The Stability of Circular Orbits S/188/60/000/001/008/010
B019/B056

ASSOCIATION: Kafedra nebesnoy mekhaniki i gravimetrii (Chair of Celestial Mechanics and Gravimetry)

SUBMITTED: September 22, 1959

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DEMIN, V.G.

Elliptic orbits in the problem of two stationary centers.
Soob.GAISH no.115:35-43 '60. (MIRA 14:3)
(Problem of two bodies)

AKSENOV, Ye.P.; DEMIN, V.G.

Periodic orbits of an artificial moon satellite. Biul.Inst. teor.astron. 7 no.10:828-832 '60. (MIRA 14:3)
(Artificial satellites--Moon)

DEMIN, V.G.

A class of periodic orbits in the restricted ciruclars problem of three bodies. Biul.Inst. teor.astron. 7 no.10:844-849 '60.
(MIRA 14:3)

(Problem of three bodies)

DEMIN, V.G.

One particular case of integrability of the Hamilton-Jacobi equation. Vest. Mosk un. Ser. 3;Fiz.,astron 15 no.1:80-82 '60.
(MIRA 13:10)

1. Kafedra nebesnoy mekhaniki i gravimetrii Moskovskogo universiteta.
(Differential equations)

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S/188/60/000/006/011/011
B101/B204

AUTHORS: Demin, V. G., Aksenov, Ye. P.

TITLE: The periodic motions of a particle in the gravitational field of a slowly rotating body

PERIODICAL: Vestnik Moskovskogo universiteta. Seriya 3, fizika, astronomiya, no. 6, 1960, 87-92

TEXT: The following problem is dealt with. A material point moves in the gravitational field of a solid, which rotates slowly round one of its inertial main axes and has dynamic symmetry with respect to the plane passing perpendicularly to the rotation axis through the center of mass. For the gravitational potential of the body, in the system of coordinates Oxyz with origin in the center of mass of the body, direction of axis agreeing with the inertial main axis, is written down:

$U = (fM/r) \left\{1 + \sum_{k=2}^{\infty} (d/r)^k \left[Q_k(x,y,z)/r^k\right]\right\}$ (1), where f is the gravitational constant, M the mass, $r = \sqrt{x^2 + y^2 + z^2}$, d is the radius vector of the

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most remote point of the body, $Q_k(x,y,z)$ homogeneous harmonic polynomials of k-th order with respect to x, y, z. If m is the angular velocity of the rotation of the body round the Oz axis, the differential equations for the motion of point P are:

$d^2x/dt^2 - 2mdy/dt - m^2x = \partial U/\partial x$; $d^2y/dt^2 + 2mdx/dt - m^2y = \partial U/\partial y$;

$d^2z/dt^2 = \partial U/\partial z$ (3). The motions of P in the plane z=0 are investigated, the variables ξ, η are introduced ($x = b\xi$, $y = b\eta$), and furthermore $m = \nu\alpha$, $(d/b)^k = \gamma\alpha^{k-1}$ (ν, γ = const) is put, and the following equations are obtained: $d^2\xi/dt^2 - 2\alpha\nu d\eta/dt - \alpha^2\nu^2\xi = \partial\overline{V}/\partial\xi$; $d^2\eta/dt^2 + 2\alpha\nu d\xi/dt - \alpha^2\nu^2\eta = \partial\overline{V}/\partial\eta$; where $\overline{V} = (k^2/\varrho)\left\{1 + \gamma\sum_{k=2}^{\infty} \alpha^{k-1}\left[\overline{Q}_k(\xi,\eta)/\varrho^{2k}\right]\right\}$.

For the required functions u and v with the independent variables τ, $\xi = \mathrm{ch}\, v \cos u - 1$; $\eta = \mathrm{sh}\, v \sin u$; $dt = (\mathrm{ch}^2 v - \cos^2 u)d\tau$ is written down. Herefrom result the equations of motions $u'' = 2\alpha\nu I v' + W'_u$;

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$v'' = -2\alpha\nu I u' + W_v$ (5), where $W = k^2(\mathrm{ch}\ v + \cos u) + 0.5h(\mathrm{ch}\ 2v - \cos 2u) + (\alpha^2\nu^2/2)(\mathrm{ch}\ v - \cos u)^2 + I\overline{W}$; $I = \mathrm{ch}^2 v - \cos^2 u$,

$\overline{W} = k^2\gamma \sum_{k=2}^{\infty} \alpha^{k-1}\left[\overline{Q}_k(u,v)/Q^{2k+1}\right]$; $Q = \mathrm{ch}\ v - \cos u$. With $\alpha = 0$,

$u_0'' = -k^2 \sin u_0 + h \sin 2u_0$; $v_0'' = k^2\ \mathrm{sh}\ v_0 + h\ \mathrm{sh}\ 2v_0$ (h = constant of the Jacobi's integrals). These equations give the solution v_0 = const; $u_0 = 2 \arctan\left[\mathrm{cth}(v_0/2)\tan\sigma\tau\right]$; where v_0 satisfies the equation $\mathrm{ch}\ v_0 = -k^2/2h$; and $\sigma^2 = k^2\mathrm{sh}^2 v_0/4\mathrm{ch}\ v_0$. To this solution corresponds a motion of the point on an elliptical orbit whose major semiaxis equals $\mathrm{ch}\ v_0$, whose eccentricity equals $-1/\mathrm{ch}\ v_0$. One finds:
$\cos u_0 = (\mathrm{ch}\ v_0 \cos 2\sigma\tau - 1)/(\mathrm{ch}\ v_0 - \cos 2\sigma\tau)$; $\sin u_0 = \mathrm{sh}\ v_0 \sin 2\sigma\tau/(\mathrm{sh}\ v_0 - \sin 2\sigma\tau)$; $u_0' = 2\ \mathrm{sh}\ v_0/(\mathrm{ch}\ v_0 - \cos 2\sigma\tau)$ (7). $u = u_0 + \overline{u}$;

$v = v_0 + \bar{v}$ is put and for the differential equation one writes down $\overline{u''} = f(\bar{u}, \bar{v}, \bar{u}', \bar{v}', \tau, \alpha)$; $\overline{v''} = \varphi(\bar{u}, \bar{v}, \bar{u}', \bar{v}', \tau, \alpha)$ (8). The functions f and φ are periodic with respect to τ with the period $T = 2\pi/\sigma$. Therefore, it is possible to apply the theorem of Poincaré to (8), and the solutions of the equations (8) are found by means of power series of the small parameter α. The following solution is given:
$v_1 = \beta_1 \cos\omega\tau + \beta_2 \sin\omega\tau + F(\tau)$; $u_1 = u_0' \int (1/u_0'^2) \left\{ \int u_0' (\partial \overline{W}_1/\partial u) d\tau + \beta_3 \right\} d\tau + \beta_4 u_0'$ (10), where β_1, β_2, β_3, β_4 are arbitrary constants, $\omega^2 = k^2 sh^2 v_0 / ch\, v_0$. In consideration of (6) one puts $u_1 = u_0'(1 + 2ch^2 v_0)\beta_3 \tau / 8\sigma^2 sh^2 v_0 + \Phi(\tau)$ (11). $F(\tau)$ and $\Phi(\tau)$ are periodic functions of τ with the period T. The result is formulated as a theorem:

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AUTHOR: Demin, V. G.

