Advanced Oil Well Drilling Engineering Handbook

Oil and gas are the most important non-renewable sources of energy. Exploring, producing and managing these resources in compliance with HSE standards are challenging tasks. New technologies, workflows and procedures have to be implemented. This book deals with some of these themes and describes some of the advanced technologies related to the oil and gas industry from HSE to field management issues. Some new technologies for geo-modeling, transient well testing and digital rock physics are also introduced. There are many more technical topics to be addressed in future books. This book is aimed at researchers, petroleum engineers, geoscientists and people working within the petroleum industry.

Intelligent Digital Oil and Gas Fields: Concepts, Collaboration, and Right-time Decisions delivers to the reader through the roadmap through the fast paced changes in the digital oil field in the form of new sensors, well mechanics such as downhole valves, data analytics and models for dealing with a barrage of data, and changes in the way professionals collaborate on decisions. The book introduces the new age of digital oil and gas technology and process components and provides a backdrop to the value and experience industry has achieved from these in the last few years. The book then takes the reader on a journey first at a well level through instrumentation and measurement for real-time data acquisition, and then provides practical information on analytics on the real-time data. Artificial intelligence techniques provide insights from the data. The road then travels to the “integrated asset” by detailing how companies utilize Integrated Asset Models to manage assets (reservoirs) within DOF context. From model to practice, new ways to operate smarter, more optimized wells enable set. Intelligent Digital Oil and Gas Fields is packed with examples and lessons learned from various case studies and provides extensive references for further reading and a final chapter on the “next generation digital oil field,” e.g., cloud computing, big data analytics and advances in nanotechnology. This book is a reference that can help managers, engineers, operations, and IT experts understand specifics on how to filter data to create useful information, address analytics, and link workflows across the production value chain enabling teams to make better decisions with a higher degree of certainty and reduced risk. Covers multiple examples and lessons learned from a variety of reservoirs from around the world and production situations. Includes techniques on change management and collaboration. Conveys real and readily applicable knowledge on technical equipment, workflows and data challenges such as acquisition and quality control that make up the digital oil and gas field solutions of today. Describes collaborative systems and ways of working and how companies are transitioning work force to use the technology and making more optimal decisions.

Sustainable Materials for Transitional and Alternative Energy, a new release in the Advanced Materials and Sensors for the Oil and Gas Industry series, comprises a list of processes across the energy industry coupled with the latest research involving advanced nanomaterials. Topics include green-based nanomaterials towards carbon capture, the importance of coal gasification in terms of fossil fuels and advanced materials utilized for fuel cells. Supplied from contributing experts in both academic and corporate backgrounds, the reference contains a precise balance on the developments, applications, advantages and challenges remaining. The book addresses real solutions as energy companies continue to deliver energy needs while lowering emissions. The oil and gas industry are shifting and implementing innovative ways to produce energy in an environmentally friendly way. One approach involves solutions developed using advanced materials and nanotechnology. Nanomaterials are delivering new alternatives for engineers making this a timely product for today’s market. Teaches readers about developments, workflows and protocols in advanced materials for today’s oil and gas sectors. Helps readers gain insights from an experienced list of editors and contributors from both academia and corporate backgrounds. Addresses environmental challenges in oil and gas through technological solutions in nanotechnology.

Volume 3 of Advanced Petrophysics presents the solutions to the 150 end-of-chapter exercises and projects in Volumes 1 and 2.

Advanced Well Control addresses all phases of well control, from the design stage of a well through plug and abandonment.
This DVD contains a collection of papers presented at Energy Materials 2014, a conference organized jointly by The Chinese Society for Metals (CSM) and The Minerals, Metals & Materials Society (TMS), and held November 4-6, 2014, in Xi’an, Shaanxi Province, China. With the rapid growth of the world’s energy production and consumption, the important role of energy materials has achieved worldwide acknowledgement. Material producers and consumers constantly seek the possibility of increasing strength, improving fabrication and service performance, simplifying processes, and reducing costs. Energy Materials 2014 has provided a forum for academics, researchers, and engineers around the world to exchange state-of-the-art development and information on issues related to energy materials. The papers on the DVD are organized around the following topics: Materials for Coal-Based Systems Materials for Gas Turbine Systems Materials for Nuclear Systems Materials for Oil and Gas Materials for Pressure Vessels

