Discrete Fracture Model For Coupled Flow And Geomechanics

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Future

Challenges of Modeling THMC SystemsHydraulic Fracturing Stimulation **How an Aquifer Works**

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DIANA10 Discrete Fracture Model For Coupled

The Discrete Fracture Model (DFM) has been widely used to model the flow and transport in natural geological porous formations. Here, we extend

the DFM approach to model deformation. The flow equations are discretized using a finite-volume method, and the poroelasticity equations are discretized using a Galerkin finite-element approximation.

Discrete fracture model for coupled flow and geomechanics ...

Discrete Fracture Model For Coupled Flow And Geomechanics Author: crafty.roundhouse-designs.com-2020-10-14T00:00:00+00:01

Subject: Discrete Fracture Model For Coupled Flow And Geomechanics
Keywords: discrete, fracture, model, for, coupled, flow, and, geomechanics
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Discrete Fracture Model For Coupled Flow And Geomechanics

An efficient discrete-fracture model is used to explicitly model the fractured system. Flexible unstructured gridding is employed to

model arbitrarily-oriented fractures. The interrelations among pore volume, permeability and geomechanical conditions are considered dynamically using two-way coupled flow and geomechanics

computations.

Sequentially coupled flow and geomechanical simulation ...

extensively. To represent the fracture deformation explicitly, the discrete fracture model has been more

widely used recently in coupled fluid flow and geomechanics problems. A fracture is defined as two surfaces in contact in the dis-crete fracture model presented by Garipov et al,18

in which a mechanical model for the fractures is derived to describe the changes in the stress and the displacement fields through the surfaces representing the fractures.

A coupled compressible flow and geomechanics model for ...

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here. As this discrete fracture ...

Discrete Fracture Model For Coupled Flow And Geomechanics

The ?rst hybrid model couples an embedded-discrete-fracture model (EDFM) with multiple

interacting continua (MINC) into EDFM/MINC, which simulates the fracture network characterized by...

(PDF) Hybrid Coupled Discrete Fracture-Matrix and ...

A continuum

model for coupled stress and ?uid ?ow in discrete fracture networks Quan Gan . Derek Elsworth Received: 23 September 2015/Accepted: 9 December 2015/Published online: 5

January 2016 The Author(s) 2016. This article is published with open access at Springerlink.com Abstract We present a model coupling stress and

A continuum model for coupled stress

and fluid flow in . . .

In this work we consider a discrete fracture-matrix (DFM) model, where the fractures are modeled as lower dimensional interfaces embedded in the rock matrix. We

assume Darcy flow both in the matrix and the fracture, and we only consider the case where the permeability in the fractures are orders of magnitude larger than in the matrix.

A simple

embedded discrete fracture-matrix model for a ...

In this paper, a numerical model is developed for coupled analysis of deforming fractured porous media with multiscale fractures. In this model, the

macro-fractures are modeled explicitly by the embedded discrete fracture model, and the supporting effects of fluid and fillings in these fractures are represented explicitly in the geomechanics

model. On the other hand, matrix and micro-fractures are modeled by a multi-porosity model, which aims to accurately describe the transient matrix ...

An efficient

hydro-mechanical model for coupled multi ...

A “discrete fracture network” (DFN) refers to a computational model that explicitly represents the geometrical properties of

each individual fracture (e.g. orientation, size, position, shape and aperture), and the topological relationships between individual fractures and fracture sets.

The use of

discrete fracture networks for modelling ...

Discrete Fracture Model For Coupled The Discrete Fracture Model (DFM) has been widely used to model the flow and transport in natural

geological porous formations. Here, we extend the DFM approach to model deformation. The flow equations are

Discrete Fracture Model For Coupled Flow And Geomechanics

DOE PAGES Journal Article: A continuum model for coupled stress and fluid flow in discrete fracture networks. A continuum model for coupled stress and fluid flow in discrete fracture

networks. Full Record; References (26) Other Related Research;

Authors: Gan, Quan; Elsworth, Derek

A continuum model for coupled stress and fluid flow in ...

The sub-model is coupled to the discrete fracture sub-model through the fracture surface. The domain size of the sub-model is such that the dominant, time-variable, dynamic transport

processes during the expected years of reservoir exploitation are captured within this geometry.

A New T-H-M-C Model Development for Discrete-Fracture EGS ...

In this study,

we developed a new numerical manifold method model for analysis of fully coupled hydro-mechanical processes in porous rock with discrete fractures. In this model the porous rock and the fractures

are both deformable and fluid conductive with large contrast of mechanical and hydraulic properties.