TITLE: On Orbits in the Problem of Two Fixed Centres

PERIODICAL: Astronomicheskiy zhurnal, 1960, Vol.37, No.6, pp.1068-1075

TEXT: The motion of a mass point M under the action of two fixed attracting centres M_1 and M_2 is considered. The moving point is attracted to the fixed centres in accordance with Newton's law. The motion is considered in a rectangular set of coordinates chosen so that M_1 and M_2 lie along the x-axis, the origin is at the mid-point of the line M_1M_2 and the coordinates of the moving point are denoted by x, y and z. The integration of the differential equations of motion is most conveniently carried out in terms of the elliptical variables of Tiele (Ref.19). Only the plane case is considered. The coordinates x, y and z are transformed into a new set u, v, w in accordance with the following equations

$$x = -c \cos u \operatorname{ch} v, \qquad (1)$$
$$y = -c \sin u \operatorname{sh} v \sin w,$$
$$z = c \sin u \operatorname{sh} v \cos w.$$

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where 2c is the distance between M_1 and M_2. The kinetic energy of the mass point is

$$T = \frac{c^2}{2}\left[I(\dot{u}^2 + \dot{v}^2) + sh^2\, v\, \sin^2 w \cdot \dot{w}^2\right] \quad (4)$$

and the force function is

$$U = \frac{1}{cI}\left[f(m_1 + m_2)ch\, v - f(m_1 - m_2)\cos u\right] \quad (5)$$

where

$$I = \frac{r_1 r_2}{c^2} = ch^2 v - \cos^2 u \quad (6)$$

and m_1, m_2 are the masses of the attracting centres and r_1, r_2 are the distances MM_1 and MM_2, respectively. It is shown that for the plane case the differential equations describing the motion are:

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$$\frac{d\xi}{d\tau} = \sqrt{\frac{h}{2}\left[\xi^2(\lambda_2 + 1) - (\lambda_2 - 1)\right]\left[\xi^2(\lambda_1 + 1) - (\lambda_1 - 1)\right]} \qquad (26)$$

$$\frac{d\eta}{d\tau} = \sqrt{\left(-\frac{h}{2}\right)\left[\eta^2(\mu_2 + 1) + (\mu_2 - 1)\right]\left[\eta^2(\mu_1 + 1) + (\mu_1 - 1)\right]}. \qquad (27)$$

where $\lambda = \text{ch } v = (1 + \xi^2)/(1 - \xi^2)$, $\mu = \cos u = (1 + \eta^2)/(1 - \eta^2)$, $I d\tau = dt$ and λ_1, λ_2, μ_1 and μ_2 are the roots of the following two equations:

$$h\lambda^2 + \frac{f(m_1 + m_2)}{c^3}\lambda + C = 0 \qquad (24)$$

$$h\mu^2 + \frac{f(m_1 - m_2)}{c^3}\mu + C = 0 \qquad (25)$$

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In these equations C is an integration constant. The above differential equations are then solved for the following cases:

1. $\lambda_2 > 1 > \lambda_1 > -1$, $\mu_2 > 1 > \mu_1 > -1$,

2. $\lambda_2 > 1 > \lambda_1 > -1$, $1 > \mu_2 > \mu_1 > -1$,

3. $\lambda_2 > 1 > \lambda_1 > -1$, $\mu_2 > \mu_1 > 1$,

4. $\lambda_2 > \lambda_1 > 1$, $\mu_2 > \mu_1 > 1$.

All these cases are characterized by a negative value of the total mechanical energy ($h < 0$). In the first cast the motion takes place in a region containing one of the masses and limited by an ellipse $\lambda = \lambda_2$ and one of the hyperbolae $\mu = \mu_1$ or $\mu = \mu_2$. In the third case the possible region of motion is limited by the ellipse $\lambda = \lambda_2$, and in the fourth case the mass point moves inside

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an elliptical ring limited by the ellipses $\lambda = \lambda_1$, $\lambda = \lambda_2$ and the trajectory is alternately tangential to these ellipses. There are 19 references: 4 Soviet, 15 non-Soviet.

ASSOCIATION: Gos. astronomicheskiy in-t imeni P. K. Shternberga (State Astronomical Institute imeni P. K. Shternberg)

SUBMITTED: February 11, 1960

26814
S/560/61/000/008/003/010
E032/E314

3.2200 2412 4512 1121 1132

AUTHOR: Demin, V.G.

TITLE: On Almost-circular Orbits of Artificial Earth Satellites

PERIODICAL: Akademiya nauk SSSR, Iskusstvennyye sputniki zemli, 1961, No. 8, pp. 57 - 63

TEXT: Artificial Earth satellites moving over periodic orbits are particularly convenient for television and similar applications. The present paper is concerned with the calculation of such orbits. Since the calculation of periodic orbits, which would include all the perturbations, is exceedingly difficult, the solution of the problem may be divided into two parts. To begin with, the periodic orbit is obtained for a simplified problem for which the equations contain all the main perturbations and this orbit is looked upon as an "intermediate orbit". Next, insequalities are derived which specify the perturbations which are neglected in the simplified problem. The basic idea of the method is borrowed

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from Hill's work on the motion of the Moon (Ref. 2 - Amer. J. Math., 1, 5, 1878). The present author derives an intermediate orbit assuming that the Moon and the Sun move relative to the Earth in the plane of the ecliptic over circular orbits with constant angular velocities. One possible method of approach is similar to Hill's method (Ref. 2), where the effect of the Moon and the Sun is evaluated without taking into account their parallax, i.e. by taking the first term in the expansion for the perturbation function. If this simplification is assumed, then the problem reduces to Hill's restricted problem of four bodies. The present author does not admit this assumption and hence the intermediate orbit is obtained under less restricting conditions. It is shown that with a suitable choice of the initial conditions, it is possible to construct an intermediate orbit which will be periodic in the particular frame of coordinates chosen by the present author. The series representing the periodic solution will converge for a sufficiently small value of a

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certain parameter μ. These values of the parameter correspond to circular generating orbits whose radii are sufficiently small compared with the distance of the Earth from the Moon and the Sun.
There are 5 references: 2 Soviet and 3 non-Soviet. The two English-language references quoted are: Ref. 2 (quoted in text); Ref. 5 - F.R. Moulton - Periodic Orbits. Published by Carnegie Institution, Washington, 1920.

SUBMITTED: May 14, 1960

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26815

3.2200 2412 4512 1121 1132 S/560/61/000/008/004/010
E032/E514

AUTHORS: Aksenov, Ye. P., Grebenikov, Ye. A. and Demin, V. G.

TITLE: General solution for the motion of an artificial satellite in the normal gravitational field of the Earth

PERIODICAL: Akademiya nauk SSSR, Iskusstvennyye sputniki zemli, 1961, No.8, pp.64-71

TEXT: In the majority of papers concerned with the motion of artificial earth satellites, the problem is treated analytically with the aid of various series and successive approximations leading to the final solution of the differential equations of motion. There is then the attendant problem of the convergence of the series which is often ignored. Papers in which convergence problems are discussed are those of A. M. Lyapunov (Ref.1: Sobraniye sochineniy, Vol.1, Izd-vo AN SSSR, 1954), A. Wintner (Ref.2: Math. Zsf. 24, 259, 1926), G. A. Merman (Ref.3: Byull. ITA, 7, L., izd-vo AN SSSR, 1959, p.441) and M. S. Petrovskaya (Ref.4: Byull. ITA, 7, L, izd-vo AN SSSR, 1959, p.441). These workers were concerned with the convergence of Hill's series representing the

