

Table of Contents

Preface	vii
List of Series Volumes 1–68	x
Nomenclature	1
Chapter I. Introduction	5
A. Background	5
B. Intent of This Volume	6
C. Characterization of Analyses of Free Turbulent Flows	10
Chapter II. Parallel Jet in a Moving Stream	19
A. Introduction	19
B. Experimental Information	19
1. Initial Region	19
2. Mean-Flow Data in the Main Mixing Region for Constant-Density Flows	20
3. Turbulence Data for Constant-Density Flows	24
4. Effects of Temperature Variations	35
5. Effects of Composition Variations	39
6. Large-Scale, Orderly Structure in Jets	51
C. Analysis	52
1. Initial Region	52
2. Mean-Flow Models	53
3. Algebraic Turbulence Function Model	61
4. One-Equation Models	64
5. Two-Equation Models	70
6. Interrelationship Between Some of the Various Models	72
7. Three-Equation Model	78
8. Reynolds Stress Models	79
9. Direct Turbulence Models	83
Chapter III. Axial Pressure Gradients	85
A. Experimental Studies	85
1. Mean-Flow Data	85
2. Turbulence Data	90
B. Analysis	91
1. Mean-Flow Models	91
2. Algebraic Turbulence Function Model	92
3. One-Equation Models	94
4. Two-Equation Models	94
5. Discussion	96

Chapter IV. Zero Net Momentum Defect Cases	97
A. Background	97
B. Experimental Results	97
1. Jet/Wake Combinations	97
2. Self-Propelled Bodies	98
C. Analysis	101
1. Mean-Flow Models	101
2. Algebraic Turbulence Function Model	103
3. One-Equation Models	103
4. Two-Equation Models	105
5. Reynolds Stress Models	106
6. Discussion	109
Chapter V. Flows with Swirl	111
A. Background	111
B. Experimental Information	111
1. Swirling Jets	111
2. Wakes Behind Propeller-Driven Bodies	114
C. Analysis	114
1. Mean-Flow Models	114
2. One-Equation Models	117
3. Two-Equation Models	120
4. Reynolds Stress Models	122
Chapter VI. Two-Phase Flows	123
A. Introduction	123
B. Experiments	124
1. Single Particle in a Turbulent Flow	124
2. Clouds of Particles in Turbulent Flow	125
3. Particle-Laden Jets	125
C. Analysis	131
1. Single Particle in a Turbulent Flow	131
2. Mean-Flow Models	132
3. Higher-Order Models	135
Chapter VII. Three-Dimensional, Coaxial Jets	137
A. Scope	137
B. Results from Experiment	137
1. Three-Dimensional Nozzles	137
2. Adjacent, Coaxial Jets	138
3. Hypermixing Nozzles	139
C. Analysis	139
1. Mean-Flow Models	139
2. Two-Equation Models	141
D. Discussion	144

Chapter VIII. Transverse Injection	145
A. Problem Definition	145
B. Experimental Information	145
1. Low-Speed, Single-Phase Flows	145
2. Transverse, Particle-Laden Jets	148
3. Transverse Jets into Supersonic Flows: Gaseous Jets	154
4. Transverse Jets into Supersonic Flow: Liquid Jets	160
C. Analysis	162
1. Trajectory Analyses	162
2. Differential, Mean-Flow Models	163
3. Higher-Order Models	164
Chapter IX. Buoyancy Force Effects	165
A. Introduction	165
B. Experiment	165
1. Buoyant Jets and Plumes	165
2. Wakes in a Stratified Environment	170
C. Analysis	174
1. Mean-Flow Models	174
2. Two-Equation Models	176
3. Reynold Stress Models	182
Chapter X. Viscous-Inviscid Interactions	183
A. Background	183
B. Analysis	183
Chapter XI. Closure	189
References	191