

Contents

<i>Contents of Volume II</i>	vii
<i>Preface</i>	ix
<i>Organization of the Book</i>	xiii
<i>List of Symbols</i>	xv
1 Introductory Concepts	
1.1 Occurrences of Noise Induced by Flow	1
1.2 Fluid–Body Interactions for Sound Production	3
1.3 Dimensional Analysis of Sound Generation	7
1.4 Signal Analysis Tools of Vibration and Sound	11
1.5 Representations of Measured Sound	31
1.6 Mathematical Refresher	40
References	43
2 Theory of Sound and Its Generation by Flow	
2.1 Fundamentals of Linear Acoustics Theory	44
2.2 Sommerfeld’s Radiation Condition	64
2.3 Lighthill’s Theory of Aerodynamic Noise	65
2.4 Effects of Surfaces on Flow-Induced Noise	77
2.5 Powell’s Theory of Vortex Sound	89
2.6 Representations in the Frequency and Wave Number Domains	102
2.7 Sources in Ducts and Pipes	118
References	127
3 Shear Layer Instabilities, Flow Tones, and Jet Noise	
3.1 Introduction	130
3.2 Shear Flow Instabilities and the Generation of Vorticity	131

3.3	The Free Shear Layer and Cavity Resonance	138
3.4	Self-Excitation of Jets	149
3.5	The Stochastic Nature of Turbulence	170
3.6	Fundamentals of Noise from Subsonic Turbulent Jets	174
3.7	Noise from Unsteady Mass Injection	204
	References	211
4	Dipole Sound from Cylinders	
4.1	Introduction: General Description of Vortex Flow, Lift Fluctuation, and Sound	219
4.2	Mechanics of Vortex Formation behind Circular Cylinders	221
4.3	Measured Flow-Induced Forces and Their Frequencies	228
4.4	Estimations of Wake-Induced Forces in Two-Dimensional Flow	248
4.5	Formulation of the Acoustic Problem for Compact Surfaces	252
4.6	Radiation from Rotating Rods	262
4.7	Other Topics in Vortex-Induced Noise	268
	Appendix: The Sound Field of a Two-Dimensional Dipole	280
	References	283
5	Fundamentals of Flow-Induced Vibration and Noise	
5.1	Introduction	288
5.2	Response of Single-Degree-of-Freedom Systems to Temporally Random Excitation	291
5.3	General Features of Structures Driven by Randomly Distributed Pressure Fields	296
5.4	Modal Shape Functions for Simple Structures	314
5.5	Essential Features of Structural Radiation	319
5.6	Radiation from Structures in Heavy Fluids	338
5.7	Sound from Flow-Induced Vibration of a Circular Cylinder	342
5.8	Summary and Principles of Noise Control	359
	References	366
6	Introduction to Bubble Dynamics and Cavitation	
6.1	Basic Equations of Bubble Dynamics	370
6.2	Theoretical Cavitation Thresholds and Nonlinear Oscillations of Spherical Bubbles	385
6.3	The Collapse of Cavitation Bubbles	393
6.4	Theory of Single-Bubble Cavitation Noise	403
	Appendix: Derivation of Approximate Spectral Functions	419
	References	421
	<i>Index</i>	<i>I</i>