



DEVELOPMENTS IN
PETROLEUM SCIENCE

60

GEOPHYSICS FOR PETROLEUM ENGINEERS

FRED AMINZADEH AND SHIVAJI N. DASGUPTA

SEVENTH EDITION
JOHN CUBITT

Geophysics For Petroleum Engineers

Fred Aminzadeh, Shivaji N. Dasgupta



Geophysics For Petroleum Engineers:

Geophysics for Petroleum Engineers Fred Aminzadeh, Shivaji N. Dasgupta, 2013-12-09 Geophysics for Petroleum Engineers focuses on the applications of geophysics in addressing petroleum engineering problems. It explores the complementary features of geophysical techniques in better understanding characterizing producing and monitoring reservoirs. This book introduces engineers to geophysical methods so that they can communicate with geophysicist colleagues and appreciate the benefits of their work. These chapters describe fundamentals of geophysical techniques, their physical bases, their applications and limitations, as well as possible pitfalls in their misuse. Case study examples illustrate the integration of geophysical data with various other data types for predicting and describing reservoir rocks and fluid properties. The examples come from all over the world with several case histories from the fields in the Middle East. Introduces geophysical methods to engineers. Helps understanding characterizing producing and monitoring of geophysical techniques. Updates the changing needs of reservoir engineering.

Geophysics for Petroleum Engineers

Fred Aminzadeh, Shivaji N. Dasgupta, 2013-12-09 Geophysical techniques apply the principles of physics for study of physical responses of rocks under passive or active perturbation. Geophysical data acquisition, processing and interpretation are driven by established scientific principles. Data from geophysical tools provide coverage with spatially continuous high density measurements. Well data like cores and well logs provide vertically high resolution measurements at the well location, however the distribution of wells is sparse and discontinuous. The detailed spatial coverage from geophysical data are calibrated with analysis of well logs, pressure tests, cores, geologic depositional knowledge and other information from appraisal wells. The methods use high precision sensors that measure the properties on the earth's surface, in oceans, in wells and from the air, also from satellites. They measure changes of physical properties and calibrate the measured geophysical attributes with rock properties. The data play an important role in developing a gross reservoir model. The reservoir architecture or structure and the reservoir rock and fluid properties are derived from the analysis and data integration. Other reservoir properties that can affect geophysical measurements are density, oil viscosity, stresses and fractures. The interpretation has inherent ambiguity or multiple interpretations. Geophysics contributes to reservoir characterization, reservoir monitoring and its management by adding maximum value in improving production plan and by minimizing risk, e.g. risk of dry hole, risk of blow out, risk of inefficient recovery process among others. Multiple geologic parameters are assessed with the same geophysical data.

Geophysics for Petroleum Engineers

Fred Aminzadeh, Shivaji N. Dasgupta, 2013-12-09 The process of drilling an oil or gas well requires knowledge of all geologic features expected to be encountered along the way from the surface of the ground to the target reservoir. Thus, in addition to steering the well so as to intersect hydrocarbon bearing reservoirs, the reservoir engineer must assure to a reasonable degree of confidence that the well drills successfully and safely to the target.

Geophysical measurements help ensure a successful drilling program 3D seismic provides a picture of the subsurface from the surface to the target *Geophysics for Petroleum Engineers* Fred Aminzadeh, Shivaji N. Dasgupta, 2013-12-09 Origin of petroleum begins with the formation of organic matter burial of organic matter in a basin maturation of the organic content with pressure temperature at burial depths Petroleum system includes source rocks reservoir rocks reservoir traps migration paths seals etc Hydrocarbons mature in source rocks migrate into reservoirs Reservoir rocks are containers of hydrocarbons with sufficient interconnected pore spaces these are sedimentary rocks clastic sandstone shale carbonate rocks Migration pathways for matured hydrocarbons migration is in separate phases from higher potential to a lower potential from deepest to the shallowest The hydrocarbons migrate into different types of petroleum traps such as anticlinal fault salt related stratigraphic traps Reservoir seals are rocks with low permeability drapes hydrocarbons traps to ensure that entrapped fluids do not escape Integration of disciplines geology geophysics petrophysics is the key to predicting reservoir geometry volume in assessment of reserves **Geophysics for Petroleum Engineers** Fred Aminzadeh, Shivaji N. Dasgupta, 2013-12-09