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motion of the Moon. A further problem which appears to be unresolved is that of whether the secular and mixed terms are due to the shortcomings of the particular method employed or whether they are inherent in the problem. Finally, it is very difficult to develop a quantitative theory by these methods. It is, therefore, very important to derive a general and also practically convenient solution of the problem. J. P. Vinti (Ref.5: J.Res.of Nat.Bur. Stand.Math. and Math.Phys., 62B, No.2, 79, 1959) and M. D. Kislik (Ref.6: Sb. Iskusstvennyye sputniki Zemli, No.4, izd-vo AN SSSR, 1960, p.3) used the Hamilton-Jacobi method to solve the problem of the artificial earth satellite in quadratures. As Kislik has pointed out, the general solution, even if it is in a very unwieldy form, turns out to be more convenient for use with computers than numerical integration of the differential equations of motion. The amount of computer time taken up by numerical integration of differential equations is very much greater than the time necessary in the case of quadratures. Moreover, the Hamilton-Jacobi method leads to complicated elliptic quadratures which means that the quantitative analysis is difficult to accomplish. The present authors point out that the general solution of the problem can also

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be obtained on the basis of a certain analogy with the problem of two fixed gravitating centres. If one considers the motion of a mass point in the gravitational field of two fixed centres having equal masses, which are at a complex distance from each other, then the force function for the problem, when the complex distance is suitably chosen, can be made to approximate the real potential of the Earth. The introduction of the complex distance is due to the fact that at least the first few terms in the expansion of the Earth's potential in terms of the Legendre polynomials have alternating signs. It is pointed out that if all the coefficients of the Legendre polynomials were positive, then the satellite problem would be analogous to the classical problem of two fixed centres. If, on the other hand, all the coefficients except the first were negative, then the satellite problem could be solved with the aid of the solution for the case of three fixed centres, one of which attracts and the other two repel. The above scheme has been found by the present authors to be suitable for the solution of the Earth's satellite problem without taking into account atmospheric resistance. It is shown that the problem can be reduced to the following elliptic integrals:

$$\int \frac{d\mu}{\sqrt{2h\mu^4 + 2(c_2 - h)\mu^2 - (2c_2 + c_1^2)}} = \tau + c_3, \qquad (31)$$

$$\int \frac{d\lambda}{\sqrt{-2h\lambda^4 - \frac{2fM}{c^3}\lambda^3 + 2(c_2 - h)\lambda^2 - \frac{2fM}{c^3}\lambda + (2c_2 + c_1^2)}} = \tau + c_4 \qquad (32)$$

where the independent variable t is given by

$$t = -\int (\lambda^2 + \mu^2)d\tau \qquad (34)$$

and h, c_1, c_2, c_3, c_4, c_5 are arbitrary constants. The cartesian geocentric coordinates of the satellite are then given by:

$$x = c\sqrt{(1+\lambda^2)(1-\mu^2)}\cdot\sin w,$$
$$y = c\sqrt{(1+\lambda^2)(1-\mu^2)}\cdot\cos w, \quad (35)$$
$$z = -c\lambda\mu.$$

where w is given by

$$w = c_1\int\frac{(\lambda^2+\mu^2)d\tau}{(1-\mu^2)(1+\lambda^2)} + c_5. \quad (33)$$

A detailed analysis of these results, i.e. the determination of the possible regions of motion, the nature of the secular and mixed terms, stability problems etc., will be given in a future publication. Acknowledgments are expressed to Professor G. N. Duboshin for advice and suggestions. There are 10 references: 6 Soviet and 4 non-Soviet. The two English-language references not mentioned in the text reading as follows:

J. A. O'Keefe, E. Eckels, R.K. Squires. Astr.J., 64, 820, 1959;
P. Herget, P. Musen. Astr. J., 63, 430, 1958.

SUBMITTED: November 22, 1960

DEMIN, V.G., nauchnyy sotrudnik

Start was made in February. Nauka i zhizn' 28 no.4:8-11 Ap '61. (MIRA 14:5)

1. Gosudarstvennyy astronomicheskiy institut imeni Shternberga. (Space flight to Venus)

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AUTHOR: Demin, V.G.

TITLE: New Classes of Periodic Solutions in the Restricted Problem of Three Bodies

PERIODICAL: Astronomicheskiy zhurnal, 1961, Vol. 38, No. 1, pp. 157 - 163

TEXT: The differential equations of motion in the plane restricted circular problem of three bodies in the barycentric rotating set of coordinates can be written down in the form:

$$\ddot{x} = 2n\dot{y} + V'_x$$
$$\ddot{y} = -2n\dot{x} + V_y \quad (1)$$

where the force function V is defined by

$$V = \frac{n^2}{2}(x^2 + y^2) + \frac{fm_1}{r_1} + \frac{fm_2}{r_2} \quad (2) .$$

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Eq. (1) has a Jacobi integral given by

$$\dot{x}^2 + \dot{y}^2 = 2(V + h) \qquad (3)\ .$$

Using the Thiele transformation (Ref. 2) one obtains

$$\left.\begin{aligned} x &= c\left(\operatorname{ch} v \cos u - \frac{m_1 - m_2}{m_1 + m_2}\right) \\ y &= - c \operatorname{sh} v \sin u \\ &= n'(\operatorname{ch}^2 v - \cos^2 u)\, d\tau \end{aligned}\right\} \qquad (4)\ .$$

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In the latter equation C is one-half of the distance between the attracting points and n' is an arbitrary quantity which is chosen so that the quantity $\mu = n/n'$ is sufficiently small. Instead of Eq. (1) one then obtains

$$u'' = 2\mu(\mathrm{ch}^2 v - \cos^2 u)\, v' + W'_u$$

$$v'' = -2\mu(\mathrm{ch}^2 v - \cos^2 u) u' + W'_v \qquad (5)$$

where the force function W is given by

$$W = \frac{f(m_1 + m_2)}{n'^2 c^3} \mathrm{ch}\, v + \frac{f(m_1 - m_2)}{n'^2 c^3} \cos u + \frac{h}{2n'^2 c^3} (\mathrm{ch}\, 2v - \cos 2u) +$$

$$+ \frac{\mu^2}{16c^2}(\mathrm{ch}\, 4v - \cos 4u) - \frac{\mu^2 (m_1 - m_2)}{4c^2 (m_1 + m_2)} (\cos u\, \mathrm{ch}\, 3v - \cos 3u\, \mathrm{ch}\, v). \quad (6) \qquad (6).$$

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The Jacobi integral can then be written in terms of the Thiele variables in the following form

$$u'^2 + v'^2 - 2W = 0 \qquad (7) .$$

It can be shown that when $\mu = 0$, Eqs. (5) represent the differential equations of the problem of two fixed centres and can be integrated in quadratures. In order to obtain a solution of Eqs. (5), the Poincaré small-parameter method (Ref. 3) can be employed. In using the small-parameter method simplified equations can be obtained from Eqs. (5) by rejecting the Coriolis and centripetal terms. From the mechanical point of view this approach is therefore similar to the method used by Hopf (Ref. 6). Using the Poincaré method one can seek periodic solutions of Eqs. (5) in the form of the series

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$$u = \sum_{k=0}^{\infty} \mu^k u_k,$$
$$v = \sum_{k=0}^{\infty} \mu^k v_k. \qquad (8)$$

where $\mu = 0$; Eqs. (5) can be integrated to obtain u_0 and v_0 as functions of τ. Each of these functions will be periodic in τ although, in general, the periods of these functions will be incommensurable. Of the ∞^4 solutions, ∞^3 will be periodic. Let T be the period of these solutions. Only those orbits will be considered for which the pericentres and the apocentres lie along the line of centres. For simplicity, it will be

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considered that the moving point intersects the line of centres at $\tau = 0$. The periodicity conditions can then be written down in the form

$$\begin{aligned} u\left(\frac{1}{2}T\right) - u\left(-\frac{1}{2}T\right) &= 0, \\ u'\left(\frac{1}{2}T\right) - u'\left(-\frac{1}{2}T\right) &= 0, \\ v\left(\frac{1}{2}T\right) - v\left(-\frac{1}{2}T\right) &= 0, \\ v'\left(\frac{1}{2}T\right) - v'\left(-\frac{1}{2}T\right) &= 0. \end{aligned} \qquad (9)$$

