Role of three Dimensional Porous Media in Multi-Phase modeling computational flows: Case Study

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Abstract: In this paper we study the multi-phase computational modeling flows. And design the modeling framework which can perform the flows of all data in computerized flows. In this we described the analysis of multi-phase computational flows in reactive three dimensional porous media targeted at the metals recovery through stockpile leaching and in this recover the computational recovery media by three dimensional media environmental recovery processes from porous media. These systems involve a complex suite of interacting fluid, thermal and chemical reaction physics in complex geometries, which in the case of heap leaching actually grow with time, and varying environmental conditions. in this paper we study the all types of porous media and conclude the modeling flows converted in multi-phase modeling computational flows in three dimensional porous media.
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Introduction:

The progress has been made in mathematical modeling of flow and transport processes in fractured rock. Research efforts, driven by the increasing need to develop petroleum and geothermal energy in reservoirs, other natural underground resources, and to resolve concerns of subsurface contamination, have developed many numerical modeling approaches and techniques. [1] Detailed microscopic models contain so many geometrical features that a rough comparison based only on porosity and specific surface is insufficient. The problem is to find general geometric characterization methods to test how well a model represents the microstructure found in reality. Given such tools they can then be used to constrain the input parameters of the models. General geometric characterization In modeling multiphase flow and transport, and heat transfer in fractured porous media, the most critical issue is how to handle inter-"flow" or interaction of mass and thermal energy at fracture-matrix interfaces under multiphase and non-isothermal condition. Commonly used mathematical methods for dealing with fracture-matrix interaction include. The framework included in the Athena simulator allows various aspects of domain decomposition strategies to be explored. In the space domain different models and discretizations can be used within the total domain. In a similar way, the time domain can be split and solved in parallel. This is achieved through a predictor-corrector strategy in which a coarse time step simulation (predictor) provides initial values for solving fine sub-intervals in parallel (corrector). As an application, we will show how the domain decomposition framework can be used for modeling flow in fractured porous media. Specifically, we suggest applying a discrete fracture network model in selected domains. Such a model is a flexible and accurate tool to describe the complex geometries of fractures, but at the cost of larger systems of equations. This problem can be solved by using parallel computations and up scaling. Also we comment on how the two-level solver relates to multiphase up scaling techniques. [2] The multiscale character of the properties of natural porous media makes the problem of predicting flow and transport in such systems a natural target for multistage methods. Recent advances in this area show great promise.[3] Along with the development of better computers, new and more robust up scaling techniques, and more detailed reservoir characterizations, there has also been an equally significant development in the area of numerical methods. State-of-the-art simulators employ numerical methods that can take advantage of multiple processors, distributed memory workstations, adaptive grid refinement strategies, and iterative techniques with linear complexity.

Generalized Mathematical Equation Models: The physical processes associated with flow and transport in fractured porous media are governed by the same fundamental conservation laws as those used in other branches of the sciences and engineering: conservation of mass, momentum, and energy governs the behavior of fluid flow, chemical transport, and heat transfer in rock. These physical laws are often represented mathematically on the macroscopic level by a set of partial differential or integral equations, called governing equations. [1]

Computational modeling strategy and implementation: In this we can create a model which is perform the faster and reliable way of work. And it is used for communication and transferring the data and perform the task easier and faster. If we can use the computational models strategy then it used for faster work. We perform a numerical experiment using the implicit mass transport formulation. The main goal of the experiment is to evaluate the parallel performance on various platforms.

