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Sommario/riassunto

This book highlights a comprehensive description of the numerical methods in rarefied gas dynamics, which has strong applications ranging from space vehicle re-entry, micro-electromechanical systems, to shale gas extraction. The book consists of five major parts: The fast spectral method to solve the Boltzmann collision operator for dilute monatomic gas and the Enskog collision operator for dense granular gas; The general synthetic iterative scheme to solve the kinetic equations with the properties of fast convergence and asymptotic preserving; The kinetic modeling of monatomic and molecular gases, and the extraction of critical gas parameters from the experiment of Rayleigh-Brillouin scattering; The assessment of the fluid-dynamics equations derived from the Boltzmann equation and typical kinetic gas-surface boundary conditions; The applications of the fast spectral method and general synthetic iterative scheme to reveal the dynamics in some canonical rarefied gas flows. The book is suitable for postgraduates and researchers interested in rarefied gas dynamics and provides many numerical codes for them to begin with.