

Contents

Foreword	v
Introduction	vii
1 Description of electromechanical systems	1
1.1 Electrostatics and magnetostatics	1
1.2 The Lagrange-Maxwell equations	8
1.3 Stability of stationary motions of systems with quasi-cyclic coordinates and the mechanical equilibrium under the action of magnetic field	12
1.4 Motion of electromechanical systems due to electromotive forces	23
2 Motion of the conducting rigid body in alternating mag- netic field	31
2.1 Asymptotic transformation of the equations of motion for conducting rigid body in alternating magnetic field	31
2.2 Pendulum in the alternating magnetic field	40
2.3 Magnetic suspension in the field of alternating currents . . .	46
3 Dynamics of synchronous electric machines	65
3.1 The idealized model of synchronous machine	65
3.2 Equation of the synchronous machine in the case of a pow- erful network	67

3.3	Systems with electromagnetic vibration absorbers	79
3.4	Optimal parameters of the magneto-electric extinguisher of small vibrations of a single-degree-of-freedom system	85
3.5	Swinging of the rotor of synchronous machine and motion of the pendulum with magneto-electric extinguishers	90
3.6	Dynamics of synchronous machine that autonomously works on load	99
3.7	Asymptotic transformation of equations when synchronous machine works on load through rectifier	109
3.8	Stationary regimes of operation of rectifier working on pure active load	112
3.9	Control of the load current	118
3.10	Work of generator on counter-electromotive force via rectifier	120
3.11	Control of excitation of brief action turbogenerators	121
3.12	Dynamics of two synchronous generators operating in parallel into a common active-inductive load	130
3.13	Equation for electromechanical processes in inductor machines	145
3.14	Some inverse problems of theory of inductor machines . . .	156
3.15	Single-pack and unlike-pole machines, machines with open slot	157
3.16	Equation of electromechanical processes in three-phase unlike-pole machine	161
3.17	Feature of transient processes for star connection with zero wire	170
4	Periodic solutions in problems of excitation of mechanical oscillations	175
4.1	Special form of notation for equations of motion and their solutions	175
4.2	Integral stability criterion for periodic motions of electromechanical systems and systems with quasi-cyclic coordinates	182
4.3	Energy relationships for oscillations of current conductors .	191
4.4	On the relationship between the resonant and non-resonant solutions	193
4.5	Routh's equations which are linear in the positional coordinates	197
5	Oscillations caused by electromagnets	205
5.1	Equations for determining the constant components of magnetic fluxes	205
5.2	Systems with a single electromagnet	212
5.3	System with electromagnets in the differentiating circuit .	220
5.4	Interaction effects. Synthesis of electromagnets for vibration excitation	226

5.5	Generating solution for the induction - field strength non-linearity	229
5.6	Oscillation of the feed frequency in system with reactive electromagnet	231
5.7	Oscillations in systems with two electromagnets. Asymmetrical modes	236
5.8	Vibrations in system with collisions. Influence of mechanical nonlinearity	241
6	Charged particle in electromagnetic field	253
6.1	Motion due to fast oscillating forces	253
6.2	Motion of the charged particle in high-frequency electromagnetic field	259
6.3	Particle in electromagnetic field with high-frequency and constant components	266
6.4	Relativistic charged particle in essentially heterogeneous crossed electric and magnetic fields	271
6.5	Motion of the non-relativistic particle in heterogeneous magnetic field	280
6.6	Motion of the non-relativistic particle in perturbed axisymmetric field	284
7	Some problems of nonlinear magnetoelasticity	289
7.1	Statement of "elastic-linear" problems of nonlinear magnetoelasticity	289
7.2	Equilibrium of ferromagnetic bodies. Nonlinear boundary-value problems	294
7.3	Boundary-value problems for equilibrium of conductors with currents	303
7.4	Equilibrium of elastically suspended rigid bodies	308
7.5	Equilibrium of string subjected to magnet force and prescribed external load	311
7.6	The Emden-Fowler equation. Reduction to autonomous system	321
7.7	Equilibrium of ferromagnetic membrane and threads with currents	332
7.8	On the stable equilibrium forms of conductors with currents	336
	Appendices	343
A	Averaging quasilinear systems with several fast variables	343
A.1	Linear equation with coefficients given by asymptotical series	343
A.2	The case when function $\xi(\tau, \varepsilon)$ is given by an asymptotic sequence	348
A.3	Separating slow variables in quasi-linear systems	350
A.4	Remarks	357

B	Systems integrable in the first approximation of the averaging method	359
C	Higher approximations of the averaging method for systems with discontinuous variables	367
D	On qualitative investigation of motion by the asymptotic methods of nonlinear mechanics	375
	References	383
	Index	395



<http://www.springer.com/978-3-540-25139-2>

Non-Linear Electromechanics

Skubov, D.; Khodzhaev, K.S.

2008, XIV, 399 p., Hardcover

ISBN: 978-3-540-25139-2