

## Contents

**Preface** IX

**Introduction** XIII

- 1 Motion of Particles and Heat Exchange in Homogeneous Isotropic Turbulence** 1
  - 1.1 Characteristics of Homogeneous Isotropic Turbulence 1
  - 1.2 Motion of a Single Particle and Heat Exchange 11
  - 1.3 Velocity and Temperature Correlations in a Fluid along the Inertial Particle Trajectories 13
  - 1.4 Velocity and Temperature Correlations for Particles in Stationary Isotropic Turbulence 27
  - 1.5 Particle Acceleration in Isotropic Turbulence 35
- 2 Motion of Particles in Gradient Turbulent Flows** 39
  - 2.1 Kinetic Equation for the Single-Point PDF of Particle Velocity 40
  - 2.2 Equations for Single-Point Moments of Particle Velocity 47
  - 2.3 Algebraic Models of Turbulent Stresses 52
  - 2.3.1 Solution of the Kinetic Equation by the Chapman–Enskog Method 53
  - 2.3.2 Solution of the Equation for Turbulent Stresses by the Iteration Method 58
  - 2.4 Boundary Conditions for the Equations of Motion of the Disperse Phase 62
  - 2.5 Second Moments of Velocity Fluctuations in a Homogeneous Shear Flow 74
  - 2.6 Motion of Particles in the Near-Wall Region 87
    - 2.6.1 Near-Wall Region Including the Viscous Sublayer 87
    - 2.6.2 The Equilibrium Logarithmic Layer 91
    - 2.6.3 High-Inertia Particles 95
  - 2.7 Motion of Particles in a Vertical Channel 96
  - 2.8 Deposition of Particles in a Vertical Channel 107

<b>3</b>	<b>Heat Exchange of Particles in Gradient Turbulent Flows</b>	<b>115</b>
3.1	The Kinetic Equation for the Joint PDF of Particle Velocity and Temperature	115
3.2	The Equations for Single-Point Moments of Particle Temperature	123
3.3	Algebraic Models of Turbulent Heat Fluxes	127
3.3.1	Solution of the Kinetic Equation by the Chapman–Enskog Method	127
3.3.2	Solving the Equation for Turbulent Heat Fluxes by the Iteration Method	130
3.4	Second Moments of Velocity and Temperature Fluctuations in a Homogeneous Shear Flow	132
<b>4</b>	<b>Collisions of Particles in a Turbulent Flow</b>	<b>137</b>
4.1	Collision Frequency of Monodispersed Particles in Isotropic Turbulence	138
4.2	Collision Frequency in the Case of Combined Action of Turbulence and the Average Velocity Gradient	149
4.3	Particle Collisions in an Anisotropic Turbulent Flow	151
4.4	Boundary Conditions for the Disperse Phase with the Consideration of Particle Collisions	159
4.5	The Effect of Particle Collisions on Turbulent Stresses in a Homogeneous Shear Flow	160
4.6	The Effect of Collisions on Particle Motion in a Vertical Channel	164
<b>5</b>	<b>Relative Dispersion and Clustering of Monodispersed Particles in Homogeneous Turbulence</b>	<b>171</b>
5.1	The Kinetic Equation for the Two-Point PDF of Relative Velocity of a Particle Pair	172
5.2	Equations for Two-Point Moments of Relative Velocity of a Particle Pair	177
5.3	Statistical Properties of Stationary Suspension of Particles in Isotropic Turbulence	180
5.4	Influence of Clustering on Particle Collision Frequency	196
5.5	Relative Dispersion of Two Particles in Isotropic Turbulence	200
5.5.1	Dispersion of Inertialess Particles	202
5.5.2	Dispersion of Inertial Particles	205
<b>6</b>	<b>Collision and Clustering of Bidispersed Particles in Homogeneous Turbulence</b>	<b>209</b>
6.1	Collision Frequency of Bidispersed Particles in Isotropic Turbulence	209
6.2	Collision Frequency in the Case of Combined Action of Turbulence and Gravity	215
6.3	Collisions of Bidispersed Particles in a Homogeneous Anisotropic Turbulent Flow	217
6.4	Vertical Motion of a Bidispersed Particle Mixture	226

- 6.5 Equation for the Two-Particle PDF and its Moments 229
- 6.6 The Clustering Effect and its Influence on the Collision Frequency of Bidispersed Particles in Isotropic Turbulence 235

**References** 241

**Notation Index** 261

**Author Index** 277

**Subject Index** 283

