Assessment of Edge-based finite element technique for geophysical electromagnetic problems: efficiency, accuracy and reliability

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ABSTRACT

In Finite Element Methods for solving electromagnetic field problems, the use of Edge Elements has become very popular. In fact, Edge Elements are often said to be a cure to many difficulties that are encountered (particularly eliminating spurious solutions) and are claimed to yield accurate results [9, 16, 17]. We will shortly describe the mathematical formulation of linear edge elements and we go through the particular issues related to the implementation of these elements in order to solve geophysical electromagnetic problems. In particular, we describe a simple, flexible and parallel Fortran 90 implementation for Edge Elements. The code is based on an abstract data structure, which allows to use different kinds of solvers with little effort. The result is an implementation that allows users to specify Edge-based Finite Element variational forms of H(curl). Finally, we also show the performance of the code in terms of efficiency, accuracy and reliability, which will shape our future line of work in order to solve more complex problems.

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