NASA TECHNICAL TRANSLATION NASA TT F-16,178

TABLE OF CONTENTS AND ABSTRACTS OF MEKHANIKA MASHIN, NO 45, 1974

Translation of table of contents and abstracts of Mekhanika Mashin, No. 45, 1974, Moscow, "Nauka" Press, pp. 144-147

(NASA-TT-F-16178) TABLE OF CONTENTS AND ABSTRACTS OF MEKHANIKA MASHIN, NO. 45, 1974 (Kanner (Leo) Associates) 11 p HC $3.25 CSCL 13I

N75-21638

Unclas
G3/37 19625

MAY 1975
RECEIVED
NASA STI FACILITY
INPUT BRANCH

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. 20546 MARCH 1975

STANDARD TITLE PAGE

1. Report No. NASA TT F-16,178	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle TABLES OF CONTENTS AND ABSTRACTS OF MEKHANIKA MASHIN, No. 45, 1974		5. Report Date March 1975
		6. Performing Organization Code
7. Author(s) I. I. Artobolevskiy, editor		8. Performing Organization Report No.
		10. Work Unit No.
9. Performing Organization Name and Address Leo Kanner Associates Redwood City, California 94063		11. Contract or Grant No. NASw-2481
		13. Type of Report and Period Covered Translation
12. Sponsoring Agency Name and Address National Aeronautics and Space Administration, Washington, D.C. 20546		14. Sponsoring Agency Code

15. Supplementary Notes

Translation of table of contents and abstracts of Mekhanika Mashin, No. 45, 1974, Moscow, "Nauka" Press, pp. 144-147

16. Abstract

Abstracts of the articles in Mekhanika Mashin, No 45, 1974, are listed.

17. Key Words (Selected by Author(s))	18. Distribution Statement Unclassified - Unlimited		
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages	22. Price

NASA-HQ

ABSTRACTS AND TABLE OF CONTENTS OF MEKHANIKA MASHIN, NO 45, 1974

Page

Second Symposium on the Theory and Geometry of Spatial Gearings, I. I. Artobolevskiy and N. I. Levitskiy /144*

Brief accounts are given of papers presented at the Second Symposium on the Theory and Geometry of Spatial Gearings (Leningrad, 1973), which was held on the decision of the Scientific Council on the Theory of Machines and Working Processes, USSR Academy of Sciences, and the Scientific-Technical Council of the USSR Ministry of Higher and Specialized Secondary Education. Since the Symposium participants dedicated their papers to the 60th birthday of the organizer of the Symposium, the director of the Leningrad branch of the seminar on the theory of machines and mechanisms, Professor and Doctor of Technical Sciences F. L. Litvin, a brief presentation of his scientific and pedagogic activity was delivered.

Synthesis of spatial gearings with line and point tangency of teeth for the simplest motions of the generating surfaces, L. V. Korostelev, V. D. Borisov, and Yu. I. Rastov

Methods of obtaining spatial gearings with line and point contact of working surfaces of teeth using the simplest motions of the generating surfaces and lines are discussed. These methods of synthesis simplify and reduce the number of tool motions, while simultaneously using simple forms of auxiliary surfaces. 6 illustrations and 6 bibliographic references.

---

* Numbers in the margin represent pagination in the foreign text.

Mutual gearings and generalization of Camus' theorem,

Ya. S. Davydov

A rigid congruent generating pair (RCGP) executes screw motion in the general case. To each gearing equation there corresponds two distinct machine tool gearings, called mutual gearings. Gears uncut in two mutual machine tool gearings form a train with line contact. New cases of mutuality were noted, permitting transmission between noncoplanar axes with line contact by means of not a screw, but a rotating RCGP.

If the gears rotate about parallel axes, and the RCGP degenerates into a pair of congruent generating lines, we get Camus' theorem, familiar from the theory of plane gearing. 1 illustration and 10 bibliographic references.

Features of gearing in a higher kinematic couple,

V. M. Vasil'yev

An examination is made of a special case of tangency of gear tooth surfaces in gearings with point contact, when at some point of contact the curvatures of the tangent surfaces coincide at one of the normal sections. It is shown that when this point of contact is present, the solution of the inverse problem of the theory of gearings is made difficult, since the nonuniqueness of the solution arises. Results obtained in this study help to find these singular points and remove them from consideration in the solution of the inverse problem. 8 bibliographic references.