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and these can be transformed with the aid of the symmetry theorem given by Moulton (Ref. 7) since the system given by Eqs. (5) is invariant with respect to the transformation

$$v = \bar{v}, \quad u = \bar{u}, \quad \tau = -\bar{\tau} \qquad (10) .$$

It then follows that

$$v\left(\frac{1}{2}T\right) = v\left(-\frac{1}{2}T\right), \quad v'\left(\frac{1}{2}T\right) = -v'\left(-\frac{1}{2}T\right),$$

$$u\left(\frac{1}{2}T\right) = -u\left(-\frac{1}{2}T\right), \quad u'\left(\frac{1}{2}T\right) = +u'\left(-\frac{1}{2}T\right), \qquad (12)$$

and the periodicity conditions become

$$u(0) = 0, \quad u\left(\frac{1}{2}T\right) = 0, \quad v'(0) = 0, \quad v'\left(\frac{1}{2}T\right) = 0 \qquad (13),$$

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It follows from the above equations that the latter conditions can be used to establish the existence of periodic orbits which are symmetric with respect to the x-axis and intersect this axis at rightangles. Eqs. (5) are also invariant with respect to the transform

$$v = -\bar{v}, \quad u = \bar{u}, \quad \tau = -\bar{\tau} \qquad (14)$$

so that using analogous arguments to those leading to Eq. (13), one can obtain the following periodicity conditions

$$u'(0) = 0, \quad u'\left(\frac{1}{2}T\right) = 0, \quad v(0) = 0, \quad v\left(\frac{1}{2}T\right) = 0 \qquad (15) .$$

This theory is applied to the following simplified system of differential equations

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$$u_0'' = -\frac{f(m_1 - m_2)}{n'^2c^3}\sin u_0 + \frac{h}{n'^2c^3}\sin 2u_0,$$
$$v_0'' = \frac{f(m_1 + m_2)}{n'^2c^3}\,\mathrm{sh}\, v_0 + \frac{h}{n'^2c^3}\,\mathrm{sh}\, 2v_0. \qquad (16)$$

Using the Liouville theorem, integration of Eq. (16) leads to

$$\frac{1}{2}u_0'^2 = \frac{f(m_1 - m_2)}{n'^2c^3}\cos u_0 - \frac{h}{2n'^2c^3}\cos 2u_0 - l; \qquad (17)$$
$$\frac{1}{2}v_0'^2 = \frac{f(m_1 + m_2)}{n'^2c^3}\,\mathrm{ch}\, v_0 + \frac{h}{2n'^2c^3}\,\mathrm{ch}\, 2v_0 + l, \qquad (18)$$

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where $\hat{c}$ is an arbitrary constant. The first-order approximation equations can be written down in the form

$$u_1'' + \left[\frac{f(m_1 - m_2)}{n'^2 c^3}\cos u_0 - \frac{h}{2n'^2 c^3}\cos 2u_0\right] u_1 = 2(\mathrm{ch}^2 v_0 - \cos^2 u_0)\, v_0', \quad (19)$$

$$v_1'' - \left[\frac{f(m_1 + m_2)}{n'^2 c^3}\,\mathrm{ch}\, v_0 + \frac{h}{2n'^2 c^3}\,\mathrm{ch}\, 2v_0\right] v_1 = -2(\mathrm{ch}^2 v_0 - \cos^2 u_0)\, u_0'. \quad (20)$$

and it is easy to verify that

$$u_1 = u_0', \quad v_1 = v_0' \quad (21)$$

are special solutions of the homogeneous equations corresponding to Eqs. (19) and (20). Assuming that

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E032/E314

$$u_1 = u_0' \xi , \quad v_1 = v_0' n \tag{22}$$

Eqs. (19) and (20) are replaced by Eqs. (23) and (24) and when the latter two equations are integrated with the aid of Eq. (22), one obtains the general solutions of the first-order approximate equations which are given by

$$u_1 = u_0' \left\{ \beta_1 \int \frac{d\tau}{u_0'^2} + \beta_2 + \int \frac{1}{u_0'^2} \left[\int (\mathrm{ch}\, 2v_0 - \cos 2u_0)\, u_0' v_0' d\tau \right] d\tau \right\}; \tag{25}$$

$$v_1 = v_0' \left\{ \beta_3 \int \frac{d\tau}{v_0'^2} + \beta_4 \int \frac{1}{v_0'^2} \left[\int (\mathrm{ch}\, 2v_0 - \cos 2u_0)\, u_0' v_0' d\tau \right] d\tau \right\}. \tag{26}$$

The above theory is then applied to the case where the motion

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New Classes of Periodic Solutions in the Restricted Problem of Three Bodies

takes place in the neighbourhood of one of the attracting masses and the existence of certain periodic solutions is established in detail.
There are 10 references: 4 Soviet and 6 non-Soviet.

ASSOCIATION: Gos. astronomicheskiy in-t im. P.K.Shternberga (State Astronomical Institute im. P.K. Shternberg)

SUBMITTED: May 18, 1960

S/035/61/000/007/013/021
A001/A101

3,2100

AUTHORS: Aksenov, Ye.P., Demin, V.G.

TITLE: On periodic orbits of an artificial satellite of the Moon

PERIODICAL: Referativnyy zhurnal. Astronomiya i Geodeziya, no. 7, 1961, 7-8, abstract 7A74 ("Byul. In-ta teor. astron. AN SSSR", 1960, v. 7, no. 10, 828 - 832)

TEXT: The authors consider the motion of an artificial lunar satellite taking into account perturbations from the Earth and the shape of the Moon. Using Poincaré's method, they prove the existence of periodic orbits close to circular ones. A particular example of such a periodic orbit is presented. Data on the lunar shape given by Tisserand (1891) were used in calculations. The circle of radius a = 2,250 km was taken as a generating orbit. It can be seen from this example, that perturbations from the lunar shape should be taken into consideration in determining the orbits of lunar satellites sufficiently close to the Moon (There is an important misprint in the article. Numerical values of co-

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On periodic orbits ...

S/035/61/000/007/013/021
A001/A101

efficients a and b in Formula (21) must be reduced by a factor of 10. Reviewer).

G. Chebotarev

[Abstracter's note: Complete translation]

Card 2/2

24357

S/035/61/000/007/003/021
A001/A101

3,0203

AUTHOR: Demin, V.G.

TITLE: On one class of periodic orbits in the restricted circular three-body problem

PERIODICAL: Referativnyy zhurnal. Astronomiya i Geodeziya, no. 7, 1961, 4, abstract 7A49 ("Byul. In-ta teor. astron. AN SSSR", 1960, v. 7, no. 10, 844 - 849)

TEXT: The author considers the plane restricted circular three-body problem. Differential equations of the problem are regularized and reduced to the canonical form. The characteristical function is divided into two parts according to Charlier. As a generating solution, the author assumed the solution of a simplified system, which represents a family of elliptical orbits with foci in attracting masses. The periodical solution is sought for in the form of a series in powers of the mean motion of the attracting masses. Using the Poincaré method, the author proves the existence of a class of periodic orbits embracing both attracting bodies. M. Volkov

[Abstracter's note: Complete translation]

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24359

S/035/61/000/007/005/021
A001/A101

3.2200

AUTHOR: Demin, V.G.

TITLE: On elliptical orbits in the problem of two fixed centers

PERIODICAL: Referativnyy zhurnal. Astronomiya i Geodeziya, no. 7, 1961, 4, abstract 7A51 ("Soobshch. Gos. astron. in-ta im. P.K. Shternberga", 1960, no. 115, 35 - 43)

TEXT: The author considers the problem of two fixed attracting centers, which is integrable in elliptical functions. For the case of small mass μ of one of the attracting centers, the author gives the solution in the form of series in powers of μ, whose coefficients are periodic functions of a regularized independent variable introduced by the author in place of time.

