

# Contents

<b>1. Introduction</b>	<b>19</b>
1.1 Problem statement . . . . .	19
1.2 Motivation . . . . .	22
1.3 State of the art . . . . .	23
<b>2. Vibrations of thin beam and plate structures</b>	<b>27</b>
2.1 Theoretical considerations . . . . .	27
2.2 Numerical simulations . . . . .	33
2.3 Orthogonality of the eigenfunctions . . . . .	37
<b>3. Acoustic radiation of vibrating plate structures</b>	<b>41</b>
3.1 Introduction . . . . .	41
3.2 Structural-acoustic coupling . . . . .	44
3.2.1 Outline . . . . .	44
3.2.2 Numerical model . . . . .	44
3.2.3 Results and discussion . . . . .	46
3.3 Far-field acoustic radiation of a baffled plate . . . . .	49
3.4 Free-field acoustic radiation – BEM model . . . . .	52
3.4.1 Theoretical background . . . . .	52
3.4.2 Implementation – the algorithm . . . . .	57
3.5 Experimental investigations, results, and discussion . . . . .	62
3.6 Conclusions . . . . .	67
<b>4. Piezoelectric sensors and actuators</b>	<b>69</b>
4.1 State of the art, assumptions, and general description . . . . .	69
4.2 Piezoelectric sensors . . . . .	71
4.3 Piezoelectric actuators . . . . .	73
4.4 Signal conditioning . . . . .	75
4.5 Some technical aspects on the preparation of the composite structures for active control systems . . . . .	80
4.6 Numerical and experimental investigations . . . . .	81
4.6.1 Beam structures . . . . .	82
4.6.2 Plate and panelled structures . . . . .	86
4.7 Excitation of resonant vibrations . . . . .	90
4.8 Conclusions . . . . .	93

<b>5. Active vibroacoustic control system</b>	<b>95</b>
5.1 Aim and methods . . . . .	95
5.2 Single feedback loop . . . . .	99
5.3 Multiple independent feedback loops . . . . .	104
5.4 Identification of the external disturbance . . . . .	109
5.5 Implementation of the active control system . . . . .	114
5.6 Experimental investigations . . . . .	116
5.7 Conclusions . . . . .	137
<b>6. Concluding remarks</b>	<b>141</b>
6.1 Summary . . . . .	141
6.2 Scope of contribution . . . . .	143
6.3 Recommendations for future work . . . . .	144

<b>Bibliography</b>	<b>147</b>
---------------------	------------