A uniformly exponentially stable ADI scheme for Maxwell equations

Konstantin Zerulla (Karlsruhe Institute of Technology (KIT))

Alternating direction implicit (ADI) schemes are a very efficient tool for time integration of linear isotropic Maxwell equations on cuboids as they are unconditionally stable and decouple into essentially one-dimensional problems.
We study the Maxwell system with Ohm's law and a strictly positive conductivity. In this case the solutions tend to zero exponentially for large times. However, works by Nicaise, Tucsnak, Zuazua and others for the discretization of wave equations suggest, that the uniform decay properties of the continuous Maxwell system get lost when discretizing in time or space without additional damping.
We thus construct a modified ADI scheme by including artificial viscous damping. In this way we obtain uniformly exponentially stable time-discrete approximations to the Maxwell equations and an unconditionally stable scheme with similar effort as the original one. Finally, we will also give a bound on the error of the modified scheme.