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Li, Jun

# Multiscale and Multiphysics Flow Simulations of Using the Boltzmann Equation

Applications to Porous Media and MEMS

- Provides customized Fortran codes to facilitate the understanding and application of the algorithm
- Demonstrates applications in multi-scale simulations
- Compares and contrasts several numerical methods for addressing the problem

This book provides a comprehensive introduction to the kinetic theory for describing flow problems from molecular scale, hydrodynamic scale, to Darcy scale. The author presents various numerical algorithms to solve the same Boltzmann-like equation for different applications of different scales, in which the dominant transport mechanisms may differ. This book presents a concise introduction to the Boltzmann equation of the kinetic theory, based on which different simulation methods that were independently developed for solving problems of different fields can be naturally related to each other. Then, the advantages and disadvantages of different methods will be discussed with reference to each other. It mainly covers four advanced simulation methods based on the Boltzmann equation (i.e., direct simulation Monte Carlo method, direct simulation BGK method, discrete velocity method, and lattice Boltzmann method) and their applications with detailed results. In particular, many simulations are included to demonstrate the applications for both conventional and unconventional reservoirs. With the development of high-resolution CT and high-performance computing facilities, the study of digital rock physics is becoming increasingly important for understanding the mechanisms of enhanced oil and gas recovery.

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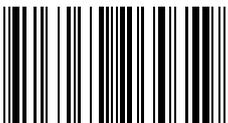
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