

# Table of Contents

*Foreword* xi

*Biography* xiii

<b>1. RESIDENCE TIME DISTRIBUTIONS.....</b>	<b>1</b>
General Definitions and Properties of RTD	2
Measurement of RTD	7
Example of Investigation of a Mixed Reactor	9
Notation	29
References	32
<b>2. THERMAL ANEMOMETRY .....</b>	<b>33</b>
Principle of Operation	33
Principles of Heat Transfer	37
Effect of Angle Sensitivity	44
Resolution of Velocity Components	44
Measurements in Non-Isothermal Flows	51
Application of Film Sensors	52
Other Measurement Techniques and Applications	55
Additional Notes and Sensor Selection	57
Notation	68
References	69
<b>3. ELECTRICAL SENSING TECHNIQUES .....</b>	<b>73</b>
Piezoelectric Transducers	73
Electroresistivity Probes	77
Electrical Discharge Technique	93
Thermal Methods	95
Measurement Techniques for Three-Phase Systems	96
Notation	100
References	101
<b>4. LIGHT PHENOMENA AND OPTICS.....</b>	<b>105</b>
Wave Theory of Light	105
Laws of Reflection and Refraction	111

Interference of Light	118
Principles of Diffraction	121
Optics	126
Notation	133
<b>5. LIGHT SCATTERING AND OPTICAL METHODS</b>	<b>135</b>
Light Transmission Techniques	135
Photographic and Optical Techniques	143
Laser Doppler Anemometry	160
Time of Flight Measurements	174
Specialized Photographic Techniques	176
Holographic Techniques	182
Notation	190
References	191
<b>6. ELECTROMAGNETIC WAVE TECHNIQUES</b>	<b>195</b>
Use of X-Rays	195
Nuclear Type Sensors	201
Use of Microwaves for Holdup Measurements	204
References	219
<b>7. ULTRASONIC TESTING TECHNIQUES</b>	<b>221</b>
Principles and Properties of Sound	222
Operation of a Piezoelectric Plate	229
Use of Ultrasonics for Interface Detection	235
Voidage and Flow Regime Measurement	238
The Acoustic Vollicimeter	240
Ultrasonic Holography	243
Notation	247
References	248
<b>8. SIGNAL PROCESSING AND ANALYSIS</b>	<b>249</b>
Types of Data	249
Probability and Statistics	254
Sampling Error Definitions	262
Fourier Series and Transforms	265
Correlation and Spectral Density Analysis	267
Standard Flow Analysis	288
Notation	290
References	291
<b>9. LABORATORY AUTOMATION</b>	<b>293</b>
Architecture for Computerized Data Acquisition	293
Principles of Mini- and Microcomputers	301
Computer Controlled Analyzers	310

Microprocessor/Microcomputer Systems	320
Computer Graphics	329
Glossary	339
References	352
<i>Index</i>	355