

Mechanics of non-holonomic systems

A New Class of control systems

Bearbeitet von
Sh.Kh Soltakhanov, Mikhail Yushkov, S Zegzhda

1. Auflage 2009. Buch. xxxii, 332 S. Hardcover
ISBN 978 3 540 85846 1
Format (B x L): 15,5 x 23,5 cm
Gewicht: 1510 g

Weitere Fachgebiete > Technik > Werkstoffkunde, Mechanische Technologie > Kontinuumsmechanik

Zu [Leseprobe](#)

schnell und portofrei erhältlich bei

The logo for beck-shop.de features the text 'beck-shop.de' in a bold, red, sans-serif font. Above the 'i' in 'shop' are three red dots of increasing size. Below the main text, 'DIE FACHBUCHHANDLUNG' is written in a smaller, red, all-caps, sans-serif font.

beck-shop.de
DIE FACHBUCHHANDLUNG

Die Online-Fachbuchhandlung beck-shop.de ist spezialisiert auf Fachbücher, insbesondere Recht, Steuern und Wirtschaft. Im Sortiment finden Sie alle Medien (Bücher, Zeitschriften, CDs, eBooks, etc.) aller Verlage. Ergänzt wird das Programm durch Services wie Neuerscheinungsdienst oder Zusammenstellungen von Büchern zu Sonderpreisen. Der Shop führt mehr als 8 Millionen Produkte.

Table of Contents

Chapter I Holonomic Systems	1
1. Equations of motion for the representation point of holonomic mechanical system	1
2. Lagrange's equations of the first and second kinds	4
3. The D'Alembert–Lagrange principle	12
4. Longitudinal accelerated motion of a car as an example of motion of a holonomic system with a nonretaining constraint	15
Chapter II Nonholonomic Systems	25
1. Nonholonomic constraint reaction	25
2. Equations of motion of nonholonomic systems. Maggi's equations	28
3. The generation of the most usual forms of equations of motion of nonholonomic systems from Maggi's equations	38
4. The examples of applications of different kinds equations of nonholonomic mechanics	45
5. The Suslov–Jourdain principle	66
6. The definitions of virtual displacements by Chetaev	74
Chapter III Linear Transformation of Forces	77
1. Some general remarks	77
2. Theorem on the forces providing the satisfaction of holonomic constraints	83
3. An example of the application of theorem on the forces providing the satisfaction of holonomic constraints	88
4. Chetaev's postulates and the theorem on the forces providing the satisfaction of nonholonomic constraints	92
5. An example of the application of theorem on forces providing the satisfaction of nonholonomic constraints	97
6. Linear transformation of forces and Gaussian principle	100
Chapter IV Application of a Tangent Space to the Study of Constrained Motion	105
1. The partition of tangent space into two subspaces by equations of constraints. Ideality of constraints	105
2. The connection of differential variational principles of mechanics	109

3. Geometric interpretation of linear and nonlinear nonholonomic constraints. Generalized Gaussian principle	113
4. The representation of equations of motion following from generalized Gaussian principle in Maggi's form	119
5. The representation of equations of motion following from generalized Gaussian principle in Appell's form	121
Chapter V The Mixed Problem of Dynamics. New Class of Control Problems	125
1. The generalized problem of P. L. Chebyshev. A new class of control problems	125
2. A generation of a closed system of differential equations in generalized coordinates and the generalized control forces	128
3. The mixed problem of dynamics and Gaussian principle	131
4. The motion of spacecraft with modulo constant acceleration in Earth's gravitational field	137
5. The satellite maneuver alternative to the Homann elliptic motion	144
Chapter VI Application of the Lagrange Multipliers to the Construction of Three New Methods for the Study of Mechanical Systems	149
1. Some remarks on the Lagrange multipliers	150
2. Generalized Lagrangian coordinates of elastic body	152
3. The application of Lagrange's equations of the first kind to the study of normal oscillations of mechanical systems with distributed parameters	154
4. Lateral vibration of a beam with immovable supports	160
5. The application of Lagrange's equations of the first kind to the determination of normal frequencies and oscillation modes of system of bars	165
6. Transformation of the frequency equation to a dimensionless form and determination of minimal number of parameters governing a natural frequency spectrum of the system	173
7. A special form of equations of the dynamics of system of rigid bodies	178
8. The application of special form of equations of dynamics to the study of certain problems of robotics	181
9. Application of generalized Gaussian principle to the problem of suppression of mechanical systems oscillations	183
Chapter VII Equations of Motion in Quasicoordinates	193
1. The equivalence of different forms of equations of motion of nonholonomic systems	193

2. The Poincaré–Chetaev–Rumyantsev approach to the generation of equations of motion of nonholonomic systems	201
3. The approach of J. Papastavridis to the generation of equations of motion of nonholonomic systems	207
Appendix A The Method of Curvilinear Coordinates	213
1. The curvilinear coordinates of point. Reciprocal bases	213
2. The relation between a reciprocal basis and gradients of scalar functions	215
3. Covariant and contravariant components of vector	216
4. Covariant and contravariant components of velocity vector . . .	217
5. Christoffel symbols	218
6. Covariant and contravariant components of acceleration vector. The Lagrange operator	220
7. The case of cylindrical system of coordinates	222
8. Covariant components of acceleration vector for nonstationary basis	225
9. Covariant components of a derivative of vector	227
Appendix B Stability and Bifurcation of Steady Motions of Nonholonomic Systems	229
Appendix C The Construction of Approximate Solutions for Equations of Nonlinear Oscillations with the Usage of the Gauss Principle	235
Appendix D The Motion of Nonholonomic System without Reactions of Nonholonomic Constraints	239
1. Existence conditions for “free (unconstrained) motion” of nonholonomic system	239
2. Free motion of the Chaplygin sledge	240
3. The possibility of free motion of nonholonomic system under active forces	243
Appendix E The Turning Movement of a Car as a Nonholonomic Problem with Nonretaining Constraints	245
1. General remarks	245
2. The turning movement of a car with retaining (bilateral) constraints	246
3. The turning movement of a rear-drive car with nonretaining constraints	249
4. Equations of motion of a turning front-drive car with non-retaining constraints	255
5. Calculation of motion of a certain car	258
6. Reasonable choice of quasivelocities	260

Appendix F Consideration of Reaction Forces of Holonomic Constraints as Generalized Coordinates in Approximate Determination of Lower Frequencies of Elastic Systems	263
Appendix G The Duffing Equation and Strange Attractor	281
References	287
Index	327