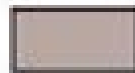


Fault core



Inner Fault Zone



Weathered interval



Faults



Outer Fault Zone

# Naturally Fractured Reservoirs

**John C. Lorenz, Scott P. Cooper**



## **Naturally Fractured Reservoirs:**

**Naturally Fractured Reservoirs** Roberto Aguilera, 1980 This book deals exclusively with naturally fractured reservoirs and includes many subjects usually treated in separate volumes A highly practical edition Naturally Fractured Reservoirs is written for students reservoir geologists log analysts and petroleum engineers

**Geologic Analysis of Naturally Fractured Reservoirs** Ronald A. Nelson, 1985

**Geomechanics, Fluid Dynamics and Well Testing, Applied to Naturally Fractured Carbonate Reservoirs** Nelson Enrique Barros Galvis, 2018-05-02 This thesis presents an important step towards a deeper understanding of naturally fractured carbonate reservoirs NFCRs It demonstrates the various kinds of discontinuities using geological evidence mathematical kinematics model and computed tomography and uses this as a basis for proposing a new classification for NFCRs Additionally this study takes advantage of rock mechanics theory to illustrate how natural fractures can collapse due to fluid flow and pressure changes in the fractured media The explanations and mathematical modeling developed in this dissertation can be used as diagnostic tools to predict fluid velocity fluid flow tectonic fracture collapse pressure behavior during reservoir depleting considering stress sensitive and non stress sensitive with nonlinear terms in the diffusivity equation applied to NFCRs Furthermore the book presents the description of real reservoirs with their field data as the principal goal in the mathematical description of the realistic phenomenology of NFCRs

**Applied Concepts in Fractured Reservoirs** John C. Lorenz, Scott P. Cooper, 2020-03-16 A much needed precise and practical treatment of a key topic in the energy industry and beyond Applied Concepts in Fractured Reservoirs is an invaluable reference for those in both industry and academia Authored by renowned experts in the field this book covers the understanding evaluation and effects of fractures in reservoirs It offers a comprehensive yet practical discussion and description of natural fractures their origins characteristics and effects on hydrocarbon reservoirs It starts by introducing the reader to basic definitions and classifications of fractures and fractured reservoirs It then provides an outline for fractured reservoir characterization and analysis and goes on to introduce the way fractures impact operational activities Well organized and clearly illustrated throughout Applied Concepts in Fractured Reservoirs starts with a section on understanding natural fractures It looks at the different types their dimensions and the mechanics of fracturing rock in extension and shear The next section provides information on measuring and analyzing fractures in reservoirs It covers logging core for fractures taking measuring and analyzing fracture data new core vs archived core CT scans comparing fracture data from outcrops core and logs and more The last part examines the effects of natural fractures on reservoirs including the permeability behavior of individual fractures and fracture systems fracture volumetrics effects of fractures on drilling and coring and the interaction between natural and hydraulic fractures Teaches readers to understand and evaluate fractures Compiles and synthesizes various concepts and descriptions scattered in literature and synthesizes them with unpublished oil field observations and data along with the authors own experience Bridges some of the gaps between reservoir engineers and

geologists Provides an invaluable reference for geologists and engineers who need to understand naturally fractured reservoirs in order to efficiently extract hydrocarbons Illustrated in full color throughout Companion volume to the Atlas of Natural and Induced Fractures in Core Naturally Fractured Reservoir Characterization Wayne Narr,2006 Naturally fractured reservoirs present unique and specialized challenges to hydrocarbon extraction This book seeks to confront many of these challenges by providing an introduction to the engineering and geological character of naturally fractured reservoirs The focus is on understanding fractures in a reservoir how to determine whether fractures are important to hydrocarbon producibility and if so how to analyze the fracture system for the purpose of improved reservoir management *Getting Up to Speed* Wayne Narr,2011 *A Study of Naturally Fractured Reservoirs* Zhicheng Chen,1982 *A Study of Naturally Fractured Reservoirs* Chih-Cheng Chen,1982 **Naturally Fractured Reservoirs and Normal Reservoirs** S. L. Sah,2017 *Numerical Modeling of Fracture Permeability Change in Naturally Fractured Reservoirs Using a Fully Coupled Displacement Discontinuity Method* Qingfeng Tao,2010 Fractures are the main flow channels in naturally fractured reservoirs Therefore the fracture permeability is a critical parameter to production optimization and reservoir management Fluid pressure reduction caused by production induces an increase in effective stress in naturally fractured reservoirs The change of effective stress induces fracture deformation and changes fracture aperture and permeability which in turn influences the production Coupled interactions exist in the fractured reservoir i fluid pressure change induces matrix deformation and stress change ii matrix deformation induces fluid volume change and fluid pressure change iii fracture deformation induces the change of pore pressure and stress in the whole field the influence disappears at infinity iv the change of pore pressure and stress at any point has an influence on the fracture and induces fracture deformation To model accurately the influence of pressure reduction on the fracture permeability change in naturally fractured reservoirs all of these coupled processes need to be considered Therefore in this dissertation a fully coupled approach is developed to model the influence of production on fracture aperture and permeability by combining a finite difference method to solve the fluid flow in fractures a fully coupled displacement discontinuity method to build the global relation of fracture deformation and the Barton Bandis model of fracture deformation to build the local relation of fracture deformation The fully coupled approach is applied to simulate the fracture permeability change in naturally fracture reservoir under isotropic in situ stress conditions and high anisotropic in situ stress conditions respectively Under isotropic stress conditions the fracture aperture and permeability decrease with pressure reduction caused by production and the magnitude of the decrease is dependent on the initial effective in situ stress Under highly anisotropic stress the fracture permeability can be enhanced by production because of shear dilation The enhancement of fracture permeability will benefit to the production of oil and gas *Characterization of Naturally Fractured Reservoirs from Conventional Well Logs* Liliana Patricia Martinez-Torres,2002 **Geologic Analysis of Naturally Fractured Reservoirs** Govind Kumar,2015-08 Reservoirs have been identified as being