This book presents a complete review of the unique instruments and the communication technologies utilized in downhole drilling environments. These instruments and communication technologies play a critical role in drilling hydrocarbon wells safely, accurately and efficiently into a target reservoir zone by acquiring information about the surrounding geological formations as well as providing directional measurements of the wellbore. Research into instruments and communication technologies for hydrocarbon drilling has not been explored by researchers to the same extent as other fields, such as biomedical, automotive and aerospace applications. Therefore, the book serves as an opportunity for researchers to truly understand how instruments and communication technologies can be used in a downhole environment and to provide fertile ground for research and development in this area. A look ahead, discussing other technologies such as micro-electromechanical-systems (MEMS) and fourth industrial revolution technologies such as automation, the industrial internet of things (IIoT), artificial intelligence, and robotics that can potentially be used in the oil/gas industry are also presented, as well as requirements still need to be met in order to deploy them in the field.

Wave propagation is central to all areas of petroleum engineering, e.g., drilling vibrations, MWD mud pulse telemetry, swab-surge, geophysical ray tracing, ocean and current interactions, electromagnetic wave and sonic applications in the borehole, but rarely treated rigorously or described in truly scientific terms, even for disciplines such as geophysics or reservoir engineering. Engineers and geophysicists who have consulted internationally, provides an integrated, comprehensive, yet readable exposition covering all of the cited topics, offering insights, algorithms and validated methods never before published. A must on every petroleum engineering bookshelf! In particular, the book: Delivers drillingstring vibrations models coupling axial, torsional and lateral motions that predict rate-of-penetration, bit bounce and stick-slip as they depend on rock-bit interaction and bit assembly properties. Explains why assembly vibrations are not a neutral point cannot be observed from the surface even in vertical wells, but providing a proven method to avoid them. Demonstrates why Fermat’s “principle of least time” (used in geophysics) applies to non-dissipative media only, but using the “kinematic wave theory” developed at MIT, derives powerful methods applicable to general attenuative inhomogeneous media. Develops new approaches to mud acoustics and applying them to MWD telemetry modeling and strong transients in modern swab-surge applications. Derives new algorithms for borehole geophysics interpretation, e.g., Rh and Rv in electromagnetic wave and permeability in Stoneley waveform analysis, and outlines many more applications, e.g., wave loadings on offshore platforms, classical problems in wave propagation, and extensions to modern kinematic wave theory. These disciplines, important to all field-oriented activities, are not treated as finite element applications that are simply gridded, “number-crunched” and displayed, but as scientific disciplines deserving of clear explanation. General results are carefully motivated, derived and applied to real-world problems, with results demonstrating the importance and predictive capabilities of the new methods.

The oil and gas industry is one of the largest and most advanced sectors of engineering. This book on the oil and gas industry discusses topics related to well logging, reservoir engineering and drilling. Recent developments in the field of oil and gas engineering or petroleum engineering are related to technologies connecting gas reservoirs to the wells as improved computer models simulation of the reservoir. This book discusses the fundamentals as well as modern approaches of this field. This book elucidates the concepts and innovative models around prospective developments with respect to the oil and gas sector. This text presents researches and studies performed by experts across the globe. This book, which is informed by the latest techniques that are available in oil and gas exploration and extraction, will be of great help to researchers in the fields of petroleum engineering, fluid dynamics and geology. The extensive content of this book on oil and gas industry provides the readers with a thorough understanding of the subject.

This is the first book in the petroleum sector that sheds light on the real obstacles to sustainable development and provides solutions to each problem encountered. Each solution is complete with an economic analysis that clarifies why petroleum operations can continue with even greater profit than before while ensuring that the negative environmental impact is diminished. The new screening tools and models proposed in this book will provide one with proper guidelines to achieve true sustainability in both technology development and management of the petroleum sector.

Drilling and production wells are becoming more digitalized as oil and gas companies continue to implement machine learning and big data solutions to save money on projects while reducing energy and emissions. Op to now, there has been one single tool has bridged the gap between theory and application, showing how to go from computer modeling to practical use. Methods for Petroleum Well Optimization: Automation and Data Solutions provides today’s engineers and researchers real-time data solutions specific to drilling and production assets. Structured for training, this reference covers key concepts and detailed approaches from mathematical to real-time data solutions through technological advances. Topical indexes include digital well planning and construction, moving teams into Onshore Collaboration Centers, operations with the best machine learning (ML) and metaheuristic algorithms, complex trajectories for wellbore stability, real-time predictive analytics by data mining, optimum decision-making, and case-based reasoning. Supported by practical case studies, and with references including links to open-source code and fit-for-use MATLAEB, R, Julia, Python and other standard programming languages. Methods For Petroleum Well Optimization delivers a critical training guide for researchers and oil and gas engineers to take scientifically based approaches to solving real field
growth has prompted professionals experienced in conventional oil and gas exploitation and development to