A numerical manifold method model for analyzing fully ...

The discrete fracture networks (DFNs) is quantitatively constructed according to the fracture density and stimulated reservoir area (SRA). This model is used to analyze the temporal/spatial

evolution of the gas pressure and the net desorption rate.

Quantitative study in shale gas behaviors using a coupled ...

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Discrete Fracture Model For Coupled Flow And Geomechanics

A model based on the code

CrunchClay is presented for a fracture-clay matrix system that takes electrostatic effects on transport into account. The electrostatic effects on transport include those associated with

the development of a diffusion potential as captured by the Nernst-Planck equation, and the formation of a diffuse layer bordering negatively charged clay particles within which ...

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The discrete fractures were idealised as lower-dimensional geometric objects with the discrete fracture elements located on the edges of continuum elements sharing

the same nodes. The coupling between the two flow systems was achieved by using the principle of superposition.

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Transient

transfer shape factor between matrix and fracture should be considered. Considering the transient transfer, a simulation workflow is developed using Discrete-Fracture and Continuum

Models, i.e., embedded-discrete-fracture model (EDFM) and dual porosity (DP) model. We consider the SRV region and USRV region respectively.

Naturally

fractured reservoirs (NFRs) hold a significant amount of the world's hydrocarbon reserves. Compared to conventional reservoirs, NFRs exhibit a higher degree of heterogeneity

and complexity created by fractures. The importance of fractures in production of oil and gas is not limited to naturally fractured reservoirs. The economic exploitation of unconventional

reservoirs, which is increasingly a major source of short- and long-term energy in the United States, hinges in part on effective stimulation of low-permeability rock through multi-stage

hydraulic fracturing of horizontal wells. Accurate modeling and simulation of fractured media is still challenging owing to permeability anisotropies and contrasts. Non-physical

abstractions inherent in conventional dual porosity and dual permeability models make these methods inadequate for solving different fluid-flow problems in fractured reservoirs.

Also, recent approaches for discrete fracture modeling may require large computational times and hence the oil industry has not widely used such approaches, even though they give more accurate

representations of fractured reservoirs than dual continuum models. We developed an embedded discrete fracture model (EDFM) for an in-house fully-implicit compositional reservoir

simulator. EDFM borrows the dual-medium concept from conventional dual continuum models and also incorporates the effect of each fracture explicitly. In contrast to dual continuum models,

fractures have arbitrary orientations and can be oblique or vertical, honoring the complexity and heterogeneity of a typical fractured reservoir. EDFM employs a structured grid to remediate

challenges associated with unstructured gridding required for other discrete fracture models. Also, the EDFM approach can be easily incorporated in existing finite difference reservoir

simulators. The accuracy of the EDFM approach was confirmed by comparing the results with analytical solutions and fine-grid, explicit-fracture simulations. Comparison of our results using the EDFM

approach with fine-grid simulations showed that accurate results can be achieved using moderate grid refinements. This was further verified in a mesh sensitivity study that the EDFM approach

with moderate grid refinement can obtain a converged solution. Hence, EDFM offers a co mputationally-efficient approach for simulating fluid flow in NFRs. Furthermore, several case studies

presented in this study demonstrate the applicability, robustness, and efficiency of the EDFM approach for modeling fluid flow in fractured porous media. Another advantage of EDFM is its

extensibility for various applications by incorporating different physics in the model. In order to examine the effect of pressu re-dependent fracture properties on production, we incorporated the

dynamic behavior of fractures into EDFM by employing empirical fracture deformation models. Our simulations showed that fracture deformation, caused by effective stress

changes, substantially affects pressure depletion and hydrocarbon recovery. Based on the examples presented in this study, implementation of fracture geomechanical effects in EDFM did not degrade

the computational performance of EDFM. Many unconventional reservoirs comprise well-developed natural fracture networks with multiple orientations and complex hydraulic

fracture patterns suggested by microseismic data. We developed a coupled dual continuum and discrete fracture model to efficiently simulate production from these

reservoirs. Large-scale hydraulic fractures were modeled explicitly using the EDFM approach and numerous small-scale natural fractures were modeled using a dual continuum approach. The

transport parameters for dual continuum modeling of numerous natural fractures were derived by upscaling the EDFM equations. Comparison of the results using the coupled model with that of

using the EDFM approach to represent all natural and hydraulic fractures explicitly showed that reasonably accurate results can be obtained at much lower computational cost by using

the coupled approach with moderate grid refinements.