G. Merman

[Abstracter's note: Complete translation]

Card 1/1

DEMIN, V. G.

Cand Phys-Math Sci - (diss) "New classes of periodic solutions of bounded circular problem of three bodies." Moscow, 1961. 7 pp; (Moscow Order of Lenin and Order of Labor Red Banner State Univ imeni M. V. Lomonosov, State Astronomical Inst imeni P. K. Shternberg); 150 copies; free; (KL, 6-61 sup, 192)

3.2300

24352
S/026/61/000/008/001/004
D051/D113

AUTHORS: Aksenov, Ye.P., Grebenikov, Ye.A., and Demin, V.G.

TITLE: An outstanding scientific experiment. Celestial mechanics and the first manned space flight

PERIODICAL: Priroda, no. 8, 1961, 7-15

TEXT: The article deals with the launching, orbiting and landing of space ships, the instrumentation and conditions on board the Soviet-built "Vostok" space ship, and the creation of astronomical observatories outside the earth's atmosphere. Multi-stage rockets are said to be superior to single-stage ones because the thrust chambers can be separated from the rocket during flight. The authors give a detailed account of the general mechanics of orbital flight and refer, in particular, to the flight of the "Vostok" space ship. The "Vostok" moved along an elliptical orbit with a perigee of 181 km and an apogee of 327 km. It took 89.1 min to revolve round the earth and the eccentricity of the orbit was equal to approximately 0.01. The ship passed over the USSR at an altitude of 175 to 200 km and covered a total distance of a little less than 50,000 km. The cosmonaut could see the earth's surface in all directions at a distance of 1,500 - 1,800 km. All quantities character-
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D051/D113

An outstanding scientific experiment...

izing the orbit of a space ship are subject to change due to the non-spherical shape of the Earth and its varying internal density. Atmospheric resistance and the displacement of the orbital plane of the space ship due to differences in the earth's equatorial and polar radii must also be taken into consideration in order to guarantee the safe landing of the space ship. The authors discussed the difference between "hard" and "soft" landing. The former, which is due to high velocity of the space vehicle at the moment of its impact with the surface of a planet, results in the destruction of the space ship. The latter is used for space ships with cosmonauts, experimental animals etc. on board and is extremely difficult to accomplish if, as in the case of the "Vostok", the ship is to be landed in a pre-determined locality. "Soft" landing methods are based on the simultaneous application of celestial mechanics and the aerodynamics of supersonic speeds. After a certain amount of speed is lost through passing through the dense layers of the atmosphere, a further reduction in speed is realized by means of rocket braking systems and parachutes. The space ship enters the braking zone several thousand kilometers from the landing place, but the braking mechanisms are put into operation only after the position and the velocity of the space ship have been exactly determined. At this moment it must be oriented towards its center of mass in such a way that the nozzles of the thrust-chambers are in a suitable

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position. This can be done thanks to a special system of stabilization. "Soft" landing can also be made possible by the cosmonaut, using load parachutes etc. As far as the construction and equipment of the "Vostok" were concerned, all measures were taken to make the cosmonaut's flight comfortable. The authors discuss the problems presented by meteoric and micrometeoric hazards and state that these hazards were successfully coped with by adjusting the design of the space ship and by supplying the cosmonaut with special clothing, which, in fact, played the role of a sort of second hermetic cabin. To avoid radiation hazards, manned space ships flying near the earth's surface, must fly on orbits below the dangerous belts of radiation surrounding the earth. On route to other planets, these ships must fly on trajectories passing near the earth's axis. The orbit of the "Vostok" was calculated only after taking these radiation factors into consideration. In addition to the many automatic installations guaranteeing, for instance, the maintenance of constant pressure and normal humidity of the air, regeneration of oxygen etc., the cabin also contained a device which enabled the cosmonaut to take up a graduated horizontal position. In this way he could more easily stand the overloads during the launching and landing of the space ship. On account of the cosmonaut's position, the overloads did not act along the spinal column, but in a perpendicular direction. The distribution of the blood and the heart

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D051/D113

An outstanding scientific experiment...

function were normal. During the entire flight, the cosmonaut was in continuous communication with the Earth. The authors point to the new possibilities in astronomic research opened up by space flights and state that projects are at present being developed to establish astronomic observatories outside the earth's atmosphere. These observatories are to be installed either on large space stations moving along orbits near the Earth or on the Moon. There are 2 figures.

ASSOCIATION: Gosudarstvennyy astronomicheskiy institut im. P.K. Shternberga (State Astronomical Institute im. P.K. Shternberg)

Card 4/4

S/124/61/000/011/001/046
D237/D305

3,2200

AUTHOR: Demin, V.G.

TITLE: On one class of periodic orbits in the restricted circular three-body problem

PERIODICAL: Referativnyy zhurnal, Mekhanika, no. 11, 1961, 11, abstract 11A92 (Byul. In-ta teor. astron. AN SSSR, 1960, 7, no. 10, 844 - 849)

TEXT: A plane restricted circular three-body problem is considered. Differential equations of motion of the third body (zero mass) re. the center of mass of the other two bodies are expressed in terms of canonical elliptic variables and normalized. Poincaré's method of a small parameter is used to show the existence of the class of periodic orbits containing both attracting masses and lying in their orbital plane. [Abstractor's note: Complete translation].

Card 1/1

DEMIN, V.G.; AKSENOV, Ye.P.

Periodic motion of a particle in the gravitational field of a slowly rotating body. Vest. Mosk. un. Ser. 3: Fiz., astron. 15 no. 6:87-92 N-D '60. (MIRA 14:5)

1. Kafedra nebesnoy mekhaniki i gravimetrii Moskovskogo gosudarstvennogo universiteta.
(Gravitation)

DEMIN, V.G.

Near-circular orbits of artificial earth satellites. Isk.sput.Zem. no.8:57-63 '61. (MIRA 14:6)
(Artificial satellites—Orbits)

AKSENOV, Ye.P.; GREBENIKOV, Ye.A.; DEMIN, V.G.

General solution of the problem of the motion of an artificial satellite in the natural gravitational field of the earth. Isk.sput.Zem. no.8:64-71 '61. (MIRA 14:6)

(Artificial satellites)

S/025/61/000/011/003/003
D243/D302

AUTHOR: Demin, V.G., Candidate of Physico mathematical Sciences

TITLE: Cloud-satellites

PERIODICAL: Nauka i zhizn', no. 11, 1961, 104-105

TEXT: The author gives an account of some cloud satellites recently detected near to Earth. The existence of such large gas and dust clouds has long been postulated. Doctor K. Kordylevskiy, a Polish astronomer, recently observed two weakly shining misty spots in space which may be regarded, for practical purposes, as occupying the same position in space. They reproduce closely the Moon's path, maintaining from the latter a constant angular distance of 60°. It has been shown that they are natural Earth satellites, 400,000 km away, which form an equilateral triangle with the Earth and Moon revolving steadily around the center of gravity of those two bodies at a rate of one revolution a

Card 1/2

AKSENOV, Ye.P.; GREBENIKOV, Ye.A.; DEMIN, V.G.

Outstanding scientific experiment; celestial mechanics and the first space flight of man. Priroda 50 no.8:7-15 Ag '61. (MIRA 14:7)

1. Gosudarstvennyy astronomicheskiy institut im. P.K. Shternberga. (Space flight)

ACCESSION NR: AT4035346 S/2623/62/000/123/0022/0037

AUTHOR: Aksenov, Ye. P.; Grebenikov, Ye. A.; Demin, V. G.