Determining relationships between principal curvatures when there is an arbitrary value of an arbitrary gear ratio, F. L. Litvin and Ye. I. Gutman

Relationship between the main curvatures of gear tooth surfaces are determined under the following assumptions:

a) the derivative of the gear ratio is nonzero, and b) the tooth surfaces are either in line or point tangency. Applications for the local synthesis of approximate gearings are given. 1 illustration and 4 bibliographic references.

Unifying local synthesis and the solution of the inverse problem for optimzing approximate gearings with application to globoid transmissions, F. L. Litvin and Ye. I. Gutman

An algorith for optimizing the quality criteria is proposed for transmissions with approximate gearing; these criteria involve the following: error of displacement, fluctuation of gearing ratio, size and orientation of instantaneous area of contact, and so on. Optimization is achieved by variation during calculation of some of the adjustment parameters when cutting the teeth. The algorithm was put into effect in a program of a digital computer based on unifying local synthesis with the solution to the inverse problem. 1 illustration and 9 bibliographic references.

Universal programs for calculating gearings on a computer, G. I. Sheveleva

It is proposed that a library of programs be set up, constructed in algorithmic languages for solving problems in the theory of gearings. Several program-modules developed for solving problems associated with approximate gearings are presented. The contact problem of the theory of elasticity is posed as applied to gear tooth surfaces and an algorithm for its solution is given. 8 bibliographic references.

Development of a complex of programs for the numerical investigation of gearings with a computer, D. T. Babichev and V. S. Plotnikov

Results are presented from work on constructing methods of investigating gearings on a computer for a major reduction in the volume of analytic studies and programming when solving specific problems in the analysis of spatial gearings. The program complex set up for the Minsk-22 computer is capable of solving numerous problems in geometric and kinematic analysis of various kinds of transmissions and burnishers. 1 table, 6 illustrations, and 4 bibliographic references.

Synthesis of semirolling bevel transmission with circular teeth, V. N. Rubtsov

An examination is made of the synthesis of transmissions for the case of cutting gears on machine tools with bevel-pointed generating gear for simultaneous use of corrections (hypoid and axial displacement) and a rolling modifier. Analysis of the resulting adjustments was made by means of the solution to the inverse problem with reference to possible errors in transmission assembly. 5 illustrations and 5 bibliographic references.

Law of transmission ratio in the synthesis of approximate transmission, K. I. Gulyayev and G. A. Livshits

An analysis of different kinds of laws of transmission ratio is given. The main law suitable for synthesizing approximate gearings is defined. A relation is obtained between the parameters of this law and the cyclic error of a transmission. 4 illustrations and 2 bibliographic references.

Projection and calculation of hypoid transmissions in automotive construction, B. A. Dekhtyar

An examination is made of a complex of quality criteria for approximate hypoid transmissions of motor vehicles and ways of improving the transmission reliability by setting up nondivisible technological-design documentation and metrological standards are pointed out. 2 bibliographic references.

Longitudinal and profile curvature of tooth in bevel gears with circular teeth, N. F. Khlebalin

Formulas are derived linking longitudinal and profile curvatures of bevel gear teeth and corrections introduced into the adjustment settings of the gear tooth-cutting machine tool. In the derivation of the formula, use was made of the concept of the geodetic curvature of the tooth line and the method of the geometric interpretation of the vector-analysis method, 5 illustrations and 32 bibliographic references.

Calculation of worm cutters for machining rotors of screw compressors, V. A. Zalgaller

General formulas are given for calculating the surface of the worm cutter for machining a given surface of a screw rotor. The cutter surface is a two-parameter envelope of the rotor surface. The pitch of the cutter and the arrangement of the axes of rotor and cutter in the calculation are assumed to have been preselected; this selection is discussed, in part. 2 illustrations and 2 bibliographic references.

Method of solving inverse problem of gearing theory, V. D. Britskiy, K. A. Yegorov, and L. I. Nazarenko

An examination is made of a method of solving the inverse problem of gearing theory for the general case

of the formation of the working surfaces of gears. Each surface is represented as a result of the n-parameter successive enveloping by its generating surface. 1 illustration and 5 bibliographic references.

Two-evolvent gear transmission, V. V. Yedunov and V. V. Shul'ts

Results are presented from a study of the geometry and kinematics of several modifications of a two-evolvent transmission. It is shown to be possible to control the spread of the contact spot during running-in using adjustment of the angle between the principal curvatures of the gear tooth surfaces. An evaluation was made of the effect of errors; recommendations on the geometrical calculation are given, and the results of stand tests of one of the modifications are presented. 4 illustrations and 4 bibliographic references.

