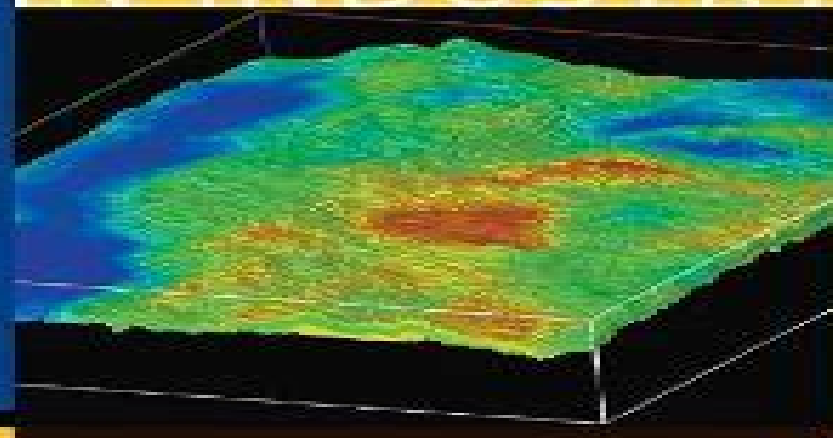


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Mathematical Methods and Modelling in Hydrocarbon Exploration and Production



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Mathematical Methods And Modeling In Hydrocarbon Exploration And Production

**Abdul Hassan Siddiqi, Martin
Brokate, Anil Kumar Gupta**



Mathematical Methods And Modeling In Hydrocarbon Exploration And Production:

Mathematical Methods and Modelling in Hydrocarbon Exploration and Production Armin Iske, Trygve Randen, 2006-01-27 Hydrocarbon exploration and production incorporate great technology challenges for the oil and gas industry In order to meet the world's future demand for oil and gas further technological advance is needed which in turn requires research across multiple disciplines including mathematics geophysics geology petroleum engineering signal processing and computer science This book addresses important aspects and fundamental concepts in hydrocarbon exploration and production Moreover new developments and recent advances in the relevant research areas are discussed whereby special emphasis is placed on mathematical methods and modelling The book reflects the multi disciplinary character of the hydrocarbon production workflow ranging from seismic data imaging seismic analysis and interpretation and geological model building to numerical reservoir simulation Various challenges concerning the production workflow are discussed in detail The thirteen chapters of this joint work authored by international experts from academic and industrial institutions include survey papers of expository character as well as original research articles Large parts of the material presented in this book were developed between November 2000 and April 2004 through the European research and training network NetAGES Network for Automated Geometry Extraction from Seismic The new methods described here are currently being implemented as software tools at Schlumberger Stavanger Research one of the world's largest service providers to the oil industry

Algorithms for Approximation Armin Iske, Jeremy Levesley, 2006-12-13 Approximation methods are vital in many challenging applications of computational science and engineering This is a collection of papers from world experts in a broad variety of relevant applications including pattern recognition machine learning multiscale modelling of fluid flow metrology geometric modelling tomography signal and image processing It documents recent theoretical developments which have lead to new trends in approximation it gives important computational aspects and multidisciplinary applications thus making it a perfect fit for graduate students and researchers in science and engineering who wish to understand and develop numerical algorithms for the solution of their specific problems An important feature of the book is that it brings together modern methods from statistics mathematical modelling and numerical simulation for the solution of relevant problems with a wide range of inherent scales Contributions of industrial mathematicians including representatives from Microsoft and Schlumberger foster the transfer of the latest approximation methods to real world applications

Acta Numerica 2010: Volume 19 Arie Iserles, 2010-05-27 A high impact prestigious annual publication containing invited surveys by subject leaders essential reading for all practitioners and researchers