Discrete Fracture Network Modeling of Hydraulic Stimulation describes the development and testing of a model that

couples fluid-flow, deformation, friction weakening, and permeability evolution in large, complex two-dimensional discrete fracture networks. The model can be used to explore

the behavior of hydraulic stimulation in settings where matrix permeability is low and preexisting fractures play an important role, such as Enhanced Geothermal Systems and gas

shale. Used also to describe pure shear stimulation, mixed-mechanism stimulation, or pure opening-mode stimulation. A variety of novel techniques to ensure efficiency and realistic model

behavior are implemented, and tested. The simulation methodology can also be used as an efficient method for directly solving quasistatic fracture contact problems. Results show how stresses induced

by fracture deformation during stimulation directly impact the mechanism of propagation and the resulting fracture network.

The development of naturally fractured

reservoirs, especially shale gas and tight oil reservoirs, exploded in recent years due to advanced drilling and fracturing techniques. However, complex fracture geometries such as irregular

fracture networks and non-planar fractures are often generated, especially in the presence of natural fractures. Accurate modelling of production from reservoirs with such geometries

is challenging. Therefore, Embedded Discrete Fracture Modeling and Application in Reservoir Simulation demonstrates how production from reservoirs with complex fracture geometries can

be modelled efficiently and effectively. This volume presents a conventional numerical model to handle simple and complex fractures using local grid refinement (LGR) and unstructured gridding.

Moreover, it introduces an Embedded Discrete Fracture Model (EDFM) to efficiently deal with complex fractures by dividing the fractures into segments using matrix cell boundaries and

creating non-neighboring connections (NNCs). A basic EDFM approach using Cartesian grids and advanced EDFM approach using Corner point and unstructured grids will be covered. Embedded

Discrete Fracture Modeling and Application in Reservoir Simulation is an essential reference for anyone interested in performing reservoir simulation of conventional and

unconventional fractured reservoirs. Highlights the current state-of-the-art in reservoir simulation of unconventional reservoirs Offers understanding of the impacts of key reservoir

properties and complex fractures on well performance Provides case studies to show how to use the EDFM method for different needs

Hydraulic Fracture Modeling delivers all the

pertinent technology and solutions in one product to become the go-to source for petroleum and reservoir engineers. Providing tools and approaches, this multi-contributed reference

presents current and upcoming developments for modeling rock fracturing including their limitations and problem-solving applications. Fractures are common in oil and gas reservoir formations, and

with the ongoing increase in development of unconventional reservoirs, more petroleum engineers today need to know the latest technology surrounding hydraulic fracturing technology such

as fracture rock modeling. There is tremendous research in the area but not all located in one place. Covering two types of modeling technologies, various effective fracturing approaches and

model applications for fracturing, the book equips today's petroleum engineer with an all-inclusive product to characterize and optimize today's more complex reservoirs. Offers

understanding of the details surrounding fracturing and fracture modeling technology, including theories and quantitative methods Provides academic and practical perspective from

multiple contributors at the forefront of hydraulic fracturing and rock mechanics Provides today's petroleum engineer with model validation tools backed by real-world case studies

Discrete Fracture Network Modeling of Hydraulic Stimulation describes the development and testing of a model that couples fluid-flow, deformation, friction weakening, and

permeability evolution in large, complex two-dimensional discrete fracture networks. The model can be used to explore the behavior of hydraulic stimulation in settings where matrix

permeability is low and preexisting fractures play an important role, such as Enhanced Geothermal Systems and gas shale. Used also to describe pure shear stimulation, mixed-mechanism

stimulation, or pure opening-mode stimulation. A variety of novel techniques to ensure efficiency and realistic model behavior are implemented, and tested. The simulation methodology can

also be used as an efficient method for directly solving quasistatic fracture contact problems. Results show how stresses induced by fracture deformation during stimulation directly impact

the mechanism of propagation and the resulting fracture network.

Multiphase Fluid Flow in Porous and Fractured Reservoirs discusses the process of modeling fluid flow in

petroleum and natural gas reservoirs, a practice that has become increasingly complex thanks to multiple fractures in horizontal drilling and the discovery of more unconventional

reservoirs and resources. The book updates the reservoir engineer of today with the latest developments in reservoir simulation by combining a powerhouse of theory, analytical, and

numerical methods to create stronger verification and validation modeling methods, ultimately improving recovery in stagnant and complex reservoirs. Going beyond the

standard topics in past literature, coverage includes well treatment, Non-Newtonian fluids and rheological models, multiphase fluid coupled with geomechanics in reservoirs, and modeling

applications for unconventional petroleum resources. The book equips today's reservoir engineer and modeler with the most relevant tools and knowledge to establish and solidify