Geophysical methods are being applied that are specifically relevant to the exploration of and production from unconventional reservoirs While many of the techniques have common applications for both conventional and unconventional reservoirs there are also some significant differences in focus Much of the unconventional reservoirs are from shale formations Characterizing of fracture system in such reservoirs is of prime importance not only to identify the sweet spots for well placement but also for optimum drilling and production from such fractured reservoirs Combining conventional and microearthquake seismic data has proven to improve the characterization process Another factor for drilling through shale reservoirs is the need for stimulation through hydraulic fracturing Use of microseismic data for monitoring the frac process has gained prominence in recent years Different types of design to acquire such geophysical data and to utilize them for multistage fracking process as well as their integration with the conventional seismic data have been developed

Geophysics for Petroleum Engineers Fred Aminzadeh, Shivaji N. Dasgupta, 2013-12-09 Accurate reservoir characterization is a key step in developing monitoring and managing a reservoir and optimizing production To achieve accuracy and to ensure that all the information available at any given time is incorporated in the reservoir model reservoir characterization must be dynamic To achieve this goal however one starts with a simple model of the reservoir at a given time point a static model As new petrophysical seismic and production data become available the reservoir model is updated to account for the changes in the reservoir The updated model would be a better representative of the current status of the reservoir Both static reservoir properties such as porosity permeability and facies type and dynamic reservoir properties such as pressure fluid saturation and temperature needs to be updated as more field data become available Characterizing a reservoir by updating of both static and dynamic reservoir properties during the life of the field is referred to as dynamic reservoir characterization Dynamic reservoir characterization is discussed in dealing with time lapse or 4D geophysical data

and reservoir monitoring This chapter however focuses on static reservoir characterization

Geophysics for Petroleum Engineers Fred Aminzadeh, Shivaji N. Dasgupta, 2013-12-09 In most oil exploration and production problems we deal with limited and incomplete data We are constantly trying to extrapolate information from sparse measurements for example sparse well data and limited core measurements on the one hand and large volumes of seismic data with limited spatial resolution on the other hand We resort to statistical methods to accomplish the data extrapolation and the integration of diverse data sets in constructing a coherent and meaningful model of the subsurface Traditional statistical methods both for spatial and temporal extrapolation have been used in E P for several decades One of the main uses of statistics has been for reservoir characterization through integrating information and data from various sources with varying degrees of uncertainty such as log well tests and seismic data Other applications include establishing relationships between measurements and reservoir properties and reserve estimation and oil field economics along with the associated risk factors

Geophysics for Petroleum Engineers Fred Aminzadeh, Shivaji N. Dasgupta, 2013-12-09 Monitoring or surveillance of reservoir fluids during the producing life of a field and mapping of oil water and gas oil interface are necessary for understanding the fluid dynamics This information would allow improving developmental plans locate production and injection wells and optimize reservoir management Engineers would like to have information between the well control for field wide surveillance of fluid front This would permit forecasting arrival of water in a producing well or understanding the effectiveness of sweep from the injected water or gas Geophysical monitoring could have major impact on ultimate recovery and drilling efficiency

Geophysics for Petroleum Engineers Fred Aminzadeh, Shivaji N. Dasgupta, 2013-12-09 Petrophysical analysis of well logs and cores provide information about formation rocks and fluids in the borehole Various types of well logs measure different properties in the well Analysis of the data determines the volume of hydrocarbons present in a reservoir and its potential to flow through the reservoir rock into the wellbore This helps us to understand and optimize the producibility of a reservoir When oil and gas wells are drilled physical property measurements are taken using specialized geophysical instrument packages either on wireline cables after the drill pipe has been removed wireline logs or from the borehole while drilling with instruments attached to drill collars

LWD Stratigraphic Reservoir Characterization for Petroleum Geologists, Geophysicists, and Engineers Roger M. Slatt, 2013-11-21 There are many tools and techniques for characterizing oil and gas reservoirs Seismic reflection techniques include conventional 2D and 3D seismic 4D time lapse seismic multicomponent seismic crosswell seismic seismic inversion and seismic attribute analysis all designed to enhance stratigraphy structure detection resolution and characterization These techniques are constantly being improved Drilling and coring a well provides the ground truth for seismic interpretation Rock formations are directly sampled by cuttings and by core and indirectly characterized with a variety of conventional and specialized well logs To maximize characterization and optimize production many of these tools as possible should be employed It is often less expensive to utilize a wide variety of tools that directly

