AUTHOR BELETSKIY, V.V., PA - 3o12

TITLE Integrability of Equations of motion of a Solid Around a Fixed Point under the Action of a Central Newtonian Field of Force. (Ob integriruyemosti uravneniy dvizheniya tverdigo tela okolo zakreplennoy tochki pod deystviyem tsentral'nogo n'yutonovskogo pola sil. Russian)

PERIODICAL Doklady Akademii Nauk SSSR,1957, Vol 113, Nr 2, pp 287-29o, (U.S.S.R.)
Received 6/1957 Reviewed 7/1957

ABSTRACT The present paper investigates the problem mentioned in the title under the assumption that the immovable point of the solid is situated in a distance R from the center of gravity large enough with respect to the dimensions of the solid. The equations of motion of the solid under the action of the above mentioned forces are put down explicitly, they are a generalization of the equation of the classical problem of motion of a heavy solid round a fixed point. The theory of the last multiplier of JAKOBI can be appleid to the equation here given and therefore the integration of these equations is under certain conditions reduced to quadratures. 1) In the general case this system of the equations ofmotion has three primary independent integrals, namely the energy integral, the integral of the moment of the momenta and a relation between the direction cosines. 2) If the solid has a total kinetic symmetry, the system of equations has a fourth integral in addition. There is also a fourth integral, if the solid has a kinetic symmetry around any principal axis of inertia or if the solid is fixed in the center of

Integrability of Equations of Motion of a Solid PA - 3o12
Around a Fixed point under the Action of a Central Newtonian Field of Force.

gravity. The presence of certain terms in the equations of motion and in the primary integrals modfies the graph of motion in some cases in comparison with the conditions in a plane-parallel field. A solution for the two-dimensional motion of the solid is put down. (Generalization of the problem of the physical pendulum). If an initial angular velocity is lacking, a solid fixed in the center of mass (as in the plane-parallel homogeneous field) will not be in equilibrium, but will move periodically. Then the special case of LAGRANGE is reduced to a quadrature. (Without illustrations).

ASSOCIATION Department for Appleid Mathematics of the Mathematical Institute of the Academy of Science of the U.S.S.R.

PRESENTED BY KELDYSH, M.V.,

SUBMITTED 9.9.1956

AVAILABLE Library of Congress

Card 2/2

AUTHOR: Beletskiy, V.V. (Moscow)

40-21-6-3/18

TITLE: Some Questions of the Motion of a Solid Body in a Newton Field of Forces (Nekotoryye voprosy dvizheniya tverdogo tela v n'yutonovskom pole sil)

PERIODICAL: Prikladnaya Matematika i Mekhanika, 1957, Vol 21, Nr 6, pp 749-758 (USSR)

ABSTRACT: The motion of a gyroscope in a radial-symmetric field of gravity is investigated. Instead of the rigorous equations there is carried out an approximation so that the measurements of the body are assumed to be small compared with the distance of the body from the center of attraction. For practical applications of gyroscopes on the surface of the earth this condition is always satisfied. As in the calculation of the motion of a gyroscope in a parallel field of gravity, also in a radial-symmetric field of gravity different integrals of motion can be found. It is possible to reduce the problem to quadratures similarly as it is done in the cases of the gyroscopic theory calculated by Euler and Lagrange. Differences against the well-known gyroscopic theory are obtained in investigating the stability of a gyroscope which is sup-

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ported in the center of mass. For very small speeds of rotation of the gyroscope there result unstable motions even when the gyroscope rotates around the axes of the greatest or smallest principal moment of inertia. Of course, the gyroscope becomes already stable for extraordinarily small speeds of rotation, so that the well-known stability behavior of the unsymmetric gyroscope results. The revolutions around the axis of the medium principal moment of inertia are always unstable even in a radially symmetric field of gravity. The author investigates the case of the spherical gyroscope and of the symmetric gyroscope. The results formerly obtained can be simplified in both cases. There are 4 figures and 9 references, 5 of which are Soviet, 3 French, and 1 Swedish.

SUBMITTED: April 29, 1957

AVAILABLE: Library of Congress

1. Bodies of revolution-Motion 2. Gravity-Applications

APPROVED FOR RELEASE: 06/06/2000 CIA-RDP86-00513R000204310012-8"

Belelskiy, V.V.

29(0) PHASE I BOOK EXPLOITATION SOV/1658

Akademiya nauk SSSR

Iskusstvennyye sputniki zemli, vyp. 1: Rezul'taty nauchnykh issledovaniy, provedennykh po programme MGG pri pomoshchi pervogo i vtorogo iskusstvennykh sputnikov zemli (Artificial Earth Satellites, Nr 1: Results of Scientific Studies Carried Out in Accordance With the IGY Program by Means of the First and Second Artificial Earth Satellites) Moscow, Izd-vo AN SSSR, 1958. 95 p. 3,500 copies printed. [Microfilm and Zerox Copy]

Resp. Ed.: L.V. Kurnosova; Ed. of Publishing House: D.M. Alekseyev; Tech. Ed.: T.V. Polyakova.

PURPOSE: This collection of articles is the first in a series to be published regularly and is intended to disseminate to the scientific community data collected in investigations performed by means of artificial earth satellites.

COVERAGE: This collection includes papers covering scientific data obtained from the first and second Soviet artificial earth satellites. Among the areas reported on are measurements of cosmic radiation, atmospheric density, electron concentration in the ionosphere, and biological studies of an animal occupant of a satellite. Papers on the motions and perturbations of satellite orbits and optical and Doppler methods of satellite tracking are also included. Coverage of the individual articles is given in the Table of Contents.

Beletskiy, V.V. Motion of an Artificial Satellite Relative to the Center of Mass 25

This article is an analytical treatment of the motion of an artificial satellite about the mass center under the action of aerodynamic and gravitational perturbations including consideration of the effect of the regression of the orbit caused by the oblateness of the Earth. In connection with the design of artificial earth satellites a series of scientific problems require the knowledge of the satellite motion about the center of masses. The survey of sun radiation by means of satellite instruments, the coefficient of resistance, satellite orientation and deceleration, and the great variety of initial angular velocities, their moments of inertia, moments of gravitational forces, aerodynamic perturbations, etc. lead to the more extensive and general stud; of motion of the space body about the center of masses. The secular motion perturbations (disturbances) are of great interest and particular attention is given to them in this paper. There are 4 references, 1 of which is Soviet, 2 French, 1 German. 42

BELETSKIY, V.V.

Libration of a satellite. Isk. sput. zem. no.3:13-31 '59.
(MIRA 12:12)
(Artificial satellites) (Mechanics, Celestial)

VAKHNIN, V.M.; BELETSKIY, V.V.

Using the anticipation method in observing an artificial satellite. Isk. sput. zem. no.3:47-53 '59. (MIRA 12:12)
(Artificial satellites)

10.5300 3,2200

25984
S/560/61/000/006/002/010
E032/E114

AUTHOR: Beletskiy, V.V.

