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| Autore | Neufeld Zoltan |
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| Altri autori (Persone) | Hernandez-GarciaEmilio <1963-> |
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| Nota di contenuto | Contents; Preface; Chemically and biologically reacting flows; Plan of the book; 1 Fluid Flows; 1.1 Conservation laws; 1.2 Laminar and turbulent flows; 1.3 Turbulence; 1.4 Kolmogorov's theory of turbulence; 1.5 Two-dimensional flows; 2 Mixing and Dispersion in Fluid Flows; 2.1 Introduction; 2.1.1 Advection; 2.1.2 Diffusion; 2.1.3 Advection and diffusion; 2.2 Steady two-dimensional flows; 2.2.1 Advection along streamlines; 2.2.2 Dispersion of diffusive tracers in steady flows; 2.3 Advection in weakly time-dependent two-dimensional flows; 2.4 Chaotic advection in three dimensions<br>2.5 Dispersion by chaotic advection 2.5.1 The Lyapunov exponent; 2.6 Chaotic advection in open flows; 2.7 Chaotic advection and diffusion; 2.7.1 The filament model; 2.7.2 Asymptotic decay in chaotic flows; 2.8 Mixing in turbulent flows; 2.8.1 Relative dispersion in turbulence; 2.8.2 Passive scalar in turbulent flows; 2.9 Distribution of inertial particles in flows; 3 Chemical and Ecological Models; 3.1 Chemical dynamics; 3.1.1 The Law of Mass Action; 3.1.2 Binary, First-Order, and Zeroth-Order Reactions; 3.1.3 Autocatalytic and Enzymatic Reactions: The adiabatic elimination |

3.1.4 Oscillations and excitability 3.1.5 Multistability; 3.2 Biological models; 3.2.1 Simple birth, death and saturation; 3.2.2 Predator-Prey models; 3.2.3 Competition; 3.3 Summary; 4 Reaction-diffusion Dynamics; 4.1 Diffusion and linear growth; 4.1.1 Linear spreading of perturbations; 4.1.2 The minimum habitat-size problem; 4.1.3 Plankton filaments; 4.2 Fisher waves; 4.3 Multistability: Fronts advancing on metastable states; 4.4 Excitable waves; 4.5 Turing diffusive instabilities; 4.6 Oscillatory media and beyond; 5 Fast Binary Reactions and the Lamellar Approach
5.1 Lamellar reacting models 5.2 Fast binary reactions in simple flows; 5.3 The fast binary reaction in complex flows; 6 Decay-type and Stable Reaction Dynamics in Flows; 6.1 Stable reaction dynamics and its global steady state; 6.2 The spectrum of decaying scalar in a flow; 6.2.1 The inertial-convective range; 6.2.2 The viscous-convective range; 6.3 Smooth and filamental distributions .; 6.4 Structure functions, multifractality and intermittency; 6.5 Two-dimensional turbulence with linear damping; 7 Mixing in Autocatalytic-type Processes; 7.1 Mixing in autocatalytic reactions
7.1.1 The closed-flow case7.1.2 The open flow case; 7.1.3 Results from the filament model; 7.1.4 Front propagation in cellular flows; 7.2 Mixing and bistable dynamics; 7.3 Mixing in excitable dynamics; 7.3.1 Excitable plankton dynamics; 7.4 Competition dynamics; 8 Mixing in Oscillatory Media; 8.1 Synchronization of oscillatory dynamics by mixing; 8.1.1 Persistent patterns in uniform medium; 8.2 Synchronization in non-uniform medium; 8.3 Noise induced oscillations in excitable media; 8.4 The effect of chaotic dispersion on cyclic competition; 9 Further Reading
9.1 Complex fluids and reactive flows

Sommario/riassunto

Many chemical and biological processes take place in fluid environments in constant motion - chemical reactions in the atmosphere, biological population dynamics in the ocean, chemical reactors, combustion, and microfluidic devices. Applications of concepts from the field of nonlinear dynamical systems have led to significant progress over the last decade in the theoretical understanding of complex phenomena observed in such systems. This book introduces the theoretical approaches for describing mixing and transport in fluid flows. It reviews the basic concepts of dynamical phenomena arising