Computer Graphics in Geology: Three-Dimensional Computer Graphics in Modeling Geologic Structures and Simulating Geologic Processes

*By **Reinhard Pflug & John W. Harbaugh**, Lecture Notes in Earth Sciences. Published by Springer-Verlag. 298 pages. ISBN 3540-55190-5*

Review by **Christopher G. Kendall**

This volume represents the companion of the papers presented in a symposium on geological applications and computer graphics to solve geologic problems. It was sponsored by the Deutsche Forschungsgemeinschaft (DFG), the University of Freiburg, and the International Association of Mathematical Geology. This book consists of some 24 papers and is divided into 3 parts. The first part consists of chapters on modeling and rendering of structures. The second part is on process simulation and the third section is on economic applications of computer generated modeling. The book begins with two introductions: one by Reinhard Pflug and another by John Harbaugh. Pflug addresses the use of three-dimensional computer graphics and reviews some of the papers in this book. The paper by Harbaugh addresses the problem of simulating geological processes. Both are excellent reviews and set the stage for the rest of the volume. Pflug points out the strengths and weaknesses of three-dimensional modeling and how the quality of visualization is related to the resolution of the model on screen, and the resolution quality of the data used. Also, Pflug recognizes the importance of having programs communicating with one another, so different data bases can be accessed to create three-dimensional models. In contrast, Harbaugh considers how to simulate geological processes, and whether one should model processes by means of a true voxel-based three-dimension or by some sort of quasi-three-dimensional and empirical model. He disusses the problems of the immense amount of data that is needed to model true three-dimensional features and considers the effects of scale and geographic extent on process models, how to display these, how to calibrate them, how to incorporate first principle models versus empirical relationships, and computing power, etc.

This book is a much more mathematically-oriented text than the AAPG volume, though it is not as well produced in terms of its printing quality. However, the scientific content is really excellent. It is aimed rather at the experienced modeler, who is trying to expand and develop their understanding of modeling of geological surfaces in two and three dimensions than at the noviciate, as was the case with the AAPG volume.

Topics covered in the section on modeling and rendering of structures includes the use of triangular facets or "T" surfaces to define three-dimensional grids; the use of rational splines in multidimensional geologic modeling; the three-dimensional visualization of three-dimensional geologic processes. There's a paper with an atlas of three-dimensional functions ranging from transformations to scale models to sheared models, the handling of volumes, surface area orientation, how to visualize three-dimensional models in terms of rotating them, the use of the center of a mass, how to build geometries, etc. There's also a paper on solid computation models of geological structures in boreholes, and one on the three-dimensional construction of pore geometry from serial-sections. There's a paper on its discussion of graphic techniques to represent geological hazards, the modeling of fault patterns from a three-dimensional point of view using an entry level two-dimensional work station. There is a paper on computer rendering of surfaces applied to geology and one on balanced three-dimensional reconstructions of the Alps.

Papers on process simulation include: Stanfords SEDSIM which is a dynamic three-dimensional simulation of geological processes; a model for the three-dimensional simulation of littoral transport; the modeling of compaction and isostatic compensation; landform development and basin filling including erosion, transport and deposition; and a three-

dimensional computer graphics for handling plutonic placement.
Finally, the papers on economic applications deal with three-dimensional modeling of hydrocarbon and reservoir exploration and production; a paper on the direct geostatic statistical estimation of regular three-dimensional volumes; a paper on the modeling of geological discontinuities to estimate reserves; and a three-dimensional predictive deposit model based on linear representation by subcubes or linear octree data structures. There is a paper on the three-dimensional modeling of stratoform deposits; one on geostatistical modeling of geological layers, and the optimization of survey design in the British Channel tunnel; one on three-dimensional geoscientific mapping related to hydrogeological assessment in Nevada; three-dimensional modeling and geothermal process simulation; and finally, the application of CAD modeling to characterization of crystalline bedrock.
This is a really excellent book and I know that certainly within my lab, we will be referring to this text for some time to come. It represents an extremely valuable book to those of us who are involved in geological visualization and the mapping of geological structures using the engineering work station. I highly recommend it to both geologists and geophysicists who are in this field and I would hope that it will be a well spent dollar for those of you who purchase this book.

Computer Graphics in Geology book. Read reviews from worldâ€™s largest community for readers.Â Computer Graphics in Geology: Three-Dimensional Computer Graphics in Modeling Geologic Structures and Simulating Geologic Processes. by. Reinhard Pflug (Contributor).Â Start your review of Computer Graphics in Geology: Three-Dimensional Computer Graphics in Modeling Geologic Structures and Simulating Geologic Processes. Write a review. No matching reviews. "A geologic structure is a geometric conï¬guration of rocks, and structural geology deals with the geometry, distribution and formation of structures". It should be added that structural geology only deals with structures created during rock deformation, not with primary structures formed by sedimentary or magmatic processes. However, deformation structures can form through the modiï¬cation of primary structures, such as folding of bedding in a sedimentary rock. The closely related word tectonics comes from the Greek word tektos, and both structural geology and tectonics relate to the