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Book Review

Shared Earth Modeling: Knowledge Driven Solutions for Building and Managing Subsurface 3D Geological Models by M. Perrin and J-F. Rainaud, Editions TECHNIP, 2013; ISBN: 978-2-7108-1002-5, 75 EU

Thibaut Perol[1]

Over the last 30 years, the oil industry has been developing interactive, intuitive, and efficient software to investigate the economic potential of subsurface hydrocarbon reservoirs. However, companies are now facing new challenges related to the scarcity of this resource. In addition to identifying new reservoirs, they also need to re-evaluate the production capacity of the ones already in production. This implies a re-interpretation of the growing volumes of well-log data, seismic surveys and rock sample analyses that are collected during operations. Unfortunately the previous interpretations are already embedded at every step of the modeling procedure, making the link between the raw data and the interpretations hard to trace back if no written reports accompanied the program. The authors, through this relatively dense book in terms of concepts, convey the message that geological modeling should be knowledge-driven (based on interpretations) instead of data-driven (data-dependence).

Shared Earth Modeling aims to compile raw data collected by a large spectrum of scientific communities such as geophysicists, geologists, petrophysicists and reservoir engineers to produce a more coherent and realistic picture of the subsurface and the distribution of the potential resources when considering economically interesting reservoirs. This book explains how geological models should share and integrate not only data, but also the knowledge related to data interpretation in the context of oil and gas reservoirs. As formulated by Dominique Lefebvre in the Foreword, it gives a 'lesson in sharing […] based on knowledge management'. The two editors, Michel Perrin (retired Geology Professor at Mines Paristech, France) and Jean-François Rainaud (Senior Project Manager at IFP Energies Nouvelles, France), offer in this book a comprehensive study of geomodeling through the collective work of 30 geologists and geophysicists, but also computer architects, and knowledge engineers from French, Brazilian and Norwegian engineering schools, universities, research institutions, and companies. The authors cover in this industry-oriented book the state of the art hydrocarbon reservoir modeling developed in the companies nowadays. However, the book will also be of interest to researchers, especially in computer science, concerned with the applications of geomechanical modeling and knowledge engineering to reservoir estimations.

The book is divided into four parts; a fifth part is a conclusion chapter written by the two editors, Michel Perrin and Jean-François Rainaud. The first part, "Earth models", divided into three chapters, is an inventory of the subsurface models available currently on the market (structural, stratigraphic, reservoir models) together with their workflows; it also provides a general guideline on reservoir modeling from the integration of various geology-related disciplines. The second part, "Knowledge oriented solutions", walks the reader through the potential issues that arise at every step of the modeling procedure. Chapter 4 examines the interpretation problems of seismic imaging and suggests a cognitive vision approach as a solution for these. Chapter 5 explains the assumptions underlying the representation of individual geological

[1] School of Engineering and Applied Sciences, Harvard University, Cambridge, MA, USA. E-mail: tperol@seas.harvard.edu

surfaces in structural models of reservoirs and suggests solutions through horizon simplification, resampling and hole-filling methods. Chapter 6 examines the rules for constructing consistent geological surface assemblages in 3D structures and provides a methodology to automate such construction of structures. Chapter 7 discusses the issues related to 3D meshing, especially in the case of fault insertion and stratigraphic flattening. Chapter 8 addresses the data extension issue and discusses the potential of geo-statistical methods. Part 3, "Knowledge formalization", is the heart of the knowledge-driven shared earth modeling methods. It defines the term ontology (chapter 9), introduces it in the context of Earth Sciences, and discusses the conditions for the various types of ontology to be robust for interpreting geo-chronological relationships (chapter 10), analyzing data expressed in natural language (chapter 11), and describing the rock petrology (chapter 12). Part 4, "Knowledge management and applications", provides solutions through ontology-based systems for managing semantic data. The conclusion part is a summary of the advancements of shared earth modeling concluded by perspectives for future research, drawn by the two editors.

As mentioned before, the book is dense and gives an exhaustive picture of the modeling effort done by the oil companies. In addition to the material described above, the authors provide at the end of each chapter the references for researchers interested in more details and a glossary at the end of the volume with 400 of the technical words encountered during the reading. The reading is made relatively easy (language and organization of the text) and the numerous figures in color make the book appealing. For the amount of information provided by the authors from various disciplines the price is relatively cheap. In other words, this book is a great deal to anyone interested in applied computational geomechanics.