stronger oil and gas recovery. Delivers updates on recent developments in reservoir simulation such as modeling approaches for multiphase flow simulation of fractured media and unconventional

reservoirs Explains analytical solutions and approaches as well as applications to modeling verification for today's reservoir problems, such as evaluating saturation and

pressure profiles and recovery factors or displacement efficiency

Utilize practical codes and programs featured from online companion website

Tight gas and shale oil play

an important role in energy security and in meeting an increasing energy demand. Hydraulic fracturing is a widely used technology for recovering these resources. The design and evaluation of

hydraulic fracture operation is critical for efficient production from tight gas and shale plays. The efficiency of fracturing jobs depends on the interaction between hydraulic

(induced) and naturally occurring discrete fractures. In this work, a coupled reservoir-fracture flow model is described which accounts for varying reservoir geometries and

complexities including non-planar fractures. Different flow models such as Darcy flow and Reynold's lubrication equation for fractures and reservoir, respectively are utilized to

capture flow physics accurately. Furthermore, the geomechanics effects have been included by considering a multiphase Biot's model. An accurate modeling of solid deformations

necessitates a better estimation of fluid pressure inside the fracture. The fractures and reservoir are modeled explicitly allowing accurate representation of contrasting

physical descriptions associated with each of the two. The approach presented here is in contrast with existing averaging approaches such as dual and discrete-dual porosity models where the

effects of fractures are averaged out. A fracture connected to an injection well shows significant width variations as compared to natural fractures where these changes are negligible.

The capillary pressure contrast between the fracture and the reservoir is accounted for by utilizing different capillary pressure curves for the two features. Additionally, a quantitative

assessment of hydraulic fracturing jobs relies upon accurate predictions of fracture growth during slick water injection for single and multistage fracturing scenarios. It is also important

to consistently model the underlying physical processes from hydraulic fracturing to long-term production. A recently introduced therm odynamically consistent phase-field approach

for pressurized fractures in porous medium is utilized which captures several characteristic features of crack propagation such as joining, branching and non-planar propagation in heterogeneous

porous media. The phase-field approach captures both the fracture-width evolution and the fracture-length propagation. In this work, the phase-field fracture propagation model is briefly

discussed followed by a technique for coupling this to a fractured poroelastic reservoir simulator. We also present a general compositional formulation using multipoint flux mixed

finite element (MFMFE) method on general hexahedral grids with a future prospect of treating energized fractures. The mixed finite element framework allows for local mass conservation,

accurate flux approximation and a more general treatment of boundary conditions. The multipoint flux inherent in MFMFE scheme allows the usage of a full permeability tensor. An

accurate treatment of dif fusive/dispersiv e fluxes owing to additional velocity degrees of freedom is also presented. The applications areas of interest include gas flooding, CO2 sequestration,

contaminant removal and groundwater remediation.

This monograph on fractures, fracture networks, and fractured porous media provides a systematic treatment of their

geometrical and transport properties for students and professionals in Geophysics, Materials Science, and Earth Sciences.

Constitutive modelling is the mathematical description of

how materials respond to various loadings. This is the most intensely researched field within solid mechanics because of its complexity and the importance of accurate constitutive

models for practical engineering problems. Topics covered include: Elasticity - Plasticity theory - Creep theory - The nonlinear finite element method - Solution of nonlinear equilibrium

equations — Integration of elastoplastic constitutive equations — The thermodynamic framework for constitutive modelling — Thermoplasticity — Uniqueness and discontinuous bifurcations • More

comprehensive in scope than competitive titles, with detailed discussion of thermodynamics and numerical methods. • Offers appropriate strategies for numerical solution,

illustrated by discussion of specific models.
• Demonstrates each topic in a complete and self-contained framework, with extensive referencing.

This book solves the open problems in

fluid flow modeling through the fractured vuggy carbonate reservoirs. Fractured vuggy carbonate reservoirs usually have complex pore structures, which contain not only matrix and fractures

but also the vugs and cavities. Since the vugs and cavities are irregular in shape and vary in diameter from millimeters to meters, modeling fluid flow through fractured vuggy porous media is

still a challenge. The existing modeling theory and methods are not suitable for such reservoir. It starts from the concept of discrete fracture and fracture-vug networks model, and then

develops the corresponding mathematical models and numerical methods, including discrete fracture model, discrete fracture-vug model, hybrid model and multiscale

models. Based on these discrete porous media models, some equivalent medium models and methods are also discussed. All the modeling and methods shared in this book offer the key recent solutions into

this area.