TITLE: Classification of the motions of an artificial earth satellite about its centre of mass

PERIODICAL: Akademiya nauk SSSR. Iskusstvennyye sputniki Zemli. No. 6. Moscow, 1961. pp. 11-32

TEXT: In a previous paper (Ref.1: same journal, No.1, idz-vo AN SSSR, 1958, p.25) the present author considered the motion of a satellite about the centre of mass without taking into account various effects leading to energy dissipation. In the present paper the theory is generalised by the inclusion of gravitational perturbations, aerodynamic perturbations and also orbit regression. The notation employed is said to be the same as that used in Ref.1. The paper is divided into the following sections: 1) equations for the secular motion; 2) interaction between aerodynamic and gravitational perturbations; 3) effect of orbit regression. The motion is classified in terms of the locus of the end-point of the angular momentum vector L on a unit sphere. Detailed classification is given of the various satellite trajectories in

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terms of the above locus. This classification depends on the given initial conditions and also the conditions under which the motion takes place. Aerodynamic effects, which would slow down the angular motion of the satellite, are not included. These will be considered in a future publication. The present analysis is based on the following considerations. The motion of the axis of the satellite in space is determined largely by the motion of the angular momentum vector. It was shown in Ref.1 that the equations for the secular motion of the angular momentum vector L can be written down in the form

$$\sin\theta \frac{d\lambda}{dn} = \frac{\partial\Phi}{\partial\theta}, \qquad \sin\theta \frac{d\theta}{dn} = -\frac{\partial\Phi}{\partial\lambda} \tag{1.1}$$

where

$$\Phi = \frac{1}{2}\tilde{\gamma}\sin^2\lambda\sin^2\theta + \int \varphi(\theta,\lambda)\sin\theta d\theta - \sin\theta\left\{k_\Omega\cos\lambda\sin\omega\sin i + \sin\lambda(k_\omega + k_\Omega\cos i)\right\} - \cos\theta k_\Omega\cos\omega\sin i \tag{1.2}$$

These equations describe the motion of the vector L relative to a set of coordinates which is attached to the perigee of the orbit: θ represents the angle between L and the velocity vector at the perigee, and λ the rotation of L about the velocity vector at the perigee. This angle is measured from the plane of the orbit. In these equations the term containing $\tilde{\gamma}$ represents the secular effect of gravitational moment. The secular effect of aerodynamic moments is represented by the function $\varphi(\theta, \lambda)$. The remaining terms in (1.2) depend on orbit regression, and hence the rotation of the above set of coordinates in absolute space. It is shown that the equation of the trajectory of the end point of the angular momentum vector on a unit sphere, whose centre coincides with a centre of mass of the satellite, is given by:

$$\frac{1}{2}\tilde{\gamma}\cdot\cos^2\theta_1 - \alpha\cdot\cos\theta - \frac{1}{3}\beta\cdot\cos^3\theta - k_{\Omega}\cdot\cos\rho = \Phi_0 \quad (1.8)$$

This equation is derived subject to certain assumptions which, however, hold in the case of the Soviet satellites. In Eq.(1.8), ρ is the angle between the angular momentum vector and the

direction towards the earth's north pole, θ_1 is the angle between the angular momentum vector and the normal to the plane of the orbit, α and β depend on the specific form assumed for the function φ (Ref.1), k_Ω is the velocity of the node, and k_ω is the velocity of the perigee. Eq. (1.8) includes effects associated with the simultaneous action of aerodynamic moments, gravitational moments and regression. The entire classification scheme put forward in the present paper is based on the detailed analysis of Eq. (1.8).
There are 9 figures, 1 table and 3 Soviet references.

SUBMITTED: August 1, 1959

APPROVED FOR RELEASE: 06/06/2000 CIA-RDP86-00513R000204310012-8"

26659
S/560/61/000/007/003/010
E032/E114

3.2300 (1121)

AUTHORS: Beletskiy, V.V., and Zonov, Yu.V.

TITLE: Rotation and orientation of the third Soviet satellite

PERIODICAL: Akademiya nauk SSSR. Iskusstvennyye sputniki Zemli, No.7, Moscow, 1961, pp. 32-55

TEXT: The third Soviet artificial Earth satellite carried a "self-orientating" magnetometer whose function was to measure the Earth's magnetic field (S.Sh. Dol'inov, L.N. Zhuzgov, N.V. Pushkov, this journal, No.2, Izd-vo AN SSSR, 1958, p.50). The magnetometer incorporates a movable frame whose normal is kept parallel to the magnetic-field vector by special probes and the tracking system. The rotation of the frame relative to the body of the satellite was measured by two probes and telemetered to the earth. The motion of the satellite about its centre of mass and also its orientation in space can be determined from the time dependence of these angles. The present paper describes the method used to solve this problem and also the results obtained for the rotation and orientation of the satellite up to the 109th orbit. The rotational parameters were determined using these and later orbit data. The first part of the present paper gives an account

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of the theory of the method. The motion of a satellite about the centre of mass is affected by gravitational and aerodynamic moments (Ref.2: V.V. Beletskiy, this journal, No. 1, AN SSSR, 1958, p 25. Ref.3: V.V. Beletskiy, this journal, No. 3, izd.vo AN SSSR, 1959, p.13. Ref.4: V.V. Beletskiy, this journal, No. 6, izd-vo AN SSSR, 1961, p. 11), electromagnetic moments (Ref.5: Yu.V. Zonov, this journal, No. 3, izd-vo AN SSSR, 1959, p. 118), possible interactions between magnetic moments associated with currents within the satellite itself and the Earth's magnetic field, etc. The motion of the satellite is therefore rather complicated, although in practice the rotational kinetic energy is very much greater than the work done by the external forces so that in a finite interval of time (for example, one complete orbit) the effect of the perturbing forces is small. Hence, in the first approximation it may be assumed that within such limited interval of time the motion of the satellite about its centre of mass is identical with the motion of a free solid body upon which no external forces are acting. In particular, in the case of the third Soviet satellite which had two equal principal central moments of inertia, the motion of the centre of mass on this approximation was found to take the form of a regular precession. The satellite's axis z', which is assumed to coincide with the dynamic symmetry axis, executed a uniform rotation with a constant precessional angular velocity $\dot{\psi}$ about the angular momentum vector L which remained fixed in absolute space (Fig.1). The nutation angle θ between z' and L was constant. Furthermore, the satellite rotated about z' with a constant angular velocity $\dot{\phi}$. In Fig.1, XYZ is the absolute Cartesian frame such that the Z axis points in the direction of the earth's pole, X points towards the Spring point, ξ_0 is the angle between L and the Y axis, and γ_0 is the angle between the LY and XY planes. The problem can then be reduced to the determination of the parameters θ, $\dot{\phi}$, $\dot{\psi}$, ξ_0 and γ_0 for each orbit and also the determination of the angles φ_0 and θ_0 of rotation and precession as functions of time. The indications of the magnetometer probes can be used to provide all these parameters. Fig.2 shows the arrangement of the magnetometer frames. The axis of the outer frame coincides with the axis of the satellite, and the frame can rotate about it. The angle of rotation Δ of this system is measured from a fixed (relative to the satellite) axis x' which is perpendicular to the satellite's symmetry axis z'. The values of this angle are telemetered to the earth by means of a probe whose indications are denoted by q_1. When $\Delta = 0$ the y' axis is normal to the outer frame. The axis of the inner frame is perpendicular to the axis of the outer frame. The normal to the inner frame is made parallel to the magnetic field $\underline{H}$ by rotating both frames through the necessary angles relative to the satellite. The angle of rotation of the inner frame is also telemetered to the Earth by a second probe, whose indications are denoted by q_2. The indications q_2 are not independent of q_1 and the independent part of q_2 is given by

