
Contents

Preface.....	xi
Contributors	xiii
Chapter 1	Introduction 1
1.1	Noise in the modern world 1
1.2	Noise reduction methods 1
1.3	Noise-controlling casing..... 3
1.4	Objectives and scope of the book 3
Chapter 2	Considered types of casings 7
2.1	Introduction..... 7
2.2	Rigid casing 7
2.2.1	Actuators and sensors 8
2.2.2	Secondary paths analysis 12
2.3	Lightweight casing..... 12
2.3.1	Actuators and sensors 12
2.3.2	Frequency response functions 14
2.3.3	Secondary paths analysis 15
2.4	Real casing..... 17
2.5	Summary..... 18
Chapter 3	Modelling of casings 21
3.1	Introduction..... 21
3.2	Analytical modelling of individual casing walls 25
3.2.1	Kirchhoff-Love plate theory 26
3.2.2	Mindlin-Reissner plate theory..... 28
3.3	Analytical modelling of the whole casing 45
3.3.1	Single-panel rigid casing..... 46
3.3.2	Double-panel rigid casing..... 52
3.3.3	Lightweight casing..... 66
3.4	Numerical modelling 77
3.4.1	Numerical simulations of a single plate..... 78
3.4.2	Numerical simulations of an active casing 84
3.5	Validation of selected models 95
3.5.1	Rigid casing walls 95
3.5.2	Lightweight casing walls 97

	3.6 Summary	104
Chapter 4	Passive control	105
	4.1 Introduction.....	105
	4.2 Shaping of structural and acoustic responses	105
	4.2.1 Optimization algorithm.....	106
	4.2.2 Objective functions	108
	4.2.3 Results.....	109
	4.3 Passive shunt systems	116
	4.3.1 Hardware platform	116
	4.3.2 Control structure	118
	4.3.3 Control results.....	124
	4.4 Composite structures	126
	4.4.1 Functionally graded materials.....	130
	4.4.2 Hybrid composites	132
	4.5 Summary	135
Chapter 5	Semi-active control.....	137
	5.1 Introduction.....	137
	5.2 Switched mechanical links for double panels.....	137
	5.2.1 Hardware platform	138
	5.2.2 Control algorithm.....	140
	5.2.3 Control results.....	142
	5.3 Coil-based links for double panels	146
	5.3.1 Hardware platform	147
	5.3.2 Control algorithm.....	150
	5.3.3 Control results.....	152
	5.4 Mass moment of inertia actuator	161
	5.4.1 Hardware platform	162
	5.4.2 Control algorithm.....	163
	5.4.3 Control results.....	164
	5.5 Semi-active shunt systems	171
	5.5.1 Hardware platform	171
	5.5.2 Control algorithm.....	174
	5.5.3 Control results.....	177
	5.6 Summary	178
Chapter 6	Active control systems.....	179
	6.1 Introduction.....	179
	6.2 Hardware platform	179
	6.2.1 Optimization of actuators arrangement.....	179
	6.2.2 Optimization of error microphones.....	187
	6.2.3 Control unit.....	192

6.3	Control structures.....	194
6.3.1	Feedforward control.....	194
6.3.2	Acoustic feedback.....	200
6.3.3	Feedback control.....	202
6.3.4	Virtual microphone control.....	204
6.4	Adaptive control algorithms	210
6.4.1	The Least Mean Square algorithm.....	210
6.4.2	Stability of the LMS-family algorithms.....	214
6.4.3	Fast implementations	216
6.4.4	Multichannel implementations.....	226
6.5	Summary.....	242
Chapter 7	Summary.....	245
Appendix A	Stiffness matrix elements.....	247
Appendix B	Mass matrix elements	251
References.....		253
Index.....		263