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	Nota di contenuto	Preface -- Introduction -- Thermal Relaxation and stability of molecular gas flows -- 1. Physico-mathematical models of relaxing molecular gas flows -- Elements of physical kinetics -- Systems of equations of relaxation gas dynamics -- Parameters of thermal relaxation in diatomic gases -- Absorption of acoustic waves in the relaxation process -- 2. Linear Stability of inviscid plane-parallel flows of vibrationally excited diatomic gases -- Equations of the linear stability theory -- Some general necessary conditions of instability growth -- Growth rates and eigenfunctions of unstable inviscid modes in a free shear flow -- 3. Linear stability of supersonic plane Couette flow of vibrationally excited gas -- Statement of problem and basic equations -- Inviscid stability problem -- Linear stability of supersonic Couette flow at finite Reynolds numbers -- 4. Asymptotic theory of neutral linear stability contours in plane shear flows of a vibrationally

excited gas -- Asymptotic solutions of linear stability equations -- Asymptotics of a neutral stability curve of the supersonic Couette flow of a vibrationally excited gas -- 5. Energy theory of nonlinear stability of plane shear flows of thermally nonequilibrium gas -- Energy Stability analysis of a plane compressible flow. Effect of a bulk viscosity -- Energy stability analysis of a plane vibrationally excited flow. Effect of a vibrational relaxation -- 6. Evolution of a large-scale vortex in shear flow of a relaxing molecular gas -- Navier-Stokes model flow. Effect of bulk viscosity -- Effect of a vibrational relaxation on damping vortex structure -- 7. Dissipation of the Kelvin-Helmholts waves in a relaxing molecular gas -- Nonlinear evolution of the Kelvin-Helmholtz instability in the Navie-Stokes model -- Effect of a vibrational relaxation on the Kelvin-Helmholtz instability.

Sommario/riassunto

This book presents an in-depth systematic investigation of a dissipative effect which manifests itself as the growth of hydrodynamic stability and suppression of turbulence in relaxing molecular gas flows. The work describes the theoretical foundations of a new way to control stability and laminar turbulent transitions in aerodynamic flows. It develops hydrodynamic models for describing thermal nonequilibrium gas flows which allow the consideration of suppression of inviscid acoustic waves in 2D shear flows. Then, nonlinear evolution of large-scale vortices and Kelvin-Helmholtz waves in relaxing shear flows are studied. Critical Reynolds numbers in supersonic Couette flows are calculated analytically and numerically within the framework of both linear and nonlinear classical energy hydrodynamic stability theories. The calculations clearly show that the relaxation process can appreciably delay the laminar-turbulent transition. The aim of the book is to show the new dissipative effect, which can be used for flow control and laminarization. This volume will be of interest and useful to mechanical engineers, physicists, and mathematicians who specialize in hydrodynamic stability theory, turbulence, and laminarization of flows.