Implicit three dimensional finite element analysis of dynamic inelastic biphasic porous media at finite strain: Simulating the mechanical response of porous materials, such as geologic materials and biological tissues. These materials are a mixture of solid constituents (e.g., collagen fibers, sand grains) and interstitial liquid and/or gas. Biological tissues are more complex than this simple definition, and thus require care in their modeling using mixture and porous media theory. The finite strain, implicit dynamic, finite element implementation and analysis provides the overlaying framework in which to develop multi-scale materials models of heterogeneous porous materials. Extension to triphasic or multi-physic mixtures may be needed. Finite strains allow the modeling of large deformation in soils and biological tissues, and implicit dynamics the efficient simulation of long period motions encountered during earthquakes and running or jumping. Higher rate impact during car crash or otherwise requires an explicit dynamic analysis, which reduces readily from an implicit implementation. [4]

Two-Phase Flow Model:
In this section we will consider the flow of two phases, one water phase w and one hydrocarbon phase. The water phase will consist of pure water, whereas the hydrocarbon phase generally is a two-component fluid consisting of dissolved gas and a residual (or black) oil. [9]

Grain-to-macro-scale modeling resolution of dynamic failure in bound particulate materials (ARO Solid Mechanics). Using solely grain-scale physics-based simulation methods, it is too computationally intensive to account for both (I) global initial boundary value problem (IBVP) conditions, and (II) grain-scale material behavior, to understand fundamentally the mechanics of dynamic failure in bound particulate materials. The desired result is to enable a more complete understanding of the role of grain-scale physics on the thermo-mechanical properties and performance of heterogeneous bound particulate materials of interest to the public. [4]

Three or Multi-phase flow Model:
We consider two-dimensional flow of three immiscible, incompressible fluid phases in a porous medium. The phases will be referred to as water, gas, and oil and indicated by the subscripts *w*, *g*, and *o*, respectively. We assume that there are no internal sources or sinks. Compressibility, mass transfer between phases, and thermal effects are neglected. We assume that the three fluid phases saturate the pores. [10]

Image Analysis for 3D Porous Media: Some research questions and challenges in porous media flow are outlined. Specifically, the nature of transport in dispersion in highly heterogeneous media and the pore-scale controls on capillary prapping. The implications for the design of carbon dioxide storage are discussed. Then some results of research are presented, using a combination of core floods, micro-flow experiments on small core samples imaged at the micron scale using micro-CT scanning and numerical modeling.[4] I will present a carbon fibre flow cell that allows the pore-scale imaging of fluids at elevated temperatures and pressures and show some preliminary pictures of super-critical carbon dioxide in the pore space. Imaging technology has provided the basis for modeling single- and multi-phase flow in porous media from first principles. The REV-scale predictions from the models are often tested against two-phase pressure-saturation and relative permeability curves. In these predictions, it is generally assumed that capillary forces dominate at the pore-scale, although it is recognized that at high capillary number viscous forces should be included. These models are known as dynamic models and testing and developing the correct physics to be included in the dynamic models is still in its infancy. We will show how dynamic models can in principle replicate the experimental behavior, and outline how the data sets can be used (along with imaging) in testing and verifying the next generation of dynamic models.[5]

Corrected operator splitting for systems: The motivation for operator splitting methods is that it is easy to combine efficient methods for solving the convection step with efficient methods for solving the diffusive step. Especially for convection dominated systems, it is a major advantage to be able to use an accurate and efficient hyperbolic solver developed for tracking discontinuous solutions. By combining this with efficient methods for the diffusive step, we get a powerful and efficient numerical method which is well suited for solving parabolic problems with sharp gradients. The obvious disadvantage of operator splitting methods is the temporal splitting errors. The temporal splitting error in OS methods can be significant in regions containing viscous shocks [6, 7, 8].

Conclusion:

In this paper we discussed developed a comprehensive models incorporating many of the preceding cases as components in a modular format and to combine them with available subsurface ow and transport simulators as a basis to perform basic research on the theoretical and numerical modeling and simulation of deforming heterogeneous porous media. If we can use these type of computational model the it provide the data easier and faster it perform the faster data. If we design the multi-phase model in 3D porous media transportation system. It is provide the 3 Dimensional transportation models. In this paper we proposed a multi- phase computational framework in three dimensional porous media.

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