Petroleum and natural gas still remain the single biggest resource for energy on earth. Even as alternative and renewable sources are developed, petroleum and natural gas continue to be, by far, the most used and, if engineered properly, the most cost-effective and efficient, source of energy on the planet. Drilling engineering is one of the most important links in the energy chain, being, after all, the science of getting the resources out of the ground for processing. Without drilling engineering, there would be no gasoline, jet fuel, and the myriad of other “have husband” products that people use all over the world every day. Following up on their previous books, also available from Wiley-Scrivener, the authors, two of the most well-respected, prolific, and progressive drilling engineers in the industry, offer this groundbreaking volume. They cover the basics tenets of drilling engineering, the most common problems that the drilling engineer faces day to day, and cutting-edge new technology and processes through their unique lens. Written to reflect the new, changing world that we live in, this fascinating new volume offers a treasure of knowledge for the veteran engineer, new hire, or student. This book is an excellent resource for petroleum engineering students, reservoir engineers, supervisors & managers, researchers and environmental engineers for planning every aspect of rig operations in the most sustainable, environmentally responsible manner, using the most up-to-date technological advancements in equipment and processes.

This short monograph focuses on the theoretical backgrounds and practical implementations concerning the thermodynamic modeling of multiphase equilibria of complex reservoir fluids using cubic equations of state. It aims to address the increasing needs of multiphase equilibrium calculations that are required to gain efficient and economical solutions to the complex issues related to reservoir development and well production. The book covers the state-of-the-art coverage on the recent improvements of cubic equations of state. Considering that stability test and flash calculation are two basic tasks involved in any multiphase equilibrium calculations, it elaborates on the rigorous mathematical frameworks dedicated to stability test and flash calculation. A special treatment is given to the new algorithms that are recently developed to perform robust and efficient three-phase equilibrium calculations. The book will be of value to graduate students who conduct research in the field of phase behavior, as well as software engineers who work on the development of multiphase equilibrium calculation algorithms.

Advances in Terrestrial Drilling: Ground, Ice, and Underwater includes the latest drilling and excavation principles and processes for terrestrial environments. The chapters cover the history of drilling and excavation, drill types, drilling techniques and their advantages and associated issues, rock coring including acquisition, damage control, caching and transport, and data interpretation, as well as unconsolidated soil drilling and borehole stability. Each chapter is written by a specialist in the field and covers a topic of specific interest to the drilling community. The book is designed to be a valuable reference for drilling engineers, students, researchers, and there is a strong emphasis on the practical aspects of drilling in these environments.

The book covers a wide range of topics, including the history of drilling and excavation, drill types, drilling techniques and their advantages and associated issues, rock coring, damage control, caching and transport, data interpretation, unconsolidated soil drilling, and borehole stability. It also includes case studies and practical examples, making it an invaluable resource for anyone involved in drilling and excavation in terrestrial environments.

"Gas Well Testing Handbook deals decisively with the theory and practice of gas well testing, including pressure transient analysis technique, analytical methods required to interpret well behavior, evaluating reservoir quality, reservoir simulation, and production forecasts. A highly practical volume, this book is written for drilling engineers, well logging engineers, reservoir engineers, engineering students, geologists, and geophysicists."--BOOK JACKET.

Applied Drilling Engineering presents engineering science fundamentals as well as examples of engineering applications involving those fundamentals.

Formulas and Calculations for Petroleum Engineering unlocks the capability for any petroleum engineering individual, experienced or not, to solve problems and locate quick answers, eliminating non-productive time spent searching for that right calculation. Enhanced with lab data experiments, practice examples, and a complimentary online software toolbox, the book presents the most convenient and practical reference for all of the calculations of a given petroleum engineer. Covering the full spectrum, this reference gives single-point reference to all critical modules, including drilling, production, reservoir engineering, well testing, well logging, enhanced oil recovery, well completion, fracturing, fluid flow, and even petroleum economics. Presents single-point access to all petroleum engineering equations, including calculation of modules covering drilling, completion and fracturing. Helps readers understand petroleum economics by including formulas on precipitation rate, cashflow analysis, and the optimum number of development wells.

