the amplitude a finite element approximation of the control is established. Further, the Maxwell equations, that have a first order hyperbolic coupled structure, are discretized by mixed finite elements based on piecewise constant elements for the electric field and lowest order edge elements of Nédélecs first family for the magnetic field. The time discretization is obtained via a Crank-Nicolson scheme. We present preliminary theoretical results on the finite element approximation of the optimal control problem including some 3D numerical examples. This is joint work with Irwin Yousept.

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