TITLE: Trajectories of a parabolic class in the problem of motion of a material particle in the earth's normal gravitational field

SOURCE: Moscow. Universitet. Gosudarstvennyy astronomicheskiy institut. Soobshcheniya, no. 123, 1962, 22-37

TOPIC TAGS: artificial satellite, artificial satellite orbit, artificial satellite orbital element, artificial satellite parabolic orbit, normal gravitational field

ABSTRACT: This article discusses the motion of a material particle in the earth's normal gravitational field. The normal gravitational field is determined by the potential of two attracting fixed centers situated at some apparent distance from one another. The authors give the results of a qualitative analysis of the equations of motion for a case when the total mechanical energy is equal to zero. It is shown that there are five types of motion. Parametric orbital equations are derived for each of these types. The paper is divided into 7 parts: 1 - Investigation of the elliptical coordinate μ; 2 - Investigation of the elliptical coordinate σ; 3 - formulas for the coordinate w; 4 - Relationship between time t and the regularizing variable τ; 5 - Polar trajectories of the class $h = 0$; 6 - Equ-

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ACCESSION NR: AT4035346

atorial orbits of the class h = 0; 7 - Summary of the formulas for the five types of motion. It is concluded that motion in all the types of the parabolic class occurs in unlimited trajectories in an infinite period of time. Orig. art. has: 73 formulas.

ASSOCIATION: Gosudarstvennyy astronomicheskiy institut Moskovskogo universiteta (State Astronomical Institute of Moscow University)

SUBMITTED: 00 DATE ACQ: 26May64 ENCL: 00

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

Card 2/2

AKSENOV, Ye.P.; GREBENIKOV, Ye.A.; DEMIN, V.G.

Polar orbits of artificial earth satellites. Vest. Mosk. un. Ser.3: Fiz., astr. 17 no.5:81-89 S-O '62. (MIRA 15:10)

1. Kafedra nebesnoy mekhaniki i gravimetrii Moskovskogo universiteta.
(Artificial satellites)

DEMIN, V.G. 2

AKSENOV, Ye. P., GREBENNIKOV, Ye. A. and DEMIN V. G.

"Generalized problem of two stationary centers"

Report presented at the Conference on Applied Stability-Of-Motion Theory and Analytical Mechanics, Kazan Aviation Institute, 6-8 December 1962

ACCESSION NR: AR3006009 S/0269/63/000/007/0008/0009

SOURCE: RZh. Astronomiya, Abs. 7.51.94

AUTHOR: Demin, V. G.

TITLE: Approximate solution to the problem of the movement of an artificial earth satellite

CITED SOURCE: Soobshch. Gos. astron. in-ta im. P. K. Shternberga, no. 125, 1962, 3-11

TOPIC TAGS: satellite motion, satellite movement, artificial earth satellite, Hamilton-Jacobi method

TRANSLATION: It was shown earlier that the problem of two stationary centers in its generalized formulation may be used in the problem of motion of artificial earth satellites in the non-central gravitational field of the earth. The generalization of the problem consists in the fact that the masses of the attracting centers and the distances between them are taken equal to certain complex quantities which are chosen in such a way that the potential assumes real

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ACCESSION NR: AR3006009

values for any position of the satellite in space.

In the geocentric equatorial system of coordinates x, y, z the earth's gravitational potential is represented in the form

$$U = \frac{fM}{2}\left\{\frac{\lambda + i\sigma}{r_1} + \frac{\lambda - i\sigma}{r_2}\right\},$$

where

$$r_1^2 = x^2 + y^2 + [z - c(\sigma + i)]^2,$$
$$r_2^2 = x^2 + y^2 + [z - c(\sigma + i)]^2.$$

Here f is the gravitational constant, M is the earth's mass, $i = \sqrt{-1}$, c and σ are quantities characterizing the compression and asymmetry of the earth and expressed in terms of the coefficients of the second and third harmonics in the expansion of the earth's gravitational potential.

The approximate solution takes into account the effect of the second harmonic. This solution is found by the Hamilton-Jacobi method in the spherical system of coordinates. N. Yakhontova.

DATE ACQ: 15Aug63 SUB CODE: AS INCL: 00

Card 2/2

GREBENIKOV, Ye., kand.fiziko-matematicheskikh nauk; DEMIN, V., kand.-fiziko-matematicheskikh nauk

Spaceship flies to Venus. Av.i kosm. 45 no.8:18-21 '62. (MIRA 15:8)

(Space flight to Venus)

AKSENOV, Ye.P.; GREBENIKOV, Ye.A.; DEMIN, V.G.; PIROGOV, Ye.N.

Some problems concerning the dynamics of flights to Venus.
Soob. GAISH no.125:12-41 '62. (MIRA 16:3)
(Space flight to Venus)

SUBBOTIN, M.F., otv. red.; GREBENIKOV, Ye.A., kand. fiz.-matem. nauk, red.; DEMIN, V.G., kand. fiz.-matem. nauk, red.; DUBOSHIN, G.N., doktor fiz.-matem. nauk, zam. otv. red.; OKHOTSIMSKIY, D.Ye., red.; YAROV-YAROVOY, M.S., kand. viz.-matem. nauk, red.; NIKOLAYEVA, L.K., red. izd-va; SHEVCHENKO, G.N., tekhn. red.

[Problems of the motion of artificial celestial bodies]Problemy dvizheniia iskusstvennykh nebesnykh tel; doklady. Moskva, Izd-vo Akad. nauk SSSR, 1963. 294 p. (MIRA 16:2)

1. Konferentsiya po obshchim i prikladnym voprosam teoreticheskoy astronomii, Moscow, 1961. 2. Chlen-korrespondent Akademii nauk SSSR (for Subbotin, Okhotsimskiy).
(Artificial satellites) (Mechanics, Celestial)
(Spaceships)

ACCESSION NR: AT3006845 S/2560/63/000/016/0163/0172

AUTHORS: Aksenov, Ye. P.; Grebenikov, Ye. A.; Demin, V. G.

TITLE: On the stability of some classes of orbits of artificial Earth satellites

SOURCE: AN SSSR. Iskusst. sputniki Zemli, no. 16, 1963, 163-172

TOPIC TAGS: satellite, Earth satellite, artificial satellite, artificial Earth satellite, sta lity, orbit stability, equatorial orbit, circular equatorial orbit, polar orbit, elliptical orbit, polar elliptical orbit, ellipsoidal orbit, hyperboloidal orbit, hyperbolic orbit

ABSTRACT: This theoretical paper issues from the authors' antecedent study, in the same series of booklets, no. 8, 1961, 64 in which the motion of artificial Earth (E) satellites (S) was examined in the normal gravitational field (NGF) of the E. The NGF, in the geocentric system of cylindrical coordinates, r, ϕ, z, the principal plane of which is assumed to be the equatorial plane of the E, and the z axis is the axis of rotation of the E, is expressed by the formula

$$U = \frac{fM}{2}\left\{\frac{1}{\sqrt{r^2+(z-ci)^2}} + \frac{1}{\sqrt{r^2+(z+ci)^2}}\right\}. \quad (1)$$

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ACCESSION NR: AT3006845

where f is the gravitational constant, M is the mass of the E, and c=210 km is a quantity determined by the flattening of the E. The present paper investigates the stability (in the sense of A. M. Lyapunov) of the particular solutions admitted by the differential equations of motion of this dynamic problem, also their stability under constantly acting perturbations (CAP) of a given form. These solutions, in particular, correspond to polar elliptical orbits, circular equatorial orbits, and periplegmatic orbits located on several ellipsoids, etc. The stability analyses set forth here comprise: (1) Stability of circular equatorial orbits (CEO); it is proved that CEO's are stable under CAP. In the potential of the NGF of the E, there are no longitudinal terms characteristic of triaxiality and also no terms that might be occasioned by asymmetries of the E relative to the equatorial plane. Harmonics of higher orders are also not fully considered. (2) Stability of ellipsoidal and polar elliptical orbits (PEO). It is demonstrated that the PEO's are stable with respect to the major semiaxis and the eccentricity of the ellipse. It is also found that for sufficiently small values of c_{10}, ellipsoidal orbits will also be stable in the Lyapunov sense relative to the major axis and the eccentricity of the ellipsoids along which the artificial S moves. (3) Stability of hyperboloidal and hyperbolic orbits (HHO). It is demonstrated that these orbits are stable with respect to the semiaxes of the hyperboloid along which the motion occurs and with respect to its eccentricity. Orig. art. has 61 numbered equations.