$$\lambda \sim q_2 - \frac{1}{3} q_1$$

The angle λ then represents the angle between the z' axis and $\underline{H}$ (Fig.2). The angle Δ is the angle between the $z'\underline{H}$ plane and a plane fixed to the satellite and containing z'. Thus the two angles λ and Δ completely specify the orientation of the satellite relative to the magnetic field. They are functions of time, owing to the rotation of the satellite about the centre of mass and the motion of the latter along the orbit. If the direction of H is defined by the two coordinates ρ and γ, which are defined similarly to ρ_0 and γ_0, then since the orbit of the satellite and the geomagnetic field are known, it follows that ρ and γ are also known as functions of time. In that case $\lambda(t)$ and $\Delta(t)$ are determined by the dependence of λ and Δ on the orientation and rotation parameters of the satellite, and the latter can be determined from the telemetric data on $\lambda(t)$ and $\Delta(t)$. The magnetic coordinates ρ and γ were obtained from published tabulations of the dip and declination angles D and I as functions of geographic coordinates and height above the earth's surface. For each height the values of I and D were given in steps of 10 deg (latitude) and 30 deg (longitude). Intermediate values have to be interpolated (linearly). The authors then set up trigonometric relationships connecting the various angles so that the above scheme can be carried out in quantitative form, and the angles $\lambda(t)$ and $\Delta(t)$ can be determined from the magnetometer readings. Fig.7 shows a comparison between the computed (dashed curve) results and the experimental (full curve) results for orbit No. 15. Equally good agreement was obtained for other orbits. Fig.8 shows the angular velocity $\dot{\varphi}$ as a

function of the orbit number. Fig.9 shows the precession angle as a function of orbit number. Other numerical results given in this paper refer to the nutation angle, the orientation of the vector L relative to the orbit and relative to the sun. The final section is concerned with the calculation of the orientation of the satellite's instruments in space. This orientation is defined by the Eulerian angles φ, ψ and θ of the satellite relative to the fixed frame. Various relations are set up giving
1) the orientation relative to the earth's magnetic field, and
2) the orientation of a given axis in the satellite relative to a given direction in space. The theory and the numerical calculations obtained by the present authors have shown that it is possible to determine the orientation of any instrument set up on a satellite. The precession and rotation periods of the satellite can be calculated by the methods described in this paper to within 5 sec; the angle between the satellite's axis and the precession axis, i.e. the nutation angle, can be determined to within 1 deg, and the position of the precession axis in space to within 10 deg. The calculated rotational and orientational satellite parameters provide information about the motion of the satellite about its

centre of mass during the first few days after its launching. It turns out that during a period corresponding to one complete orbit the motion about the centre of mass can be approximately looked upon as a regular precession. The parameters describing this precession vary slowly from orbit to orbit. The satellite rotated about the direction of the vector $\bar{L}$ so that the angle between the satellite's axis and $\bar{L}$ was near 90 deg. The departures from this were not greater than 6 deg. The precession period ("somersault" period) slowly increased from 135-140 sec (orbits numbers 1-5) to 195 sec on the 283rd orbit. In addition, the satellite slowly rotated about its own symmetry axis. The angular velocity of this rotation decreased from 0.375 deg/sec in the first orbit to zero in the 20th orbit. Thereafter the direction of the rotation changed sign and varied about an average of about 0.1 deg/sec, deviations from the average being not greater than 0.1 deg/sec. The direction of the vector $\bar{L}$, i.e. the axis about which the "somersault" motion takes place, slowly changed its position in space at an average rate of about 1 degree per orbit. This motion was such that the direction of $\bar{L}$ tended towards the velocity vector of the centre of mass at the perigee. The two

directions become nearly identical in the 100-110th orbit. In these orbits the satellite experienced the maximum aerodynamic resistance. At the perigee and the apogee the base of the satellite turned towards the Earth with a period equal to the "somersault" period. The slow variation in the rotation and orientation parameters can be explained by aerodynamic and gravitational perturbations, the interaction between currents induced in the satellite and the Earth's field, and other effects. Acknowledgments are expressed to O.S. Ryzhina and O.I. Rau who programmed the electronic computer used in the numerical calculations. A.I. Repnev and a number of other workers at the AS USSR took part in the analysis of the data.
There are 21 figures, 7 tables and 7 Soviet references.

BELETSKIY, V. V.

"Motion of a satellite relative to the center of mass,"

Report presented at the Conference on applied Stability-of-Motion Theory and Analytical Mecahnics, Kazan Aviation Institute, 6-8 December 1962

BELETSKIY, V.V.

Orbit of an equatorial artificial earth satellite. Isk.sput. Zem. no.13:53-60 '62. (MIRA 15:7)
(Artificial satellites--Orbits)

BELETSKIY, V.V.

[redacted]

Libration of a satellite on an elliptic orbit. Isk. sput.
Zem. no.16:46-50 '63. (MIRA 16:6)

(Artificial satellites--Orbits)

BELETSKIY, V.V.

Evolution of the rotation of a dynamically symmetrical satellite.
Kosm. issl. 1 no.3:339-386 N-D '63. (MIRA 17:4)

BELETSKIY, V. V., SARYCHEV, V. A.,

"Problems of motion of the earth's artificial satellites about the center of the mass"

report to be submitted for the 14th Congress Intl. Astronautics Federation, Paris France, 25 Sep-1 Oct 1963

L 18191-63 EPA(b)/EWT(1)/FCC(w)/FS(v)-2/BDS/ES(v) AFFTC/AFMDC/ESD-3/APGC/
ACCESSION NR: AT3006839 S/2560/63/000/016/0068/0093
SSD Pg-4/Pd-4/Pe-4/Po-4/Pq-4 GW

AUTHOR: Beletskiy, V. V.

TITLE: Certain problems in the theory of translatory-rotary motion of a solid body in a Newtonian force field

SOURCE: AN SSSR. Iskusst. sputniki Zemli, no. 16, 1963, 68-93

TOPIC TAGS: translatory rotary motion, Newtonian force field, motion equation, first integral, relative equilibrium, equilibrium condition, equilibrium stability

ABSTRACT: The article gives a detailed presentation of certain results obtained earlier by the author (Iskusstvenny*ye sputniki Zemli, no. 3, Izd-vo AN SSSR 1959, p. 13); it also contains new results concerning the numerical estimates of certain effects arising from joint translatory and rotary motions. Motion equations are written in the most general form, and their solution is analyzed by taking the force function in its exact and approximate forms. The energy integral is derived and shows that the kinetic energy of mass

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ACCESSION NR: AT3006839

center translatory motion and the kinetic energy of a rotary motion about the mass center are closely connected; i.e., both transformation of the kinetic energy of a translatory motion into the kinetic energy of a rotary motion and the reverse take place. In addition to the energy integral three integrals of the kinetic moment are also derived. The solution of motion equations in the case of a plane motion of the body along a circular orbit with constant velocity as well as the relative equilibrium of the body (the location of principal central axes of inerita with respect to the radius vector, tangent, and binormal of a circular orbit at any instant of a motion) are analyzed. Conditions under which such a motion exists are established, and the class of bodies satisfying these conditions and their properties are analyzed. Stability of a relative equilibrium is studied on the basis of a quadratic Lyapunov function. Sufficient stability conditions, which are also the conditions necessary for the Lyapunov function to be definite and positive, are derived and then reduced to the final form B > A > C, where A, B, and C are principal central moments of

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ACCESSION NR: AT3006839

inertia of the body. The results obtained are formulated as follows: For the relative equilibrium of a body on a circular orbit in a Newtonian force field to be stable, it is sufficient that during the nonperturbed motion the direction of the major axis of the ellipsoid of inertia coincide with the direction of the radius vector of the orbit, that the minor axis coincide with the direction of the normal to the orbit plane, and that the intermediate axis coincide with the direction of the tangent to the orbit. A particular case of translatory-rotary motion, when the orbit of the center of mass is plane and the y-axis of the body coincides with the normal to the orbit plane, is studied. Orig. art. has: 4 figures and 102 formulas.

ASSOCIATION: none

SUBMITTED: 06Aug62 DATE ACQ: 08Aug63 ENCL: 00

SUB CODE: AS NO REF SOV: 011 OTHER: 002

Card 3/3

L 18275-63 EPA(b)/EWT(1)/FCC(w)/FS(v)-2/BDS/EEC-2/ES(v) AFFTC/AFMDC/ESD-3/APGC/SSD Pd-4/Pe-4/Pi-4/Po-4/Pq-4 TT/GW
ACCESSION NR: AT3006840 S/2560/63/000/016/0094/0123

87

AUTHOR: Okhotsimskiy, D. Ye.; Beletskiy, V. V.