Synthesis of gear transmissions with "mixed" contact of working surfaces, L. V. Korostelev, P. D. Balakin, S. A. Baltadzhi, and S. A. Lagutin

It is shown possible to synthesize gear transmissions with mixed contact of working surfaces; this provides constancy of the transmission ratio when there are errors in the mutual arrangement of the gear axes and there is a high loading ability inherent to transmissions with line contact. 4 illustrations and 3 bibliographic references.

Synthesis of globoid transmissions where the worm is cut with a disking tool, N. N. Krylov, N. A. Chvanova, and B. L. Salamandra

An algorithm is presented for the goal-oriented search for the optimal parameters of the machine tool gearing

of a disking tool and a cutter worm ensuring the pre-assigned structure of the gearing surface and the orientation of the contact lines. The problem of synthesizing the globoid transmission formed by the successive two-step enveloping is solved based on accumulated experience in the designing of globoid pairs with lined surface of worm and the method of profiling a tool for machining these worms. The effect of deviations in the optimal parameters of the machine tool adjustments on the error of surface manufacture is established. 3 illustrations and 7 bibliographic references.

Investigating orthogonal spiroid transmission with cylindrical worm provided with ideally variable pitch turns, A. K. Georgiyev and V. I. Gol'dfarb

Results are presented from an analytic and numerical investigation of an orthogonal spiroid transmission with cylindrical worm having turns of ideally variable pitch. Equations are derived for the side surfaces of the turns; conditions of pointing of the latter at tips and valleys are determined; and equations of gearing and lines of limiting points of the first and second kind are derived. Data of specific numerical studies are presented. 3 illustrations and 9 bibliographic references.

Gearing angle and engagement factor of two-parameter gear transmissions, Ye. P. Soldatkin, S. D. Osipova, and B. F. Voronin

A transmission with variable angle between axes is examined; the transmission is composed of cylindrical and two-parameter gears. Functions are derived for determining the gearing angle and the engagement factor. The equation of the surface of the two-parameter gear blank is obtained. 6 illustrations and 3 bibliographic references.

Reliability and geometry of gear transmissions, V. V. Shul'ts

An examination is made of necessary conditions for retaining the operating indicators of a gear transmission for the required time period. Mated profiles cannot be reproduced in the flat gearings during wear since the wear laws are unique. It is shown that the convex-concave profiles of spiral polar transmissions of the two-evolvent or cyclo-evolvent types measure up most closely to the requirements of increased wear resistance and stable hydrodynamic lubrication. 1 illustration and 6 bibliographic references.

Stepped belt drive, A. Sh. Koliskor

An examination is made of the layout of a new stepped belt drive intended for small displacements, with respect to travel, of the working parts of machines. A method of calculation of the main drive parameters is set forth. 6 illustrations and 4 bibliographic references.

Investigation of the dynamics of winding of a belt with a free end, N. V. Gulia, M. Yu. Ochan, and O. V. Fedoseyev

An examination is made of the dynamics of a belt wound on a rotating drum and secured at only one end. Situations arising in the event the belt breaks in the rotating coil are analyzed theoretically. 2 illustrations and 5 bibliographic references.

Equations of motion of a machine assembly when nonholonomic connections are present, Ya. L. Geronimus

Differential equations of motion using the law of variation in the kinetic energy of a material system and not employing the following equations are presented for

a machine assembly with a variator, as a for a system with nonholonomic connections: the equations of Appel, Lagrange with indeterminate multipliers, and other analogous equations of nonholonomic mechanics. It is shown possible to extend this method to more general problems of the dynamics of machine assemblies. 2 illustrations and 7 bibliographic references.

Method of synthesizing technological complexes, I. I. Artobolevskiy and D. Ya. Il'inskiy

The fundamentals of the problem-oriented language Sistema: a synthesis of technological complexes are presented. The following processes are examined: forming sets of possible combinations of admissible values of the variables, finding solutions, screening out inadmissible and unsatisfactory solutions, and selecting the optimal solution. The concepts of set theory are used (to finding the possible combinations of variables), along with the language of discrete mechanical motions (for structural synthesis), tables of solutions (for finding all results), dynamic programming, and the logic of predicates (for the optimization process). 6 bibliographic references.