Modern Engineering Mathematics Abul Hasan Siddiqi, Mohamed Al-Lawati, Messaoud Boulbrachene, 2017-12-22 This book is a compendium of fundamental mathematical concepts methods models and their wide range of applications in diverse fields of engineering It comprises essentially a comprehensive and contemporary coverage of those areas of mathematics which provide foundation to

electronic electrical communication petroleum chemical civil mechanical biomedical software and financial engineering It gives a fairly extensive treatment of some of the recent developments in mathematics which have found very significant applications to engineering problems *Handbook of Mathematical Geosciences* B.S. Daya Sagar, Qiuming Cheng, Frits Agterberg, 2018-06-25 This Open Access handbook published at the IAMG's 50th anniversary presents a compilation of invited path breaking research contributions by award winning geoscientists who have been instrumental in shaping the IAMG It contains 45 chapters that are categorized broadly into five parts i theory ii general applications iii exploration and resource estimation iv reviews and v reminiscences covering related topics like mathematical geosciences mathematical morphology geostatistics fractals and multifractals spatial statistics multipoint geostatistics compositional data analysis informatics geocomputation numerical methods and chaos theory in the geosciences **Introduction to Geological**

Uncertainty Management in Reservoir Characterization and Optimization Reza Yousefzadeh, Alireza Kazemi, Mohammad Ahmadi, Jebraeel Gholinezhad, 2023-04-08 This book explores methods for managing uncertainty in reservoir characterization and optimization It covers the fundamentals challenges and solutions to tackle the challenges made by geological uncertainty The first chapter discusses types and sources of uncertainty and the challenges in different phases of reservoir management along with general methods to manage it The second chapter focuses on geological uncertainty explaining its impact on field development and methods to handle it using prior information seismic and petrophysical data and geological parametrization The third chapter deals with reducing geological uncertainty through history matching and the various methods used including closed loop management ensemble assimilation and stochastic optimization The fourth chapter presents dimensionality reduction methods to tackle high dimensional geological realizations The fifth chapter covers field development optimization using robust optimization including solutions for its challenges such as high computational cost and risk attitudes The final chapter introduces different types of proxy models in history matching and robust optimization discussing their pros and cons and applications The book will be of interest to researchers and professors geologists and professionals in oil and gas production and exploration *Quantitative Geosciences: Data Analytics, Geostatistics, Reservoir Characterization and Modeling* Y. Z. Ma, 2019-07-15 Earth science is becoming increasingly quantitative in the digital age Quantification of geoscience and engineering problems underpins many of the applications of big data and artificial intelligence This book presents quantitative geosciences in three parts Part 1 presents data analytics using probability statistical and machine learning methods Part 2 covers reservoir characterization using several geoscience disciplines including geology geophysics petrophysics and geostatistics Part 3 treats reservoir modeling resource evaluation and uncertainty analysis using integrated geoscience engineering and geostatistical methods As the petroleum industry is heading towards operating oil fields digitally a multidisciplinary skillset is a must for geoscientists who need to use data analytics to resolve inconsistencies in various sources of data model reservoir properties evaluate

uncertainties and quantify risk for decision making This book intends to serve as a bridge for advancing the multidisciplinary integration for digital fields The goal is to move beyond using quantitative methods individually to an integrated descriptive quantitative analysis In big data everything tells us something but nothing tells us everything This book emphasizes the integrated multidisciplinary solutions for practical problems in resource evaluation and field development Shared Earth Modeling Michel Perrin, Jean-François Rainaud, 2013 Over the last two decades earth modeling has become a major investigative tool for evaluating the potential of hydrocarbon reservoirs Earth modelling must now face new challenges since petroleum exploration no longer consists in only investigating newly identified resources but also in re evaluating the potential of previously investigated reservoirs in the light of new prospecting data and of revised interpretations Earth models incorporate a variety of different interpretations made on various types of data at successive steps of the modeling process However current modeling procedures provide no way to link a range of data and interpretations with a final earth model For this reason sharing and exchanging information about the model building process is at present a major difficulty Recently the term Shared Earth Modeling has been used for expressing the idea that earth models should be built in such a way that experts and end users can have access at any time to all the information incorporated into the model This information does not only concern the data but also the knowledge that geoscientists produce by interpreting these data Accordingly practical solutions must be studied for operating a knowledge driven approach of Shared Earth Modeling This is the goal of this book This study of earth subsurface modeling is intended for several categories of readers It concerns in the first place geologists engineers and managers involved in the study and evaluation of subsurface reservoirs and hydrocarbon exploration Relying on recent progress in various fields of computer sciences the authors present innovative solutions for solving the critical issue of knowledge exchange at key steps of the modeling process This book will also be of interest to researchers in computer science and more generally to engineers researchers and students who wish to apply advanced knowledge based techniques to complex engineering problems