TITLE: Use of an earth-oriented satellite for solar investigations

SOURCE: AN SSSR. Iskusst. sputniki Zemli, no. 16, 1963, 94-123

TOPIC TAGS: satellite attitude, orbital element, solar investigation, instrument illumination, satellite instrumentation

ABSTRACT: An analysis is made of solar illumination of instruments mounted on a satellite with triaxial stabilization—one axis oriented to the earth, the second along the normal to the orbital plane, and the third along the transversal. A slight change occurs in the attitude of the orbit relative to the sun owing to the yearly motion of the earth around the sun and the regression of the orbital node of the satellite due to the oblateness of the earth. The problem of determining the total time of illumination is solved 1) by determining the illumination time at a constant angle ν between the direction to the sun and the normal to the orbital plane, and 2) by considering changes in angle ν with time. Illumination time is the time the sun remains within the

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angle of view of the instrument. To solve the first part, the maximal time of instrument illumination during one orbit of the satellite at given values of angle ν and instrument angle of view ρ and with a varying angle between the optical axis of the instrument and the axis of the satellite is sought. It is found that the maximal illumination time increases as angle ν decreases. The determination of angle ν as a function of time makes it possible to establish its dependence on the angle of orbital inclination to the equatorial plane and on the initial conditions (hour and date) of satellite launching. For a typical orbit (inclination to equator $i = 65°$; period of rotation $T_0 = 90$ min) the total time of illumination during a satellite lifetime can reach about 60 hr under optimal conditions and only about 15 hr for an instrument with an angle of view of 5°. Increasing the angle of view increases the illumination time. The total time of illumination depends on the hour and date of launching, the position of the optical axis of the instrument relative to the satellite, and the inclination of the orbit to the equatorial plane. Optimization of the orbital elements and programmed control of the position of the axis of the instrument can increase illumination time 2—10 times. The analysis supports the feasibility of using earth-oriented satellites for solar investigations. Orig. art. has: 25 figures and 23 formulas.

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ACCESSION NR: AP4009621 S/0293/63/001/003/0339/0386

AUTHOR: Beletskiy, V. V.

TITLE: Evolution of spin in a dynamically symmetrical satellite

SOURCE: Kosmicheskiye issledovaniya, v. 1, no. 3, 1963, 339-386

TOPIC TAGS: satellite, dynamically symmetrical satellite, satellite motion, satellite spin, aerodynamic friction, aerodynamic pressure, satellite shell eddy current, satellite magnetic field, light pressure, satellite shell magnetization, artificial earth satellite

ABSTRACT: A complete system of equations in osculant elements is presented, as a continuation and expansion of previous reports (V. V. Beletskiy. Sb. "Iskusstvenny*ye sputniki Zemli", Izd-vo AN SSSR, No. 6, 1961, 13-32; ibid, No. 1, 1958, 26-43; ibid, No. 3, 1959, 13-32), to describe the spin of a dynamically symmetrical earth satellite. The osculant elements (see Fig. 1 in the Enclosure) are used as system $L, \sigma, \rho, \vartheta, n, \psi$.

or $L, \sigma, \rho, \vartheta, \varphi, \psi$.

where moments of interference forces are, respectively, independent of or dependent

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ACCESSION NR: AP4009621

on the angular velocity of inherent spin φ. A method of averaging based on one or two fast variables is employed for simplification. The concept of "second approximation" is introduced and defined as a solution of equations in osculant elements averaged only for the precession period. The evolved theory is employed to analyze the motion of a satellite, as affected by gravitational forces, aerodynamic friction and pressure forces, its own magnetic field and magnetization of the satellite shell in the Earth's magnetic field, eddy currents in the shell, and light pressure on a cosmic vehicle travelling in an orbit around the Sun. "The author expresses gratitude to D. Ye. Okhotsimskiy for his evaluation of this study". Orig. art. has: 14 figures, 1 table, and 236 formulas.

ASSOCIATION: none

SUBMITTED: 01Jul63 ATD PRESS: 3047 ENCL: 01

SUB CODE: SV, ES NO REF SOV: 013 OTHER: 006

Card 2/31

S/040/63/027/001/023/027
D251/D308

AUTHOR: Beletskiy, V.V. (Moscow)

TITLE: On one case of the motion of a rigid body about a fixed point in a Newtonian force field

PERIODICAL: Prikladnaya matematika i mekhanika, v. 27, no. 1, 1963, 175-178

TEXT: The author considers the problem of a rigid body possessing dynamic symmetry, moving about a fixed point which coincides with its center of mass in a Newtonian force field. Initially the transverse components of the angular velocity are zero and the longitudinal component is non-zero and arbitrary. It is evident that any perturbation from a constant rectilinear motion along the axis will be solely due to the Newtonian nature of the field. Instead of solving the problem in quadratures, the author analyzes the motion of the body graphically, considering the track of the axis of the body on a unit sphere, with center at the center of mass. Formulas for the precession and nutation are deduced in terms of ellip-

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On one case of the motion ... S/040/63/027/001/023/027
D251/D308

tic integrals, and very rapid rotation is discussed as a special case, using the small parameter method.

SUBMITTED: November 20, 1962

Card 2/2

BELETSKY, V.V. (Moscow)

"Motion of an artificial satellite about its center of mass"

report presented at the 2nd All-Union Congress on Theoretical and Applied Mechanics, Moscow 29 Jan - 5 Feb 64.

BELETSKY, V. V.; GOLUBKOV, V. V.; YEGOROV, V. A.; YERSHOV, V. G. (Moscow)

"Investigation of flight trajectories with low thrust"

report presented at the 2nd All-Union Congress on Theoretical and Applied Mechanics, Moscow, 29 Jan - 5 Feb 1964.

ACCESSION NR: AP4041562 S/0293/64/002/003/0360/0391

AUTHOR: Beletskiy, V. V.; Yegorov, V. A.

TITLE: Interplanetary flights with constant-power engines

SOURCE: Kosmicheskiye issledovaniya, v. 2, no. 3, 1964, 360-391

TOPIC TAGS: interplanetary flight, space flight, space flight trajectory, constant power flight, interstellar reaction vehicle

ABSTRACT: The problem of interplanetary flight (between the gravitational fields of planets) of a reaction vehicle with an ion or plasma engine is studied, assuming that the power input for generating the jet reaction is constant. A method for linearizing the equations of motion relative to some suitable known trajectory is used in the investigation. This method is called the "method of transporting trajectories" and was initiated by T. M. Eneyev. A "transporting coordinate system" moving translationally along the transporting trajectory is used, thus taking account, in the first approximation, of solar gravitation. Flights with optimum control of the

Card 1/2

ACCESSION NR: AP4041562

reactive acceleration and flights with a constant acceleration vector changing its direction in space by a single jump are discussed. The speed and high accuracy achieved in computing a large class of practically interesting trajectories are the advantages of this method. The proposed method can be used for any type of control of reactive acceleration. The authors express a sincere gratitude to D. Ye. Okhotsimskiy and T. M. Eneyev for their assistance and N. B. Myshetskiy, N. A. Malinina, and Ye. A. Sidorova for carrying out the computations. Orig. art. has: 14 figures, 85 formulas, and 3 tables.

ASSOCIATION: none

SUBMITTED: 20Feb64 A TD PRESS: 3052 ENCL: 00

SUB CODE: SV, PR NO REF SOV: 003 OTHER: 001

Card 2/2

ACCESSION NR: AP4041563 S/0293/64/002/003/0392/0407

AUTHOR: Beletskiy, V. V.; Yegorov, V. A.

