

Contents

Preface	5
Translator's preface	8
1 Dynamic characteristics and efficiency of vibration protection systems	13
1.1 Statement of the problem of protection from dynamic excitations	13
1.1.1 One-dimensional dynamic vibration absorber	15
1.1.2 Multidimensional dynamic vibration absorber	17
1.1.3 Uniaxial vibration isolator	17
1.2 Dynamic characteristics of the vibration-isolated system and the base	20
1.2.1 Example 1: The dynamic compliance matrix for a free rigid body	35
1.2.2 Example 2. The dynamic compliance of a two degree-of-freedom system	36
1.3 Efficiency conditions in the case of harmonic excitation	39
1.4 Efficiency in case of polyharmonic, random and non-stationary excitations	56
2 Linear active systems	61
2.1 Structure and elements of active systems	61
2.1.1 Transfer functions of active systems	61

2.1.2	Sensors	64
2.1.3	Compensators and amplifiers	67
2.1.4	Actuators	70
2.2	One-dimensional linear active systems	81
2.3	Conditions for stability of active systems	108
2.4	Systems with several measurement points	122
2.5	Transient processes in active systems and protection from impacts	129
2.6	Work and power in active systems	147
2.7	Multidimensional systems	156
3	Nonlinear passive single-degree-of-freedom systems	167
3.1	Methods of analysis for nonlinear system	167
3.2	Forced vibration under harmonic excitation and linear damping	183
3.3	Forced vibrations under harmonic excitation and Coulomb friction	199
3.4	Forced vibration in a system with internal friction	208
3.5	Comparative study of the various types of damping	212
3.6	Forced vibration under polyharmonic excitation	218
3.6.1	System with nonlinear elastic force and linear damping	219
3.6.2	System with linear elastic force and dry friction	224
3.6.3	General solution for the problem of polyharmonic driving	227
3.7	Subharmonic resonances in vibration protection systems	230
3.8	Subharmonic resonance in systems with rigid stops	242
3.9	Forced random vibrations	249
4	Nonlinear passive multi-degree-of-freedom systems	257
4.1	Static analysis of nonlinear elastic suspensions	257
4.2	Small vibration of elastically suspended rigid body	263
4.3	Vibration of an object mounted on nonlinear elastic isolators	272
4.4	Free vibration of a nonlinear vibration protection system	282
4.5	Resonant vibration	293
4.6	Forced vibration in systems with Coulomb friction	300
4.7	Forced vibration of elastic bodies	306
5	Nonlinear active systems	319
5.1	Resonant vibrations in nonlinear systems under harmonic excitation	319
5.2	Subharmonic vibrations	332
5.3	Influence of nonlinearities in feedback	342
5.4	Stability of vibration in nonlinear systems	354
6	Optimal systems of vibration protection	365

6.1	Statement of the optimisation problem	365
6.2	Determination of the optimal control	370
6.3	Optimal vibration isolation of a rigid body	390
6.4	Approximate synthesis of the optimal isolator characteristics	402
	Bibliography	411
	Index	423