

Upscaling of Single and Two Phase Flow in Reservoir Engineering: A Comprehensive Exploration

Upscaling is a process of converting fine-scale geological and engineering data into coarser-scale models for use in reservoir simulation. It is an essential step in the process of reservoir modeling, as it allows for the efficient and accurate simulation of fluid flow in hydrocarbon reservoirs.



Upscaling of Single- and Two-Phase Flow in Reservoir Engineering by Hans Bruining

★★★★★ 5 out of 5

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There are a variety of upscaling techniques available, each with its own advantages and disadvantages. The choice of upscaling technique depends on the specific reservoir characteristics and the simulation objectives.

This article provides a comprehensive overview of the upscaling techniques currently used in the oil and gas industry. The focus is on upscaling methods applied to single and two-phase flow problems.

Upscaling of Single Phase Flow

The upscaling of single phase flow is relatively straightforward compared to two-phase flow. This is because single phase flow is governed by Darcy's law, which is a linear equation.

The most common upscaling technique for single phase flow is the transmissibility upscaling method. This method involves calculating the transmissibility between each pair of grid blocks in the coarse-scale model. The transmissibility is a measure of the ease with which fluid can flow between the two grid blocks.

Once the transmissibilities have been calculated, the single phase flow equations can be solved using a standard numerical simulator.

Upscaling of Two Phase Flow

The upscaling of two phase flow is more challenging than the upscaling of single phase flow. This is because two phase flow is governed by a system of nonlinear equations.

There are a variety of upscaling techniques available for two phase flow, each with its own advantages and disadvantages. The choice of upscaling technique depends on the specific reservoir characteristics and the simulation objectives.

Some of the most common upscaling techniques for two phase flow include:

* The fractional flow upscaling method * The relative permeability upscaling method * The capillary pressure upscaling method

Each of these methods has its own advantages and disadvantages. The fractional flow upscaling method is relatively simple to implement, but it can be inaccurate in some cases. The relative permeability upscaling method is more accurate, but it can be more difficult to implement. The capillary pressure upscaling method is the most accurate, but it can be the most difficult to implement.

Applications of Upscaling

Upscaling is used in a variety of applications in reservoir engineering, including:

* Reservoir simulation * History matching * Optimization * Uncertainty quantification

Upscaling is an essential tool for the efficient and accurate simulation of fluid flow in hydrocarbon reservoirs.

Upscaling is a complex and challenging process, but it is essential for the efficient and accurate simulation of fluid flow in hydrocarbon reservoirs. A variety of upscaling techniques are available, each with its own advantages and disadvantages. The choice of upscaling technique depends on the specific reservoir characteristics and the simulation objectives.

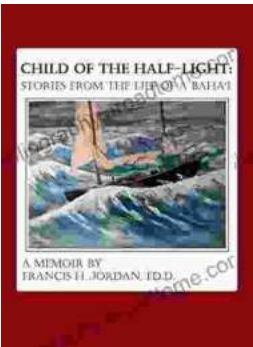
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