fracture controlled and great strides have been made in the integration of the work and approaches of the many disciplines needed to work successfully with these reservoirs. Indeed, from exploration through blow down, the effective management of these reservoirs requires the application of multi-disciplinary approaches more than virtually any other type of petroleum reservoir. Geologists, engineers and petrophysicists concerned with hydrocarbon production from naturally fractured reservoirs will find a valuable tool for obtaining pertinent rock data to evaluate reserves and optimize well location and performance.

*Characterization of Fluid Flow in Naturally Fractured Reservoirs* Ronald D. Evans, Bartlesville Energy Technology Center, John McGhee, United States. Department of Energy, University of Central Florida. College of Engineering, 1980

*Multi-rate Testing in Naturally Fractured Reservoirs* Djilali Boulenouar, 2003

*Projects Investigating Oil Recovery from Naturally Fractured Reservoirs* United States. National Petroleum Technology Office, 1999

**Simulating Water Tracer Test in Naturally Fractured Reservoirs Using Discrete Fracture and Dual Porosity Models** Farshad Lalehrokh, 2005

A naturally fractured reservoir (NFR) is a reservoir with a connected network of fractures created by natural processes such as diastrophism and volume shrinkage. Ordóñez et al. (2001) There are two models to simulate this kind of reservoirs: the discrete fracture model and the dual porosity model. In the dual porosity model, the matrix blocks occupy the same physical space as the fracture network and are identical rectangular parallelepipeds with no direct communication between isotropic and homogeneous matrix blocks. However, each fracture and matrix property is defined separately in the discrete fracture model. Another feature of this thesis is tracer testing. In this process, a chemical or radioactive element is injected to the reservoirs and then it can be traced using the devices which are designed to detect the tracers. Tracer tests have several advantages such as determining residual oil saturation, identifying barriers or high permeability zones in reservoirs and providing the information on flow patterns. Limited number of research studies has been done on performing tracer tests in naturally fractured reservoirs. Also, because there is not enough information about the advantages and disadvantages of the discrete fracture and the dual porosity models, researchers and engineers lack the expertise to confidently select either the discrete fracture or the dual porosity models to simulate the different types of NFRs. In this thesis, we compared the oil and water productions and tracer concentration curves in various reservoir conditions using both the discrete fracture and the dual porosity models. We used the ECLIPSE which is a commercial software package in the area of petroleum industry to model a naturally fractured reservoir. We performed a simple waterflooding with two conservative tracers on the reservoirs. The results presented in each section include the graphs of the oil production rate, water production rate and tracer concentration. In addition, we presented the oil saturation profiles of a cross section which includes the production and injection wells. The results illustrated that both the discrete fracture and the dual porosity models are in good agreement except for a few special cases. Generally, the oil production using the dual porosity model is more than in the discrete fracture model. The major disadvantage of the dual porosity model is that the fluid distribution in

the matrix blocks is changing homogenously during the waterflooding period In other words ECLIPSE shows a constant value of the oil and water saturations in each time step for the matrix blocks However the dual porosity model is 3 to 4 times faster than the discrete fracture model In the discrete fracture model the users have complete control in defining the reservoirs For example the fracture aperture fracture spacing and fracture porosities can be set by the user The disadvantage of this model is that millions of grid blocks are needed to model a large reservoir with small fracture spacing      *Well Testing of Naturally Fractured Reservoirs* Farhad Aschar Sobbi,1988      *Geologic Analysis of Naturally Fractured Reservoirs* Ronald Nelson,2001-10-07 Geologists engineers and petrophysicists concerned with hydrocarbon production from naturally fractured reservoirs will find this book a valuable tool for obtaining pertinent rock data to evaluate reserves and optimize well location and performance Nelson emphasizes geological petrophysical and rock mechanics to complement other studies of the subject that use well logging and classical engineering approaches This well organized updated edition contains a wealth of field and laboratory data case histories and practical advice A great how to guide for anyone working with fractured or highly anisotropic reservoirs Provides real life illustrations through case histories and field and laboratory data

**The Behavior of Naturally Fractured Reservoirs** J. E. Warren,1963      *Naturally Fractured Reservoirs* Society of Exploration Geophysicists,1996

## Whispering the Techniques of Language: An Mental Journey through **Naturally Fractured Reservoirs**

In a digitally-driven earth where screens reign great and immediate conversation drowns out the subtleties of language, the profound strategies and mental nuances hidden within phrases usually move unheard. Yet, situated within the pages of **Naturally Fractured Reservoirs** a captivating literary prize blinking with natural feelings, lies an extraordinary quest waiting to be undertaken. Published by a skilled wordsmith, that enchanting opus attracts viewers on an introspective journey, softly unraveling the veiled truths and profound influence resonating within ab muscles material of every word. Within the mental depths with this emotional evaluation, we will embark upon a sincere exploration of the book is primary subjects, dissect their charming publishing type, and fail to the powerful resonance it evokes heavy within the recesses of readers hearts.

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