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Conclusion Appendix Glossary **Uncertainty Analysis and Reservoir Modeling** Y. Zee Ma, Paul R. La Pointe, 2011-12-20

Advances in Geophysics Cedric Schmeltzbach, 2018-11-13 Advances in Geophysics is a highly respected publication in the field of geophysics. Since 1952 each volume has been eagerly awaited, frequently consulted and praised by researchers and reviewers alike. Now with over 50 volumes, the series contains much material still relevant today, truly an essential publication for researchers in all fields of geophysics. Provides high level reviews of the latest innovations in geophysics. Written by recognized experts in the field. Presents an essential publication for researchers in all fields of geophysics.

Modelling of Engineering and Technological Problems Abdul Hassan Siddiqi, Martin Brokate, Anil Kumar Gupta, 2009-07-20 The theme of the conference is an important ingredient of scientific computing, also known as computational science and engineering. The themes of Modeling of Real World Systems, Wavelet Analysis with Applications, Dynamical Systems, Compromise Numerical Methods, Typical Methods of Engineering and Technology were discussed.

Advanced Methods for Interpreting Geological and Geophysical Data Ahmed M. Eldosouky, Luan Thanh Pham, David Gomez-Ortiz, Saulo Oliveira, Ahmed Henaish, 2024-07-08 The introduction and application of advanced geological and geophysical methods can solve many problems related to geoscience. This Research Topic gives a thorough treatment of the interpretation of geological and geophysical data through advanced techniques and integrated approaches. It aims to create a more reliable integration of various geological and geophysical data in an exploration and new findings context, weighing the strengths and limitations of the various methods in order to develop geophysical and geological models. It will also focus on the interpretation techniques for evaluating structural and sedimentological stratigraphical processes with applications within resource exploration, geohazards, seismology, seabed ecology and global climate. **Technical Guidance**

for Petroleum Exploration and Production Plans Tarek Al-Arbi Omar Ganat, 2020-03-31 This book presents detailed explanations of how to formulate field development plans for oil and gas discovery. The data and case studies provided here, obtained from the authors' field experience in the oil and gas industry around the globe, offer a real world context for the theories and procedures discussed. The book covers all aspects of field development plan processes, from reserve estimations to economic analyses. It shows readers in both the oil and gas industry and in academia how to prepare field development plans in a straightforward way and with substantially less uncertainty. **Industrial Structural Geology** F.L. Richards, N.J.

Richardson, S.J. Rippington, R.W. Wilson, C.E. Bond, 2015-10-22 The practical application of structural geology in industry is varied and diverse; it is relevant at all scales, from plate wide screening of new exploration areas down to fluid flow behaviour along individual fractures. From an industry perspective, good structural practice is essential since it feeds into the quantification and recovery of reserves and ultimately underpins commercial investment choices. Many of the fundamental structural principles and techniques used by industry can be traced back to the academic community, and this volume aims to provide insights into how structural theory translates into industry practice. Papers in this publication describe case studies

and workflows that demonstrate applied structural geology covering a spread of topics including trap definition fault seal fold and thrust belts fractured reservoirs fluid flow and geomechanics Against a background of evolving ideas new data types and advancing computational tools the volume highlights the need for structural geologists to constantly re evaluate the role they play in solving industrial challenges

Intelligent Robotics Zhiwen Yu,Xinhong Hei,Duanling Li,Xianhua Song,Zeguang Lu,2023-02-17 This book constitutes selected papers presented during the Third China Annual Intelligent Robotics Conference CCF CIRAC 2022 held in Xi an China in December 2022 The 35 papers presented were thoroughly reviewed and selected from the 120 qualified submissions They are organized in the following topical sections robot safety intelligent robot sensing autonomous robot navigation artificial intelligence and cloud robot unmanned cluster collaboration natural human computer interaction other robot related technologies