TITLE: Acceleration of a space vehicle in the gravitational field of a planet

SOURCE: Kosmicheskiye issledovaniya, v. 2, no. 3, 1964, 392-407

TOPIC TAGS: space vehicle, space vehicle trajectory, reactive acceleration, acceleration control, constant tangential acceleration

ABSTRACT: Trajectories of a space vehicle moving with a small reactive acceleration within the gravitational field of a planet are discussed. An approximate solution is presented for the variational problem of optimum control of the reactive acceleration to obtain optimum trajectories after liftoff until the parabolic speed is reached. Some of these trajectories are analyzed, with special attention being paid to those close to the optimal trajectories. Formulas are given for calculating the parameters of the trajectory at the end of its acceleration section. Results of the computation of some trajectories with constant tangential reactive acceleration up to the point at

ACCESSION NR: AP4041563

which the parabolic speed is reached are presented. "The authors express their gratitude to O. S. Ryzhina for carrying out the programming and numerical calculations on an electronic computer." Orig. art. has: 6 figures, 7 tables, and 17 formulas.

ASSOCIATION: none

SUBMITTED: 20Feb64 ATD PRESS: 3059 ENCL: 00

SUB CODE: AV NO REF SOV: 002 OTHER: 002

Card 2/2

ACCESSION NR: AP4041564 S/0293/64/002/003/0408/0413

AUTHOR: Beletskiy, V. V.

TITLE: Trajectories of cosmic flights with a constant vector of reactive acceleration

SOURCE: Kosmicheskiye issledovaniya, v. 2, no. 3, 1964, 408-413

TOPIC TAGS: cosmic flight, cosmic trajectory, cosmic flight trajectory, Newtonian gravitational field, plane trajectory, three dimensional trajectory

ABSTRACT: The possible trajectories of flight of a cosmic vehicle within a Newtonian gravitational field with a single attracting center are discussed. The vehicle is said to be propelled by an ion, plasma, or similar engine ensuring thrust for a long period. The vector of reactive acceleration is assumed to be constant. Through the integration of equations of motion the problem is completely reduced to quadratures, and parametric equations of a trajectory are derived. The plane trajectories obtained are of four kinds: 1) unbounded, self-crossing, not enclosing the center of gravitation;

ACCESSION NR: AP4041564

2) unbounded, self-crossing, enclosing the center of gravitation; 3) unbounded, not self-crossing; and 4) bounded trajectories. Three-dimensional trajectories can be classified in the same way. Orig. art. has: 2 figures and 14 formulas.

ASSOCIATION: none

SUBMITTED: 14Feb64 ATD PRESS: 3049 ENCL: 00

SUB CODE: SV NO REF SOV: 000 OTHER: 001

Card 2/2

BELETSKIY, Vladimir Vasil'yevich; ABASHEVA, D.A., red.

[Motion of an artificial satellite relative to the center of mass] Dvizhenie iskusstvennogo sputnika otnositel'no tsentra mass. Moskva, Nauka, 1965. 416 p. (MIRA 19:1)

L 62221-65 EEO-2/EWP(m)/EWG(j)/EEC(k)-2/EWG(v)/EWT(1)/FS(v)-3/EWA(d) TT/GW
ACCESSION NR: AP5021245 UR/0293/65/003/004/0507/0522
629.197.

AUTHOR: Beletskiy, V. V.; Yegorov, V. A.; Yershov, V. G.
55 55 55 40 B

TITLE: Analysis of interplanetary trajectories for constant-power propulsion systems

SOURCE: Kosmicheskiye issledovaniya, v. 3, no. 4, 1965, 507-522

TOPIC TAGS: interplanetary flight, interplanetary trajectory
12 55, 12

ABSTRACT: An analytic method for approximate calculation of the interplanetary trajectories of a spacecraft with constant low thrust proposed by V. V. Beletskiy and V. A. Yegorov (Kosmicheskiye issledovaniya, v. 2, no. 3, 1964, p. 360 and p. 392) is applied to the calculation of flight trajectories to Mars, Venus, and Jupiter with return and without return to the Earth. The article deals mostly with the analysis of calculations carried out on electronic computers. It is shown that the movable coordinate system with its origin moving on a given conic and with a constant direction of its axes (ecliptic transport system) introduced for the case of near-Keplerian motion (plane problem) is also convenient for the case when perturbations of the Sun (spatial problem) are taken into account. A large number of calculations were car-

Card 1/2

L 62221-65

ACCESSION NR: AP5021245

ried out for flights with optimal variation of the magnitude and the direction of a thrust with and without taking account of perturbations and also for flights with thrust acceleration of equal magnitude but with a single change of direction. A graphical method for representing the calculation results (where the isolines are lines of equal thrust accelerations or of equal expenditures of fuel) is proposed which makes it possible to choose from the totality of trajectories those trajectories with the required optimal characteristics. Orig. art. has: 11 figures and 8 tables. [LK]

ASSOCIATION: none

SUBMITTED: 16Jul64 ENCL: 00 SUB CODE: SV, DP

NO REF SOV: 002 OTHER: 000 ATD PRESS: 4076

Card 2/2

ACC NR: AM6012200 Monograph UR/

Beletskiy, Vladimir Vasil'yevich

Movement of an artivicial satellite relative to its center of mass (Dvizheniye iskusstvennogo sputnika otnositel'nogo tsentra mass Moscow, Izd-vo "Nauka", 65. 0416 p. illus., biblio.
3,000 copies printed.

Series note: Mekhanika kosmicheskogo poleta

TOPIC TAGS: artificial Earth satellite, scientific satellite, satellite motion, satellite navigation, Earth satellite orbit, elliptic orbit, equatorial orbit, orbit perturbation, orbital aircraft, artificial satellite

PURPOSE AND COVERAGE: After the launching of the first artificial satellite and consequent success in the conquest of space, the interest rose sharply to other problems connected with further space explorations. In particular, the important problems are those dealing with the motion theory of artificial satellites. This book deals with one part of the cosmic flight dynamics - the motion of artificial satellite relative to its center of mass. The problems discussed in this book are limited to the dynamics of solids. This book is based on other works published or presented by the author at the mechanical and mathematical faculty of Moscow University. The results obtained by some other authors are also used in this book.

Card 1/3 UDC629.195.1

ACC NR: AM6012200

TABLE OF CONTENTS (abridged):

ACC NR: AM6012200

App. I. Motion of a solid around a fixed point in Newton field of force -- 379
App. II. Orbits of an equatorial artificial satellite -- 400
Bibliography -- 411

SUB CODE 22/ SUBM DATE: 09Oct65/ ORIG REF: 073/

Card 3/3

ULYUYEV, D.I., inzh.; BOLOTIN, V.I., inzh., retsenzent; BELETSKIY, V.V., inzh., retsenzent; SERGEYEVA, A.I., inzh., red.; KHITROVA, N.A., tekhn. red.

[Handbook for the track maintenance worker] Posobie putevomu rabochemu. Moskva, Transzheldorizdat, 1963. 322 p. (MIRA 16:8)

(Railroads--Track)
(Railroads--Equipment and supplies)

DANILOV, Dmitriy Ivanovich, inzh.; BELETSKIY, Vsevolod Vladimirovich, inzh.; GORYANSKIY, Yu.V., kand. tekhn. nauk, retsenzent; ORALOV, V.A., inzh., retsenzent; YEGOROV, S.A., inzh., nauchnyy red.; SOSIPATROV, O.A., red.; CHISTYAKOVA, R.K., tekhn. red.

[Trailer and container vessels] Treilernye i konteinernye suda. Leningrad, Sudpromgiz, 1963. 235 p. (MIRA 16:5)
(Ferries) (Unitized cargo systems)

BELETSKIY V. YA.

