Statistical Fluid Mechanics - vol 1: Mechanics of Turbulence

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This book, originally published in Moscow in 1965, is of interest to a wide scientific and technical audience, including geophysicists, meteorologists, aerodynamicists, chemical, mechanical, and civil engineers—in short, all interested in the fundamental problems of flow, mass, and heat transfer. The authors deal with the theory of hydrodynamic instability and the development of turbulence, the application of dimensional analysis, and the theory of similarity to turbulent flow in pipes, ducts, and boundary layers, as well as free turbulence. They discuss semiempirical theories of turbulence, develop the similarity theory for turbulence in nonhomogeneous media, and present Lagrangian characteristics of turbulence and the theory of turbulent diffusion. Every effort has been made to present a wealth of experimental material; a large number of examples are drawn from physics of the atmosphere, permitting a generalization of results beyond that which can be obtained in the laboratory. Considerable attention has been given to Kolmogorov's theory of the local structure of developed turbulence and to the theory of turbulence in stratified media.

Contents: I. Laminar and Turbulent Motion: Equations of dynamics of a fluid and their most important consequences; Hydrodynamic instability and development of turbulence. *II. Mathematical Methods for Describing Turbulence, Mean Values and Correlation Functions:* Methods for taking mean; The fields of hydrodynamic characteristics regarded as stochastic fields; The moments of hydrodynamic fields. *III. The Reynolds Equation and Semiempirical Theories of Turbulence:* Turbulent flow in pipes and in the boundary layer; Turbulent energy balance and results derived from it. *IV. Turbulence in a Medium Stratified with Respect to Temperature:* Generalization of the theory of the logarithmic boundary layer to the case of a medium stratified with respect to temperature; Comparison of the theory with experimental data on the atmospheric layer near the ground. *V. Motion of Particles (or Elements) in a Turbulent Stream:* Lagrangian description of Turbulence; Turbulent diffusion.

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