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AKSENOV, Ye.P.; GREBENIKOV, Ye.A.; DEMIN, V.G.

Qualitative analysis of the forms of motion in the problem of the motion of an artificial earth satellite in the normal field of the earth's attraction. Isk. sput. Zem. no.16:173-197 '63. (MIRA 16:6)

(Artificial satellites)

GREBENIKOV, Ye. A., kand. fiz.-matem. nauk; DEMIN, V. G., kand. fiz.-matem. nauk

Study of the minor bodies of the solar system; astronomical conference at Baku. Vest. AN SSSR 33 no.1:126-127 Ja '63. (MIRA 16:1)

(Planets, Minor)
(Astronomy—Congresses)

S/033/63/040/002/018/021
E001/E120

AUTHORS: Aksenov Ye.P., Grebenikov Ye.A., and Demin V.G.

TITLE: The generalized problem of two fixed centers and its application in the theory of motion of artificial earth satellites

PERIODICAL: Astronomicheskiy zhurnal, v.40, no.2, 1963, 363-372

TEXT: The classical problem of two fixed centers consists in a study of the motion of a passively gravitating material point subjected to attraction by two fixed material points P_1 and P_2. In the present paper this problem is investigated in application to the motion of artificial satellites. The potential U in the problem under consideration can be presented, if inverse distances r_1 and r_2 are expanded in series in Legendre polynomials, in the form:

$$U = \frac{fM}{r}\left\{1 + \sum_{n=0}^{\infty} \frac{\gamma_n}{r^n} P_n\left(\frac{z}{r}\right)\right\} \qquad (4)$$

where M is mass of both fixed bodies and $\gamma_n = \frac{M_1 a_1^n + M_2 a_2^n}{M}$;

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n is integer. The authors formulate conditions under which the expression for the potential should be real, although other quantities may be complex ones. On the other hand, the gravitational potential of the Earth is expressed, in the geocentric equatorial system of coordinates, as follows:

$$V = \frac{fM}{r}\left\{1 + \sum_{k=2}^{\infty} I_k \left(\frac{R}{r}\right)^k P_k\left(\frac{z}{2}\right)\right\} \quad (21)$$

It is shown that expression (4) can represent, under certain conditions, the gravitational potential of the Earth, and potentials proposed by M.D. Kislik and J.P. Vinti are particular cases of the generalized problem of two fixed centers. Using generalized coordinates u, v, w, differential equations of Lagrange of the second kind are written in the form:

$$\frac{d}{dt}(I\dot{u}) + \left[\dot{u}^2 + \dot{v}^2 - \dot{w}^2 \operatorname{ch}^2 v\right] \sin u \cos u = \frac{1}{c^2}\frac{\partial U}{\partial u};$$

$$\frac{d}{dt}(I\dot{v}) - \left[\dot{u}^2 + \dot{v}^2 + \dot{w}^2 \sin^2 u\right] \operatorname{sh} v \operatorname{ch} v = \frac{1}{c^2}\frac{\partial U}{\partial v}; \quad (36)$$

$$\frac{d}{dt}\left[\dot{w}\ \mathrm{ch}^2 v \sin^2 u\right] = 0.$$

The system of equations (36) has integrals of energy and area. Introducing new variables $\lambda = \mathrm{sh}\ v$ and $\mu = \cos u$, the following expressions for the coordinates of a satellite in the rectangular system are derived:

$$x = c\sqrt{(1+\lambda^2)(1-\mu^2)}\cos w;$$

$$y = c\sqrt{(1+\lambda^2)(1-\mu^2)}\sin w;$$

$$z = c\sigma + c\lambda\mu.$$

There is 1 table.

ASSOCIATION: Gos. astronomicheskiy in-t im. P.K. Shternberga (State Astronomical Institute imeni P.K. Shternberg)

SUBMITTED: January 25, 1962

Card 3/3

DEMIN, V.G.

Stability of the permanent rotation of a heavy solid having one fixed point and differing little from S.V. Kovalevskaia's gyroscope. Trudy Un. drush. nar. 5 Teor. mekh. no.2:136-140 '64. (MIRA 18:9)

L 17627-65 EWT(1)/EWP(m)/FS(v)-3/EWG(v)/T-2 Po-4/Pe-5/Pq-4/Pg-4 GW
ACCESSION NR: AP4046776 S/0293/64/002/005/0716/0718

AUTHOR: Demin, V. G.

TITLE: Application of Rumyantsev's theorem on the stability of some of the variables in celestial-mechanics problems

SOURCE: Kosmicheskiye issledovaniya, v. 2, no. 5, 1964, 716-718

TOPIC TAGS: conservative perturbing force, Poincare canonic element, characteristic function, differential equation gravitational constant, major semiaxis, motion stability, restricted function, satellite motion, node longitude, pericenter longitude

ABSTRACT: The motion of a celestial body under the action of conservative perturbing forces may be studied by the use of Poincare's system of canonic elements. The characteristic functions of differential equations of perturbed motion are given in the formula:

$$S=\frac{f^2(m_0+m)^2}{2L^2}+\mu R(L,\rho_1,\rho_2,\lambda,\omega_1,\omega_2,\mu),$$

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where f is the gravitational constant, m_0 and m are the masses of the mutually attracting bodies, R is the external perturbing force which depends upon the Poincare elements L, ρ_1, ρ_2, λ, ω_1, ω_2. The μ is a small parameter expressing the perturbation. When variations in the major semiaxis occur within restricted limits, the motion is stable. The problem of the orbital stability of heavenly bodies may be solved by using V. V. Rumyantsev's theorem on the stability of some of the variables in motion equations. The function R is analyzed as a restricted function of the Poincare element L and the parameter μ. The function R has two integrals which are stable for L according to Lyapunov and the Rumyantsev theorem. This takes place when the derivatives of the integrals of perturbed motion are equal to zero, where motion is stable relative to L_0 which depends upon the major semiaxis. This result may be related to the motion of a satellite around a slightly oblate planet. If the partial derivative of the characteristic function S_0 in respect to the longitude, is equal to the sum of partial derivatives of the same function in respect to the longitudes of the node and the pericenter, the differential equations also have one integral according to which the orbit is located within a circular ring. Orig. art. has: 13 formulas.

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ACCESSION NR: AP4046776

ASSOCIATION: none

SUBMITTED: 20Mar64 ENCL: 00 SUB CODE: AA

NO REF SOV: 001 OTHER: 000

Card 3/3

L 12451-65 EWT(1)/EWP(m)/EEC(a)/FS(v)-3/EEC(j)/EEC(r)/EWG(v)/EWA(d) Po-4/Pe-5/ Pq-4/Pg-4 AFMDC/AFETR/AFMD(t)/ESD(dp)/ESD(t) GW

ACCESSION NR: AP4046777 S/0293/64/002/005/0719/0723

AUTHOR: Demin, V. G.