PA 10T65

USSR/Gears - Design Jun 1947
Mathematics

"Certain Problems in the Manufacture of the Crank-gear," V. Ya. Beletskiy, 5 pp

"Vestnik Inzhenorov i Tekhuikov" No 6

Mathematical treatment, with diagrams of the following problems: 1) Designing a crankgear according to a given motion of the slide and a coefficient of the change of speed in that motion. 2) Designing a crankgear in which the angle of transmission of pressure at the time of operation, with a given motion of the slide, is not less in advance of the given quantity. 3) Designing a crankgear with given

10T66

USSR/Gears - Design (contd) Jul 1947
Mathematics

motion of the slide, coefficient of change of speed, and a minimum angle of pressure transmission.

10T66

BELETSKIY, V. Ya.

Beletskiy, V. Ya. - "Movement of grain in a horizontal sowing bolter", Trudy In-ta (Odes. in-t inzhenerov mukomol. prom-sti i elevator. khoz-va im. Stalina), Vol. II, 1948, p. 53-59

SO: U-3042, March 11, 1953, (letopis 'nykh Statey, No. 10, 1949)

BELETSKIY, V. Ya.

Beletskiy, V. Ya. - "Kinetostatics of self-balancing sowing", Trudy In-ta (Odes. in-t inzhenerov mukomol. prom-sti elevator. khoz-va im. Stalina), Vol II, 1948, p. 88-103

SO: U-3042, 11 March 1953, (letopis 'nykh Statey, No. 10, 1949):

BELETSKIY, V. Ya.

Beletskiy, V. Ya. - "The kinetostatics of self-balancing sifters," Trudy Vsesoyuz. nauch.-issled.in-ta zerna i produktov ego pererabotki, Issue 16, 1949, p. 60-74.

SO: U-4110, 17 July 53, (Letopis 'Zhurnal 'nykh Statey, No. 19, 1949).

BELETSKIY, V. YA.

K raschetu potrebnoi moshchosti kolebatel'nykh mekhanizmov. (Vestn Mash. 1951, no. 3, p. 13-17)

Includes bibliography.

Calculations of the required power of oscilating mechanisms.

SO: Manufacturing and Mechanical Engineering in the Soviet Union, Library of Congress, 1953.

1. BELETSKIY, V.Ya.

2. USSR (600)

4. Flywheels

7. Calculating flywheel masses of oscillating mechanisms with small amplitudes, Sel'khozmashina no. 4, 1953.

9. Monthly List of Russian Accessions, Library of Congress, APRIL 1953, Uncl.

BELETSKIY, V. Ya.

2
14E2c

1919. Beletskii, V. Ya., Analytical method of determining the curvature of projected plane cams (in Russian), Trudi Odessk. tekhnol. in-ta 7, 19-26, 1955; Ref. Zh. Mekh. no. 10, 1956, Rev. 6460.

By means of a variable four-term process with minimum pairs a formula was obtained for calculating the curvature of the theoretical profile of the cam. A number of particular cases were examined.

S. G. Kislitsyn

Courtesy Referativnyi Zhurnal, USSR
Translation, courtesy Ministry of Supply, England

124-58-2-6344

Translation from: Refertivnyy zhurnal, Mekhanika, 1958, Nr 6, p 9 (USSR)

AUTHOR: Beletskiy, V. Ya.

TITLE: Designing Sliding-block (Slider-crank) Linkages in Accordance With Given Laws of Motion for the Driving and Driven Links (Proyektirovaniye krivoshipno-shatunnogo mekhanizma po zadannym zakonam dvizheniya vedushchego i rabochego zven'yev)

PERIODICAL: Tr. Odessk. tekhnol. in-ta, 1957, pp 57-67

ABSTRACT: Bibliographic entry. See RzhMekh, 1958, Nr 6, abstract 6343.

1. Mechanical drives--Design

Card 1/1

124-58-6-6343

Translation from: Referativnyy zhurnal, Mekhanika, 1958, Nr 6, p 9 (USSR)

AUTHOR: Beletskiy, V. Ya.

TITLE: Rendering More Precise the Dimensions of Plane Mechanisms With Lower (Closed) Pairs Which Reproduce a Given Law of Motion (Utochneniye razmerov ploskikh mekhanizmov s nizshimi parami, vosproizvodyashchikh zadannyy zakon dvizheniya)

PERIODICAL: Tr. Odessk. tekhnol. in-ta, 1957, Nr 8, pp 37-47

ABSTRACT: A solution is examined for the problem of designing a hinged four-bar-linkage mechanism intended to achieve a desired relationship between the movements of the driving link and the driven (operating) link. In order to calculate three and four parameters, multiple interpolation is performed with one coupling, the interpolation factor of which equals three and four respectively. In the calculation of five parameters one parameter is determined from the condition of zero deviation Δ from the given function, and the remaining four parameters are found from the minimum mean-square value of the second derivative of a function which expresses approximately the deviation Δ. This method for calculating five parameters is erroneous, because it does not assure at

Card 1/2

124-58-6-6343

Rendering More Precise the Dimensions of Plane Mechanisms (cont.)

even a single point a zero value of the first derivative of the deviation Δ; in other words, when this method is used, the direction of the tangents to the given function does not coincide with that of the tangents to the approximate function.

N. I. Levitskiy

1. Mechanics--Theory

Card 2/2

124-58-6-6345

Translation from: Referativnyy zhurnal, Mekhanika, 1958, Nr 6, p 9 (USSR)

AUTHOR: Beletskiy, V. Ya.

TITLE: On the Designing of Plane Mechanisms With Lower (Closed) Pairs Which Reproduce Desired Trajectories (K proyektirovaniyu ploskikh mekhanizmov s nizshimi parami, vosproizvodyashchikh zadannyye trayektorii)

PERIODICAL: Tr. Odessk. tekhnol. in-ta, 1957, Nr 8, pp 49-56

ABSTRACT: A solution is given for the problem of calculating three and four parameters for a hinged four-bar-linkage mechanism and for a sliding-block (slider-crank) mechanism to satisfy the condition of the minimum mean-square deviation of the connecting-rod curve from a desired trajectory. This method differs from the well-known method with respect to the function which characterizes the deviation from the desired trajectory.

1. Mechanical drives--Design

N. I. Levitskiy

Card 1/1

BELETSKIY, V. Ya.

BARER, G.O.; BELETSKIY, V.Ya.; VORONKOV, P.I.; DEMIDOV, P.G.; DZYADZIO, A.M.; DOMBROVSKIY, G.D.; ZOLOTAREV, S.M.; KRAVCHENKO, I.K.; PLATONOV, P.N.; PA[illegible]NKO, A.V.; UGOLIK, N.F.

V. IA. Girshson. Muk.-elev. prom. 23 no.4:23 Ap '57. (MLRA 10:5)
(Girshson, Vasilii IAkovlevich, 1880-1957)

BELETSKIY, V.Ya., doktor tekhn. nauk, prof.

designing crankgears with given coefficient of reverse-running speed change and limit transmission angle. Izv. vys. ucheb. zav.; mashinostr. no.3/4:3-8 '58. (MIRA 12:5)

1. Odesskiy tekhnologicheskiy institut imeni I.V. Stalina.
(Cranks and crankshafts)

BELETSKIY, V.Ya., doktor tekhn.nauk, prof.

