Challenges in the Generation of 3-D Unstructured Mesh for Simulation of Geological Processes.

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Realistic representation of 3-D earth models is one of the most important factors for increasing the accuracy of predictions based on simulations of complex geological phenomena. However, 3-D, discrete, accurate earth models with sufficient geological significance and spatial resolution are still far beyond from the capacity of many available computer systems. For using 3-D finite element analysis in computational geology, a robust automatic 3-D mesh generator is also needed. The generation of numerical meshes derived from an interpreted earth model is a necessary step to provide specific data representations such as finite difference grids or finite element meshes for the solution of partial differential equations governing, for instance, heat and fluid transfer within compacting heterogeneous porous media. In this presentation, we will discuss our approach to the creation of general 3-D earth models and the challenges of generating useful unstructured meshes that conform to the input surfaces bounding the model. One of the most difficult tasks in this process is the mesh generation for arbitrarily complex geometries normally defined by a set of horizons and faults not only because of the limitations imposed by available meshing algorithms but the quality of the input data. The main problems are the large volume data of the original input surfaces and the presence of very small angles among the surfaces, especially at the intersection of two input surfaces. We will discuss some robust techniques to tackle these problems efficiently.