

# Reservoir Geomechanics

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praise for reservoir geomechanics

geomechanics is the basic science for many engineering fields including oil and gas recovery mining civil engineering water supply etc as well as for many environmental sciences including earthquake prediction ecology landscape dynamics and explosion works historically the major concepts of geomechanics were founded on the methods of the elasticity theory and the static equilibrium of joints with solid friction underground hydrodynamics was developed quite separately and included only simple conventional ideas of elastic pore space deformation today the situation is drastically different tremendous achievements in numerical computer technique have eliminated many of the routine difficulties of problem solution with respect to selected mathematical models as the result major efforts now are applied to sophisticated experimental studies and to new applications of generalized continuum theories of course traditional rheological schemes have been adjusted to be into account the real properties of such geomaterials as soils rocks and ice the main

changes have been connected with the kinematics of the internal structure of geomaterials that influences their strength and that can play unusual roles in dynamic processes the theoretical considerations are in good agreement with experimental observations in situ because of precise measuring devices impact of modern physics concepts and large scale monitoring

a comprehensive overview of the key geologic geomechanical and engineering principles that govern the development of unconventional oil and gas reservoirs covering hydrocarbon bearing formations horizontal drilling reservoir seismology and environmental impacts this is an invaluable resource for geologists geophysicists and reservoir engineers

conventional geomechanics cannot provide suitable modes of behavior and performance for today s unconventional reservoirs such as the evolution of porosity permeability relationships with multiphysics coupled effects which ultimately help determine production rates unconventional reservoir geomechanics delivers a reference that discusses a variety of approaches tailored in developing geomechanical models and provides a smarter tool to predict hydrocarbon extraction specifically for unconventional reservoirs starting with a full explanation on a more unified theoretical framework discussing permeability characterization the authors advance to offer a full range of new modelling solutions followed by a series of lab scale and field scale applications to match the history verified models bridging a gap for engineers to fully understand the interactions of multiple processes in field scales from theory to practice going a step further other applications such as co2 sequestration in coal seam or shale gas reservoirs are explained to illustrate how unconventional reservoir geomechanics can be extended to solve related and even more complex challenges combining both theoretical and practical models backed by data unconventional reservoir geomechanics gives reservoir engineers a smarter and more sophisticated tool to approach today s more complex geomechanical modeling challenges provides a foundation of solutions for the extraction of unconventional resources and other related areas introduces a completely new theoretical framework of coupled multi spatial and multi temporal multi physics in rocks with significant contracts of physical properties among components focuses on understanding and inclusion of four characteristics of unconventional rocks with applications to areas such as shale gas coal seam and co2 sequestration

geomechanics is the study of the mechanical behavior of geologic formations geomechanics plays an important role in the life of a well without a proper understanding of the geomechanics of a reservoir the projects associated with it may run into problems related to drilling completion and production geomechanics is important for issues such as wellbore integrity sand production and recovery in heavy oil reservoirs while studying geomechanics proper weight is given to mechanical properties such as effective mean stress volumetric strain etc and the changes that these properties cause in other properties such as porosity permeability and yield state the importance of analyzing geomechanics increases for complex reservoirs or reservoirs with heavy oil this project is a case study of the west sak reservoir in the north slope of alaska waterflooding has been implemented as enhanced oil recovery method in the

reservoir in this study a reservoir model is built to understand the behavior and importance of geomechanics for the reservoir first a fluid model is built after that reservoir simulation is carried out by building two cases one coupled with geomechanics and one without geomechanics coupling geomechanics to simulations led to the consideration of many important mechanical properties such as stress strain subsidence etc once the importance of considering geomechanical properties is established different injection and production pressure ranges are used to understand how pressure ranges affect the geomechanical properties the sensitivity analysis defines safer pressure ranges contingent on whether the formation is yielding or not the yielding criterion is based on mohr s coulomb failure criteria in the case of waterflooding injection pressure should be maintained at 3800 psi or lower and production at 1600 psi or higher and if injection rates are used as the operating parameter it should be maintained below 1000 bbls day it is also observed that injection pressure dominates the geomechanics of the reservoir

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