

3-D magnetotelluric modeling using finite element method incorporating unstructured hexahedral elements

Weerachai Sarakorn

Department of Mathematics, Faculty of Science, Khon Kaen University, Khon Kaen, 40002, Thailand (wsarakorn@kku.ac.th)

The unstructured hexahedral mesh algorithm has been applied to various three-dimensional modeling. For geophysical modeling, the unstructured hexahedral mesh can handle complex structures, such as topography, bathymetry, and irregular anomalies, as well as the unstructured tetrahedral mesh. Nevertheless, it requires less elements and nodes than the unstructured tetrahedral mesh and needs no additional adaptive routines for improving their accuracy. In this research, we present the finite element (FE) method with unstructured hexahedral mesh and use it to solve three-dimensional magnetotelluric modeling. Our FE algorithm is validated on nontopographic, topographic, and bathymetric models. The accuracy and efficiency of our FE algorithm is presented and compared with other numerical methods. Our numerical results indicate that our algorithm achieves comparable efficiency compared with those of other schemes. Furthermore, our FE code with unstructured hexahedral mesh utilizes local refinement mesh to handle complex topography and bathymetry inside the model appropriately.