Synthesis of crankshaft mechanisms at approximately steady speed of the driver. Izv.vys.ucheb.zav.; mashinostr. no.6: 10-14 '58. (MIRA 12:8)

1. Odesskiy tekhnologicheskiy institut im. I.V.Stalina.
(Cranks and crankshafts)

25 (1) SOV/145-58-7/8-2/24

AUTHOR: Beletskiy, V.Ya., Professor, Doctor of Technical Sciences

TITLE: Estimation of Five Parameters for Crank-Connecting Rod Transfer Mechanisms

PERIODICAL: Izvestiya vysshikh uchbenykh zavedeniy - Mashinostroyeniye, 1958, Nr 7-8, pp 11-16 (USSR)

ABSTRACT: The problem of estimation of transfer mechanism five parameters has been analyzed by Professor, Doctor of Technical Sciences, N.I. Levitskiy, in his work "Designing Mechanisms with Lower Pairs", ASUSSR, 1950, [1] and by Docent, Candidate of Technical Sciences, Ye.P. Novodvorskiy, in his work "One Method of Synthesis of Mechanisms". Proceedings of the Seminar on Theory of Machines and Mechanisms, Volume XI, Issue 42, AS USSR, 1951, [2]. The present article deals with the estimation of five parameters by applying the same method as it was used by the author when estimating three and four parameters. Reference [4]

Card 1/3

SOV/145-58-7/8-2/24

Estimation of Five Parameters for Crank-Connecting Rod Transfer Mechanisms

"Designing Crank-Connecting Rod Mechanism on the Basis of Given Law of Driving and Working Link Movement". Proceedings of the Odessa Technological Institute imeni I.V. Stalin, Volume VIII, 1957. In Fig 1, the author gives a diagram of transfer mechanism and denotes the sought for parameters by r, l, a, X_o and α_o. The final values of parameters are determined by the following expressions: $r = \frac{p_1}{\sin \alpha_o}$;

$$l = \sqrt{(X_o+X_s)^2-2r(X_o+X_s)\cos(\alpha_o+\alpha_s)+2ar\sin(\alpha_o+\alpha_s)+r^2+a^2}$$

$a = \frac{p_3}{p_2} - p_o \frac{p_1}{p_2}$; $X_o = p_o$; $\mathrm{tg}\,\alpha_o = \frac{p_1}{p_2}$, where X_s is the relative value of the slide initial displacement; α_s angle of the crank initial turn; r - relative length of the crank; a - relative value of displacement. The

Card 2/3

SOV/145-58-7/8-2/24

Estimation of Five Parameters for Crank-Connecting Rod Transfer Mechanisms

interrelations between the coefficients p_o, p_1, p_2 and p_3 are expressed by the functions: $p_o = X_o$; $p_1 = r\sin\alpha_o$; $p_2 = r\cos\alpha_o$; $p_3 = r(a\cos\alpha_o + X_o\sin\alpha_o)$. There are 1 figure and 4 references, 3 of which are Soviet and 1 German.

ASSOCIATION: Odesskiy tekhnologicheskiy institut imeni I.V. Stalina (Odessa Technological Institute imeni I.V. Stalin)

SUBMITTED: November 19, 1958.

Card 3/3

SOV/145-58-7/8-2/24

Estimation of Five Parameters for Crank-Connecting Rod Transfer Mechanisms

interrelations between the coefficients p_0, p_1, p_2 and p_3 are expressed by the functions: $p_o = X_o$; $p_1 = r\sin\alpha_0$; $p_2 = r\cos\alpha_0$; $p_3 = r(a\cos\alpha_0 + X_o\sin\alpha_0)$. There are 1 figure and 4 references, 3 of which are Soviet and 1 German.

ASSOCIATION: Odesskiy tekhnologicheskiy institut imeni I.V. Stalina (Odessa Technological Institute imeni I.V. Stalin)

SUBMITTED: November 19, 1958.

Card 3/3

BELETSKIY, V.Ya., prof., doktor tekhn.nauk

Calculating five parameters of hinged four-bar transmission linkages. Izv.vys.ucheb.zav.; mashinostr. no.6:3-9 '59. (MIRA 13:5)

1. Odesskiy tekhnologicheskiy institut.
(Links and link motion)

BELETSKIY, V.Ya., doktor tekhn.nauk, prof.

Calculating six parameters of three-dimensional crankgears having an approximately uniform motion. Izv.vys.ucheb.zav.; mashinostr. no.1:20-23 '60. (MIRA 14:5)

1. Odesskiy tekhnologicheskiy institut imeni I.V.Stalina.
(Cranks and crankshafts)

BELETSKIY, V.Ya., doktor tekhn.nauk prof.

Determining the reduced dynamic coefficient of the external friction of bulk mixtures. Trakt.i sel'khozmash. no.1:32 Ja '60. (MIRA 13:4)

(Friction)

17.1000
24.4100

30252
S/145/60/000/009/003/017
D221/D304

AUTHOR: Beletskiy, V.Ya., Doctor of Technical Sciences, ~~Professor~~

TITLE: The analytical method of designing four-bar mechanisms

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy. Mashinostroyeniye, no. 9, 1960, 29 - 33

TEXT: The author exposes the analytical solution for determining a family of four-bar mechanisms which ensures that the limit angle of pressure should be below a certain value. It is based on the synthesis of four-bar linkages advanced by the author previously. The obtained equations permit computation of mechanism parameters, and thus relieve the designer of selecting linkages by trial methods. The extreme two positions of the four-bar mechanism (AB_1C_1D and AB_2C_2D) are shown in Fig. 1. The instantaneous ratio of driven and driving linkages is $i_2 = \frac{AB_2}{DB_2}$. Applying the theorem of sines to

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the triangle DC_2B_2, the author deduces equations for lengths of cranks, CD and AB, as well as conrod BC. Repeating the same for the other position of the mechanism and designating by i_1 the instantaneous ratio of speeds of driven and driving linkages, author deduces further equations for the above arms. After mathematical elaboration,

$$i_2 = 0,5\ (k + 1) \qquad (14)$$

is obtained, where

$$k = \frac{\sin \psi_2}{\sin \psi_1} \cdot \frac{\sin \gamma_1}{\sin \gamma_2} \qquad (15)$$

which is a known quantity. Substituting ψ_2, γ_2 and i_2 in the expression of linkages, it is possible to compute the required lengths of linkages. These calculations are insufficient for the four-bar mechanisms. Therefore, in practice it is simpler to assume some value of ψ_1 in the limits of $0 < \psi_1 < \gamma_1$, and then proceed with the

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S/145/60/000/009/003/017

The analytical method of designing ... D221/D304

indicated method. This will provide a family of four-bar mechanisms where the driving arm is a crank, and then separate the two-crank mechanisms, where $a > 1$ and $c > 1$. A numerical example is given. There are 2 figures and 4 references: 2 Soviet-bloc and 2 non-Soviet-bloc. The reference to the English-language publication reads as follows: K. Hain, How to apply drag-linkages in the synthesis of mechanisms, Machine Design, no. 13, 1958.

ASSOCIATION: Odesskiy tekhnologicheskiy institut im. I.V. Stalina (Odessa Technological Institute im. I.V. Stalin)

SUBMITTED: March 26, 1959

Card 3/3

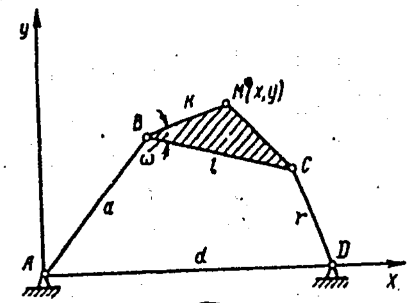
Calculating 3 parameters of a ...

S/145/60/000/010/001/014
D211/D302

ASSOCIATION: Odesskiy tekhnologicheskiy institut (Odessa Technological Institute)

SUBMITTED: November 5, 1959

Fig. 1.



(Рис. 1)

Card 2/2

B JETSKIY, V.Ya., doktor tekhn. nauk, prof.