As the shale revolution continues in North America, unconventional resource markets are emerging on every continent. In the next eight to ten years, more than 100,000 wells and one- to two-million hydraulic fracturing stages could be executed, resulting in close to one trillion dollars in industry spending. This growth has promoted professionals experienced in conventional oil and gas exploitation and development to
acquire practical knowledge of the unconventional realm. Unconventional Oil and Gas Resources: Exploitation and Development provides a comprehensive understanding of the latest advances in the exploitation and development of unconventional resources. With an emphasis on shale, this book: Addresses all aspects of the exploitation and development process, from data mining and accounting to drilling, completion, stimulation, production, and environmental issues. Offers in-depth coverage of sub-surface measurements (geological, geophysical, petrophysical, geochemical, and geomechanical) and their interpretation. Discusses the use of microseismic, fiber optic, and tracer reservoir monitoring technologies and the use of artificial intelligence and machine learning to identify reservoirs and develop solutions. Explores future trends in reservoir and industry technologies for unconventional resources.

Uniquely comprehensive and up to date, this book covers terrestrial as well as extraterrestrial drilling and excavation, combining the technology of drilling with the state of art in robotics. The authors come from industry and top ranking public and corporate research institutions and provide here real-life examples, problems, solutions and case studies, backed by color photographs throughout. The result is a must-have for oil companies and all scientists involved in planetary research with robotic probes. With a foreword by Harrison “Jack” Schmitt -- the first geologist to drill on the moon.


This second edition of the original volume adds significant new innovations for revolutionizing the processes and methods used in petroleum reservoir simulations. With the advent of shale drilling, hydraulic fracturing, and underbalanced drilling, the petroleum industry has come a virtual renaissance of scientific methodologies in the oil and gas industry. New ways of thinking are being pioneered, and Dr. Islam and his team have, for years now, been at the forefront of these important changes. This book clarifies the underlying mathematics and physics behind reservoir simulation and makes it easy to have a range of simulation results along with their respective probability. This makes the oil and gas industry rather than guesswork. The book offers by far the strongest tool for engineers and managers to back up reservoir simulation predictions with real science. The book adds transparency and ease to the process of reservoir simulation in a way never witnessed before. Finally, No other book provides readers complete access to the 3D, phase reservoir simulation software that is available with this text. A must-have for any reservoir engineer or petroleum engineer working upstream, whether in exploration, drilling, or production, this text is also a valuable textbook for advanced students and graduate students in petroleum or chemical engineering departments.

Finally, there is a one-stop reference book for the petroleum engineer which offers practical, easy-to-use tables, solutions to common problems, and access to information not available in standard textbooks. This is a must-have for any engineer or non-engineer working in the petroleum industry, anyone studying petroleum engineering, or any reference library. Written by one of the most well-known and prolific petroleum engineering writers who has ever lived, this modern classic is sure to become a staple of any engineer’s library and a handy reference in the field. Whether open on your desk, on the hood of your truck at the well, or on an offshore platform, this is the only book available that covers the petroleum engineer’s rules of thumb that have been compiled over decades. Some of these “rules,” until now, have been “unspoken but everyone knows,” while others are meant to help guide the engineer through some of the more recent breakthroughs in the industry’s technology, such as hydraulic fracturing and enhanced oil recovery. The book covers every aspect of crude oil, natural gas, refining, recovery, and any other area of petroleum engineering that is useful for the engineer to know or to be able to refer to, offering practical solutions to everyday engineering problems and a comprehensive reference work that will stand the test of time and provide aid to its readers. If there is only one reference work you buy in petroleum engineering, this is it.

Drilling circulation systems in the oil and gas industry have advanced significantly in the last decade. The major changes resulted from the merging of air and gas drilling and underbalanced drilling with traditional liquid drilling systems. During the several years of teaching drilling engineering courses in both academic and industry, the authors realised the need for a book that covers modern drilling practices. The books that are currently available fail to provide adequate information about how engineering principles are applied to solving problems that are frequently encountered in drilling systems. This fact motivated the authors to write this book. This book is written primarily for well-drilling engineers and college students of both senior and graduate levels.

Presented in an easy-to-use format, Formulas and Calculations for Drilling Operations is a quick reference for day-to-day work out on the rig. It also serves as a handy study guide for drilling and well control certification courses. Virtually all the mathematics required on a drilling rig is here in one convenient source, including formulas for pressure gradient, specific gravity, pump, output, annular velocity, buoyancy factor, and many other topics.

Casing design has followed an evolutionary trend and most improvements have been made due to the advancement of technology. Contributions to the technology in casing design have come from fundamental research and field tests, which have made casing safe and economical. This book gathers together much available information in the subject area and shows how it may be used in deciding the best procedure for casing design. It is a guide to optimizing casing design for deriving maximum profit from a particular well. The problems and their solutions, which are provided in each chapter, and the computer program (3.5 in. disk) are intended to serve two purposes: firstly, as illustrations for students and practicing engineers to understand the subject matter; and secondly, to enable them to optimize casing design for a wide range of wells to be drilled in the future.