image or measure reservoir properties at different scales than to drill one or two dry holes Guide to Petroleum Engineering Career Engr. Azunna I. B. Ekejiuba (Ph.D.),2020-11-02 Guide to Petroleum Engineering Career By Engr Azunna I B Ekejiuba Ph D Historically human beings have used petroleum in one form or another since ancient times more than 8000 years ago However the birth of the modern petroleum industry was on August 27 1859 when Colonel Edwin L Drake used the then popular cable tool also called churn or percussion drilling method to drill the actual historically first oil well on a stream called Oil Creek near Titusville Pennsylvania at a depth of 69 feet six inches 21 metres In recent years the advent of the transcontinental transmission lines and petrochemical industries has increased the value of natural gas methane to a fuel in great demand and a chemical feedstock raw material for many modern commercial and industrial products particularly the synthesis of plastics rubber fertilizers solvents adhesives pesticides gas to methanol GTM liquefied natural gas LNG et cetera Guide to Petroleum Engineering Career is an ideal career guide lecture note practical manual petrochemical production guide information source to all categories of practicing petroleum industry workers and enthusiasts who are interested to know more about the current key mankind energy resources as well as a reference on the emerging renewable fuel economy which reflects the challenges faced by the millennium petroleum engineers **Introduction to Petroleum Engineering** John R. Fanchi,Richard L. Christiansen,2016-09-13 Presents key concepts and terminology for a multidisciplinary range of topics in petroleum engineering Places oil and gas production in the global energy context Introduces all of the key concepts that are needed to understand oil and gas production from exploration through abandonment Reviews fundamental terminology and concepts from geology geophysics petrophysics drilling production and reservoir engineering Includes many worked practical examples within each chapter and exercises at the end of each chapter highlight and reinforce material in the chapter Includes a solutions manual for academic adopters **Petroleum Development and Technology** American Institute of Mining, Metallurgical, and Petroleum Engineers. Petroleum Branch,American Institute of Mining, Metallurgical, and Petroleum Engineers Petroleum Division,American Institute of Mining and Metallurgical Engineers. Petroleum Branch,1926 The Integration of Geology, Geophysics, Petrophysics, and Petroleum Engineering in Reservoir Delineation, Description, and Management ,1991 Applied Geothermics for Petroleum Engineers I.M. Kutasov,1999-05-24 The purpose of Applied Geothermics for Petroleum Engineers is to present in a clear and concise form methods of utilizing the data of temperature surveys in deep boreholes as well as the results of field laboratory and analytical investigations in geothermics to a wide audience Although some aspects of the subject of this book have been discussed in several previous books and numerous papers Applied Geothermics for Petroleum Engineers is the first book on this topic available to the petroleum engineering community The objective of the book is to present the state of knowledge and prediction of downhole and formations temperatures during well drilling well completion shut in and production Applied Geothermics for Petroleum Engineers is intended for drilling engineers impact of elevated temperatures on well drilling and completion technology

Arctic drilling production engineers temperature regime of production injection and geothermal wells Arctic production reservoir engineers temperature field of reservoirs thermal properties of formations and formation fluids well logging engineers interpretation of electrical resistance mud density and temperature logs and geophysicists and geologists interpretation of geophysical data calculation of the terrestrial heat flow reconstruction of past climates *Bibliography of Borehole Geophysics as Applied to Ground-water Hydrology* Tacie A. Taylor, Joyce A. Dey, 1985 Petrophysics, 1994-01-01

Oil and Gas Exploration Said Gaci, Olga Hachay, 2017-02-13 Oil and Gas Exploration Methods and Application presents a summary of new results related to oil and gas prospecting that are useful for theoreticians and practical professionals The study of oil and gas complexes and intrusions occurring in sedimentary basins is crucial for identifying the location of oil and gas fields and for making accurate predictions on oil findings Volume highlights include Advanced geophysical techniques for achieving hydrocarbon exploration efficiency from beneath the Earth Discussion of theoretical and practical approaches in solving problems related to exploring and mining new oil and gas deposits New geological concepts for predicting potential hydrocarbon targets Novel methods of control of the outworking of these deposits using different geophysical methods significant for optimization of mining hydrocarbon and carbonate deposits Estimation of the degree of outworking of oil and gas deposits to facilitate the use of space time monitoring of different kinds of fields Analysis of exploration data by an efficient processing system based on strong methods proven mathematically Oil and Gas Exploration is a valuable resource for exploration geophysicists petroleum engineers geoengineers petrologists mining engineers and economic geologists who will gain insights into exploring new methods involved in finding natural resources from our Earth Read an interview with the editors to find out more <https://eos.org/editors-vox-where-and-how-can-we-find-new-sources-of-oil-and-gas> Transactions of the American Institute of Mining and Metallurgical Engineers, 1927

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