Designing flat four-bar linkages according to given conditions in a certain position. Izv. vys. ucheb. zav.; mashinostr. no.6:18-22 '61. (MIRA 14:7)

1. Odesskiy tekhnologicheskiy institut.
(Links and link motion)

APPROVED FOR RELEASE: 06/06/2000 CIA-RDP86-00513R000204310012-8"

BELETSKIY, V.Ya.

Synthesis of a flat transmission crankgear with a restricted value of the angle of transmission. Izv.vys.ucheb.zav.; prib. 5 no.1:140-146 '62. (MIRA 15:2)

1. Odesskiy tekhnologicheskiy institut. Rekomendovana kafedroy teorii mekhanizmov i mashin i detaley mashin.
(Gearing)

BELETSKIY, V.Ya., doktor tekhn.nauk, prof.

Calculating four parameters of a driving flat four-bar linkage considering the transmission angle. Izv.vys.ucheb.zav.; mashinostr. no.6:35-38 '62. (MIRA 15:11)

1. Odesskiy tekhnologicheskiy institut.
(Links and link motion)

BELETSKIY, V.Ya., doktor tekhn.nauk, prof.

Calculation of all parameters of some four-bar plane transmission linkage with advancing pairs. Izv.vys.ucheb.zav.; mashinostr. no. 8:20-26 '63. (MIRA 16:11)

1. Odesskiy tekhnologicheskiy institut imeni Lomonosova.

BELETSKIY, V.Ya., doktor tekh. nauk, prof.

Calculating six and seven parameters of approximate guides for four-bar mechanisms. Izv. vys. ucheb. zav.; mashinostr. no.2:28-30 '64. (MIRA 17:5)

1. Odesskiy tekhnologicheskiy institut.

BELETSKIY, YE. A. and K. S. KHARCHENKO.

Sovremennye metody mekhanizatsii lekal'nogo proizvodstva. Moskva, Mashgiz, 1949. 166 p. illus.

Modern methods of mechanizing the pattern making industry.

DLC: TS240.B4

SO: Manufacturing and Mechanical Engineering in the Soviet Union, Library of Congress, 1953.

BILETSKIY, YU.A.

Opticheskie profileshlifoval'nye stanki (Optical profiling and polishing machines). Pod. red. N.F. Soboleva, Moskva, Mashgiz, 1951, 144 p.

APPROVED FOR RELEASE: 06/06/2000 CIA-RDP86-00513R000204310012-8"

BELETSKIY, YE. A.

12-1-2/26

AUTHOR: Beletskiy, Ye.A.

TITLE: In the Mountains of West China (V gorakh zapadnogo Kitaya)

PERIODICAL: Izvestiya Vsesoyuznogo Geograficheskogo Obshchestva, 1958, # 1, pp 14-24 (USSR)

ABSTRACT: The author tells of the first expeditions by Soviet and Chinese mountaineers to the high Central-Asian mountains in the south western region of Sinkiang, primarily to climb the Mustagat (7546 m) and the Qungur-tag (7,719 m). These expeditions were organized by the VTsSPS and the All-Chinese Federation of Syndicates in the summer of 1956. Detailed plans relating to the preparation and realization of the expedition were drawn up in 1955. Preliminary aerial photographs were taken at altitudes of 8,000, 10,000 and 12,000 m. The transportation of material and personnel was carried out by trucks, camels, yaks and horses. Two radio stations maintained communication with Osh and Kashtar. Ultra short wave radio stationr with a range of 20 km were utilized to connect the camp b ses with mountaineer groups. Visual observations and distance photography were carried out by a special optical 40-fold-magnifying instruments. The article then describes the successful climbing of the

Card 1/2

In the Mountains of West China 12-1-2/26

two peaks, and gives information on this general region. There are 3 photos, 2 tables and 1 map.

AVAILABLE: Library of Congress

Card 2/2

BELETSKIY, Ye.A.

Across Tibet to the foot of Chomolungma. Izv.Vses.geog.ob-va 95 no.3:203-212 My-Je '63. (MIRA 16:8)
(Everest, Mount--Scientific expeditions)

GUREVICH, M.D.; BELETSKIY, Ye.L.

Ultrasonic therapeutic portable apparatus UTP-1. Med.prom. 15 no.8: 57-60 Ag '61. (MIRA 14:12)

1. Vsesoyuznyy nauchno-issledovatel'skiy institut meditsinskikh instrumentov i oborudovaniya.
(ULTRASONIC WAVES--THERAPEUTIC USE)

BELETSKIY, Ye. L.; OSMOLOVSKAYA, I. G.

Procedural low-clearance "PCh" clock. Nov. med. tekh. no.2:77-79 '61. (MIRA 14:12)

1. Vsesoyuznyy nauchno-issledovatel'skiy institut meditsinskikh instrumentov i oborudovaniya.

(MEDICAL INSTRUMENTS AND APPARATUS)

GUREVICH, M.D.; BELETSKIY, Ye.L.; DEMIDOV, G.Ye.; KOZLOV, A.P.

A stationary ultrasonic therapeutic device. Nov.med. tekh. no.4:10-19'61. (MIRA 16:9)

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(MEDICAL INSTRUMENTS AND APPARATUS)

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Insulated arched covering for industrial buildings made present from two-core panels. Prom. stroi. 41 no.10:37-38 O '63. (MIRA 16:11)

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L 21562-66 EWT(m)/EPF(n)-2/T/EWP(t) IJP(c) JD/JG

ACC NR: AP6009420 SOURCE CODE: UR/0020/66/166/006/1328/1331

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ORG: Institute of Metal Physics, Academy of Sciences UkrSSR (Institut metallofiziki Akademii nauk UkrSSR)

TITLE: Relationship between the shape of the homogeneity region of the β-phase in the niobium-tin system and the superconductivity characteristics of Nb_3Sn

SOURCE: AN SSSR. Doklady, v. 166, no. 6, 1966, 1328-1331

TOPIC TAGS: niobium tin compound, superconducting compound, superconducting alloy

ABSTRACT: A series of niobium-tin alloys containing up to 37.5 at % tin were studied in order to explain the negative effect of annealing at temperatures above 900—1000C on the characteristics of superconductivity of Nb_3Sn compound. Alloys were annealed at 700—1800C for up to 350 hr and quenched. All the alloys containing 16.9 to 37.5 at % tin were found to consist of a phase with a β-tungsten structure, i. e., Nb_3Sn phase, regardless of the annealing temperature, which proves that this compound is stable at temperatures up to 1800C. The lattice parameter of Nb_3Sn was found to increase linearly with increasing tin content from 5.2790 Å at 9.3 at % tin to 5.2875 Å at 34.9 at % tin. The niobium side of the phase diagram of the niobium-tin system plotted on the basis of experimental results (see Fig. 1) shows that the

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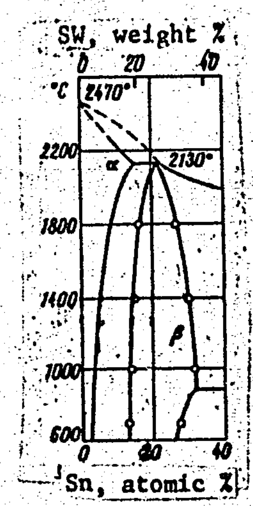

Fig. 1. Niobium side of the niobium-tin phase diagram

solubility of tin in Nb_3Sn drops sharply at temperatures below 900C. On the other hand the critical temperature of the compound appears to depend linearly on the tin content, which was determined from the analysis of some literature data. This explains why the critical temperature of Nb_3Sn increases sharply with annealing temperature increased to 900C and drops again with a further increase of annealing temperature. Orig. art. has: 4 figures and 1 table. [DV]

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ture increased to 900C and drops again with a further increase of annealing temperature. Orig. art. has: 4 figures and 1 table. [DV]

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superconducting alloy 18

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