FOREWORD BY ACADEMICIAN N. N. BOGOLYUBOV	vi
INTRODUCTION	1
Chapter I. EXAMPLES OF DIFFERENTIAL EQUATIONS ENCOUNTERED WHEN INVESTIGATING NONLINEAR VIBRATING SYSTEMS WITH SLOWLY VARYING PARAMETERS	4
§ 1. Typical differential equations, basic definitions and restrictions	4
§ 2. Examples of vibrating systems described by differential equations of the type (1.1).	10
§ 3. Vibrations of systems of a variable mass	11
§ 4. The action of "periodic" forces of variable frequencies and amplitudes on a vibrating	
system. Transition through resonance	12
5. Examples of vibrating systems described by differential equations of the type (1.6)	
(1.18) and (1.21)	15
$\delta$ 6 Vibrations about a "guasi-stationary" state of motion	18
§ 7. Examples of vibrations about a state of musi-stationary motion	20
8 . Vibrations of vibrations with variable constraints	20
8.0. The idea and have assumptions of sourcestatic methods in population methods	- <u>-</u>
s , the idea and basic assumptions of asymptotic methods in nonlinear mechanics ,	20
Chapter II. "NORMAL" OSCILLATIONS IN NONLINEAR SYSTEMS WITH SLOWLY VARYING PARAMETERS	29
§ 1. Method of constructing asymptotic solutions for an equation close to a linear one	29
<ul> <li>Equations of the first and second approximations and methods for their construction</li> </ul>	36
<ul> <li>a particular cases of guardian (9, 1)</li> <li>a particular cases of guardian (9, 1)</li> </ul>	40
$\delta$ , vincular cases of equation $(\lambda, 1)$ , $\ldots$	41
5 4. Viblations of a periodian with variable length	• <del>1</del> 1
integrable one	
	44
s o, example of an equation close to an exactly integrable one	52
\$ 7. Investigation of the equation of first approximation for the amplitude, and methods for	
	55
8. Construction of envelopes for the amplitudes of vibrations described by equations close to	
	58
Chapter III. THE ACTION OF "PERIODIC" FORCES ON NONLINEAR VIBRATING SYSTEMS	
WITH SLOWLY VARYING PARAMETERS	63
§ 1. General method for constructing asymptotic solutions	63
§ 2. Particular cases of equation (3.1)	75
§ 3. Stationary modes and their stability in nonlinear vibrating systems	78
§ 4. Linear second order equations with slowly varying coefficients	82
\$ 5. Numerical integration of the systems of equations of the first second erc approximations	87
6. Forced withstigne of a nonlinear withstor during a transition brough the source	80
\$ 7. Comparison of theoretical and experimental resonance curves for transition through	00
	109
Solution through demultiplicative and parametric recording to the second s	102
5 0. Examples of transition through demutificative and parametric resonances	1107
5. A the offer of energy a period force a strength prolinger under grand and	101
10. The effect of external periodic forces of subject provide the training systems	121
\$ 11. Investigation of differential equations close to equations with "periodic" coefficients	129
\$ 12. Examples of nonstationary vibrations in systems described by equations close to an equa-	
tion with "periodic" coefficients	136
§ 13. Construction of asymptotic solutions for a nonlinear differential equation with slowly	
varying parameters of the type (1.16)	140
§ 14. Examples of vibrating systems with slowly varying parameters described by equations	
of the type (1.16)	146
Chapter IV MONORDROITENCY MER ATIONS IN NONLINEAD SYSTEMS WITH MANY	
DECREES OF EDETOM AND STORY VADVING DADAMETEDS	150
A L Construction of augmentatic columnary companying to a manafrague and in the	100
s L Construction of asymptotic solutions corresponding to a monomequency mode in a	160
viorating system	156
9 2. Asymptotic expansions for particular cases of the system (4.3). Stationary modes and	
their stability	167
§ 3. Torsional vibrations of a crankshaft in a nonstationary mode	174

§ 4. Construction of asymptotic solutions in the case of a vibrating system with a single	
nonlinear element	181
§ 5. Methods of constructing approximate solutions for the fundamental resonance and	
stationary modes	186
§ 6. Torsional vibrations of the crankshaft of an aircraft engine in a nonstationary mode	189
§ 7. Construction of asymptotic approximations in presence of an internal resonance	198
§ 8. The action of a perturbing force with several frequencies on a nonlinear vibrating	
system with many degrees of freedom	203
§ 9. Transformation of the system of differential equations (4.3) to "quasi-normal" coor-	
dinates. Construction of a general solution	208
Chapter V. NONLINEAR VIBRATING SYSTEMS WITH GYROSCOPIC TERMS	210
§ 1. Construction of asymptotic solutions describing monofrequency vibrations in nonlinear	
gyroscopic systems	210
§ 2. Derivation of differential equations describing the nonstationary mode in a gyroscopic	
system of centrifugal type	220
§ 3. Forced vibrations during a transition through critical numbers of revolutions in a centri-	
fuge taking account of the gyroscopic effect of the rotor	232
§ 4. Reduction of a system of equations of the type (5.4) to "normal" coordinates $\cdots$	236
§ 5. Example of reducing a system of equations with gyroscopic terms to "normal" coordinates	239
9 6. Construction of the general solution for a system of nonlinear equations of the type (5, 167)	243
§ 7. Construction of asymptotic solutions for a nonlinear equation with gyroscopic terms in the	
	251
s 8. Investigation of the nonstationary mode in a gyroscopic system of centrifugal type in the	
for Nonetationary vibrations of occurrent states	256
\$ 9. Nonstationary vibrations of coaxial fotors	265
s to, construction of asymptotic approximations for systems of differential equations of the	070
	270
Chapter VI. MONOFREQUENCY VIBRATIONS OF SYSTEMS WITH DISTRIBUTED PARAMETERS	274
§ 1. The construction of approximate solutions without a derivation of the exact differential	
equations of the problem	274
§ 2. Transversal vibrations of a rod subjected to the action of a longitudinal sinusoidal force	
of variable frequency	279
9 3. Transversal vibrations of a beam subjected to the action of a pulsating force with a	
$ \begin{cases} 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1$	285
\$ 4. Transversal vibrations of a rod of double-valued rigidity in a transient rotational mode .	288
	298
\$ 7. Asymptotic expansions for poplinear partial differential equations , along the human line	302
equations	907
	307
Chapter VIL METHODS OF CONSTRUCTING ASYMPTOTIC SOLUTIONS FOR SYSTEMS OF	
DIFFERENTIAL EQUATIONS CONTAINING SLOWLY VARYING PARAMETERS.	311
§ 1. Relaxation systems with slowly varying parameters	311
§ 2. Asymptotic representations for two-parametric families of solutions	320
9 3. Application of the method of averaging to the study of vibrating systems with slowly	
varying parameters	328
Chapter VIII, THE MATHEMATICAL FOUNDATION OF THE ASYMPTOTIC METHOD	335
§ 1. Asymptotic convergence of approximate solutions. Estimation of the error of the	
$m$ -th approximation $\ldots$ $\ldots$ $\ldots$ $\ldots$ $\ldots$ $\ldots$	335
§ 2. Some stability criteria of a monofrequency mode in vibrating systems with slowly	
varying parameters	343
§ 3. The existence and stability of integral manifolds for nonlinear systems with slowly varying	
parameters	353
$\S$ 4. Theorems on the stability of one- and two-parametric families of solutions in general form $~$ .	362
APPENDIX	368
BIBLIOGR APHY	
LIST OF ABBREVIATIONS	375
	375 385
	375 385
	375 385
iv	375 385
iv	375 385