This book presents the signal processing and data mining challenges encountered in drilling engineering, and describes the methods used to overcome them. In drilling engineering, many signal processing technologies are required to solve practical problems, such as downhole information transmission, spatial attitude of drillstring, drillstring dynamics, seismic activity while drilling, among others. This title attempts to
bridge the gap between the signal processing and data mining and oil and gas drilling engineering communities. There is an urgent need to summarize signal processing and data mining issues in drilling engineering so that practitioners in these fields can understand each other in order to enhance oil and gas drilling functions. In summary, this book shows the importance of signal processing and data mining to researchers and professional drilling engineers and open up a new area of application for signal processing and data mining scientists.

Sustainable Materials for Oil and Gas Applications, a new release in the Advanced Materials and Sensors for the Oil and Gas Industry series, comprises a list of processes across the upstream and downstream sectors of the industry and the latest research on advanced nanomaterials. Topics include enhanced oil recovery mechanisms of nanofluids, health and safety features related to nanoparticle handling, and advanced materials for produced water treatments. Supplied from contributing experts in both academic and corporate backgrounds, the reference contains developments, applications, advantages and challenges. Located in one convenient resource, the book addresses real solutions as oil and gas companies try to lower emissions. As the oil and gas industry are shifting and implementing innovative ways to produce oil and gas in an environmentally friendly way, this resource is an ideal complement to their work. Covers developments, workflows and protocols in advanced materials for today’s oil and gas sectors Helps readers gain insights from an experienced list of editors and contributors from both academia and corporate backgrounds Address environmental challenges in oil and gas through technological solutions in nanotechnology

Once a natural gas or oil well is drilled, and it has been verified that commercially viable, it must be “completed” to allow for the flow of petroleum or natural gas out of the formation and up to the surface. This process includes: casing, pressure and temperature evaluation, and the proper instillation of equipment to ensure an efficient flow out of the well. In recent years, these processes have been greatly enhanced by new technologies. Advanced Well Completion Engineering summarizes and explains these advances while providing expert advice for deploying these new breakthrough engineering systems. The book has two themes: one, the idea of preventing damage, and preventing formation from drilling into an oil formation to putting the well introduction stage; and two, the utilization of nodal system analysis method, which optimizes the pressure distribution from reservoir to well head, and plays the sensitivity analysis to design the tubing diameters first and then the production casing size, so as to achieve whole system optimization. With this book, drilling and production engineers should be able to improve operational efficiency by applying the latest state of the art technology in all facets of well completion during development drilling-completion and work over operations. One of the only books devoted to the key technologies for all major aspects of advanced well completion activities. Unique coverage of all aspects of well completion activities based on 25 years in the exploration, production and completion industry. Matchless in-depth technical advice for achieving operational excellence with advance solutions.

Modern Well Design – Second Edition presents a unified approach to the well design process and drilling operations. Following an introduction to the field, the second chapter addresses drilling fluids, as well as optimal mud weight, hole cleaning, hydraulic optimization, and methods to handle circulation losses. A relatively large chapter on geomec

Petroleum engineers, drilling and production professionals, and advanced petroleum engineering students will welcome this important new book on annular flows in oil and gas well drilling operations. It is the only book on the subject presently available to the industry that combines rigorous theory, practical examples, and important applications. The book describes several annular borehole flow models that deal with eccentric, nonrotating flow, concentric rotating flow, and recirculating heterogeneous flow. These models are designed to handle the special problems that arise from drilling and producing deviated and horizontal wells, problems such as cutting transport, stuck pipe, cementing, and coiled tubing. State-of-the-art computer modeling techniques "Snapshots" showing computed velocity, apparent viscosity, viscous stress, and local shear rate for different annuli Practical rule of thumb and extensive applications to real world problems make this an important reference tool for drilling and production professionals

This two-volume set includes the latest principles behind the processes of drilling and excavation on Earth and other planets. It covers the categories of drills, the history of drilling and excavation, various drilling techniques and associated issues, rock coring (acquisition, damage control, caching and transport, restoration of “in-situ” conditions and data interpretation), as well as unconsolidated soil drilling and borehole stability. It describes the drilling process from basic science and associated process of breaking and penetrating various media and the required hardware and the process of excavation and analysis of the sampled media.

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