High-Order Numerical Methods for Maxwell's Equations on Unstructured Meshes

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For more than fifteen years, spectral finite elements (i.e. finite element methods on hexahedral meshes with mass-lumping) showed their efficiency to model the propagation of acoustic and elastic waves in the time domain, in particular in terms of accuracy. Moreover, their mixed formulation [1] dramatically increases their efficiency in terms of storage and computational time.

This approach, which used initially continuous elements for acoustics and linear elastodynamics, has been recently extended to discontinuous Galerkin methods in order to solve Maxwell's equations in the time domain [2] as well as to the first family of edge elements fot the time-harmonic problem [3].

ln our talk, we justify, in a first part, the different options we selected for our approximations. ln particular, we show that the gain realized by using spectral elements in their mixed formulation.

ln a second part, we present the different spectral elements we used for solving Maxwell's equations and the strong and weak points of each method are discussed in order to point out the optimal choice for each kind of problem.

Finally, numerical experiments which show the performance of the methods are provided and sorne comparisons with FDTD are given.

References

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