Geology and Geochemistry of Oil and Gas L. Buryakovskiy,N.A. Eremenko,M.V. Gorfunkel,G.V. Chilingarian,2005-10-13 This book discusses the progress that is being made through innovations in instrumental measurements of geologic and geochemical systems and their study using modern mathematical modeling It covers the systems approach to understanding sedimentary rocks and their role in evolution and containment of subsurface fluids Fundamental aspects of petroleum geology and geochemistry generation migration accumulation evaluation and production of hydrocarbons are discussed with worldwide examples Various physical and chemical properties of subsurface waters crude oils and natural gases are described which is especially important to production engineering Among various properties of liquid and gaseous hydrocarbons the most important are wettability affecting production characteristics and ultimate recovery relative permeability affecting reservoir fluid flow to the production wells density differences between immiscible fluids which affects gravity drainage viscosity of subsurface fluids affecting the relative mobility of each fluid and fluid chemistry which affects the absorption ultimate recovery and monetary value of produced hydrocarbons Discussion of the formation and accumulation of hydrocarbons includes 1 the changes in the chemical composition of hydrocarbons that originate from the debris of living plants and organisms to form crude oil and natural gas 2 the origin of hydrocarbons in different areas of a single reservoir 3 the conditions which determine the distribution of water oil and gas in the reservoir 4 the migration of subsurface fluids until they eventually accumulate in isolated traps 5 discussion of the traps as a function of sedimentary geology and tectonics This is based on the systems approach to the specific geologic and geochemical systems using analytical and statistical principles and examples of modern mathematical modeling of static and dynamic systems Discusses fundamental aspects of petroleum geology and geochemistry and generation migration accumulation evaluation and production of hydrocarbons Presents a systems approach to the specific geologic and geochemical systems

Advanced Digital Signal Processing of Seismic Data Wail A. Mousa,2020-01-16 Seismic data must be interpreted using digital signal processing techniques in order to create accurate representations of petroleum reservoirs and the interior structure of the Earth This book provides an advanced overview of digital signal processing DSP

and its applications to exploration seismology using real world examples The book begins by introducing seismic theory describing how to identify seismic events in terms of signals and noise and how to convert seismic data into the language of DSP Deterministic DSP is then covered together with non conventional sampling techniques The final part covers statistical seismic signal processing via Wiener optimum filtering deconvolution linear prediction filtering and seismic wavelet processing With over sixty end of chapter exercises seismic data sets and data processing MATLAB codes included this is an ideal resource for electrical engineering students unfamiliar with seismic data and for Earth Scientists and petroleum professionals interested in DSP techniques

Geostatistical and Geospatial Approaches for the Characterization of Natural Resources in the Environment N. Janardhana Raju, 2015-11-30 These proceedings of the IAMG 2014 conference in New Delhi explore the current state of the art and inform readers about the latest geostatistical and space based technologies for assessment and management in the contexts of natural resource exploration environmental pollution hazards and natural disaster research The proceedings cover 3D visualization time series analysis environmental geochemistry numerical solutions in hydrology and hydrogeology geotechnical engineering multivariate geostatistics disaster management fractal modeling petroleum exploration geoinformatics sedimentary basin analysis spatiotemporal modeling digital rock geophysics advanced mining assessment and glacial studies and range from the laboratory to integrated field studies Mathematics plays a key part in the crust mantle oceans and atmosphere creating climates that cause natural disasters and influencing fundamental aspects of life supporting systems and many other geological processes affecting Planet Earth As such it is essential to understand the synergy between the classical geosciences and mathematics which can provide the methodological tools needed to tackle complex problems in modern geosciences The development of science and technology transforming from a descriptive stage to a more quantitative stage involves qualitative interpretations such as conceptual models that are complemented by quantification e g numerical models fast dynamic geologic models deterministic and stochastic models Due to the increasing complexity of the problems faced by today s geoscientists joint efforts to establish new conceptual and numerical models and develop new paradigms are called for

SIAM Journal on Scientific Computing ,2008

Resources and Sustainable Development III Xi Xi Lu, Kin Che Lam, He Xu, Zhi Bin Jia, 2014-06-18 2014 International Conference on Energy and Environmental Protection ICEEP 2014 April 26 28 2014 Xi an China

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