TITLE: On the stability of satellite orbits under constantly acting disturbances

SOURCE: Kosmicheskiye issledovaniya, v. 2, no. 5, 1964, 719-723

TOPIC TAGS: satellite orbit stability, satellite orbit, Kalmogorov Arnol'd method, conditionally periodic motion, Hamiltonian system

ABSTRACT: The limiting case of the problem of two fixed centers, presented previously by the author, is applied to the qualitative analysis of the motion of satellites. The motion of a satellite which is taken as a mass point is studied in a coordinate system with the L-axis taken in the direction of rotation of the planet, the x, y plane parallel to the equatorial plane of the planet, and the origin at one point of the sphere of inertia. In the selected coordinate system, the gravitational potential of the planet is expressed in the form

$$V=\frac{fm}{r}+\frac{fm\delta}{r^2}+R(r,\varphi,\lambda),$$

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L 12451-65
ACCESSION NR: AP4046777

where f is the gravitational constant; m is the mass of the planet; δ is the L-coordinate of the point of the sphere of inertia; r, δ, and λ are the spherical coordinates of the satellite; and R is a disturbing function. The nature of the disturbing forces is not taken into account; it is assumed only that they are sufficiently small. For the qualitative analysis of the motion, a Hamiltonian system of disturbed motion is written in canonical variables ξ_i, η_i, and the Hamiltonian function K is established. Using the Kolmogorov-Arnol'd method, the author proves the stability of satellite orbits and the conditionally periodic motion of a satellite, under the assumption that K is an analytic function in a certain domain and that the non-degeneracy condition (a certain Jacobian is not equal to zero) is satisfied. It is pointed out that the motion of a satellite will be conditionally periodic and Lagrange-stable for any initial conditions when the disturbing function R does not depend on λ. Orig. art. has: 24 formulas.

ASSOCIATION: none

Card 2/3

L 12451-65
ACCESSION NR: AP4046777

SUBMITTED: 20Mar64 ENCL: 00 SUB CODE: AA, MA

NO REF SOV: 006 OTHER: 001 ATD PRESS: 3127

Card 3/3

L 27215-66 EWP(m)/EEC(k)-2/EWT(1)/EWA(d)/FSS-2 TT/GW

ACC NR: AM6001049 Monograph UR/
53
49
B+1

Grebnikov, Yevgeniy Aleksandrovich; Demin, Vladimir Grigor'yevich

Interplanetary flights (Mezhplanetnyye polety) Moscow, Izd-vo "Nauka," 1965. 199 p. illus. 18,500 copies printed.

TOPIC TAGS: interplanetary flight, interplanetary trajectory, space flight motion, flight mechanics, cosmic dust

PURPOSE AND COVERAGE: This book is intended for a wide circle of readers interested in space-flight mechanics. It can be arbitrarily divided into two parts: the first two chapters contain fundamentals of astronomy, which are necessary for solving astronautical problems; the last three chapters present a description of various interplanetary trajectories from the point of view of flight mechanics.

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SUB CODE: 22/ SUBM DATE: 16Aug65/ ORIG REF: 012

Card 3/3

PROCESSES AND PROPERTIES INDEX

DEMIN, V.I.

29

Finishing chrome-tanned pig skins with a damaged face side. V. I. Demin and A. Yu. Livshits. *Kozhevenno-Obuvnaya Prom. S. S. S. R.* 19, No. 1, 20(1940).—The skins are coated with a mixt. of brown casein pigment 20 kg., NH_4Cl 1 kg., zapon varnish 2.7 kg., castor oil 0.45 l., alizarin oil 2 l., glycerol 1 l., aq. ext. of linseed 10 l. (contg. 75 g./l.) and water to a total vol. of 80 l. The soln. has a density of 2.5–2.8°Bé. A. A. Boehtlingk

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

BC

2-4

Replacement of protein (in cattle rations) by ammonium salts. S. V. Fomin and V. I. Damin (Ukrain. Biochem. J., 1934, 7, No. 1, 133—143).—Replacement of proteins in the ration by urea and NH_4 salts lowered the rate of growth. Ch. Abs. (p)

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

BC

a-4

Influence of various diets on the amino-acids in muscle. S. V. [illegible] and V. D[illegible] (Ukrain. Biochem. J., 193[illegible], 7, No. 2, 147—157).—The tyrosine content of rat muscle is fairly const. and is not decreased by continuous protein starvation. The metabolism in the [illegible] is disturbed by a gelatin and [illegible], and the amount of tyrosine is increased, whilst the proportion of tyrosine-N to total N remains normal. Complete starvation does not affect the tyrosine content of the muscle. J. N. A.

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

1ST AND 2ND ORDERS

PROCESSES AND PROPERTIES INDEX

3RD AND 4TH ORDERS

a-4

Proteinases and proteolytic processes in muscle. II. Activity of muscle proteinases of the dog's leg after working. E. V. Fomin and V. I. [illegible] (Ukrain. Biokhim. [illegible], 19[illegible], [illegible], No. 1, 73–85).—The activity of the muscle proteinases in the weighted hind leg of a dog was increased > in the other leg, due to increased oxidation. E. P.

ASB-SLA METALLURGICAL LITERATURE CLASSIFICATION

1ST AND 2ND ORDERS

3RD AND 4TH ORDERS

PROCESSES AND PROPERTIES INDEX

BC

A-3

Preservation of vitamin-C in dried vegetables. V. I. D[illegible] (Ukrain. Biochem. J., 1936, 9, 395—406).—Potatoes, onions, cabbages, carrots, and turnips, dried at 60—65° in an air stream for 3—4 hr., lose their vitamin-C activity, as tested chemically and biologically. F. A. A.

A.S.M.-S.L.A. METALLURGICAL LITERATURE CLASSIFICATION

BC

A-4

Effect of seasonal factors on brain-lipins of frogs. V. I. DENIS (Ukrain. Biochem. J., 1939, 13, 47—59).—The cholesterol content of frog's brain is lowest in summer and highest in winter; that of saturated and unsaturated phosphatides is least in the spring, and greatest in the summer. Exposure of summer frogs to low temp., darkness, and hunger causes changes in brain-lipins similar to those caused by hunger alone. The amplitude of the variations observed is greater in males than in females. R. T.

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

Demin V.I.

The solubility of the enamel of the teeth. V. A. Belitser, I. O. Novik, and V. I. Demin. *Stomatologiya* 1954, No. 3, 17-22; *Referat. Zhur., Khim., Biol. Khim.* 1955, No. 7076.—The inorg. P of teeth (I) was detd. first. *In vitro* I is easily sol. even in low acid concns. The soly. of I in localities where the water has a high F content was lower than in vicinities with water of a low F content. The use of F-contg. tooth paste increases the resistance of the enamel to the action of acids. B. S. Levine

MD

(2)

URBANOVICH, L.I., assistent (Kiyev); DEMIN, V.I., kand.biol.nauk (Kiyev)

Charater of the proteins of the saliva of patients with para-
dentosis. Probl.stom. 4:151-155 '58. (MIRA 13:6)
(GUMS--DISEASES) (PROTEINS)

BELITSER, V.A., prof. (Kiyev); FETISOV, N.V., prof. (Kiyev); DEMIN, V.I., kand.biol.nauk (Kiyev); POKOTILO, Ye.D., kand.med.nauk (Kiyev)

Significance of the complex of B vitamins in the treatment of paradentosis. Probl.stom. 4:237-240 '58. (MIRA 13:6)
(VITAMINS--B, ETC.--THERAPEUTIC USE)
(GUMS--DISEASES)

Denin, V. I., Morgunov, I. N., Zatuia, D. G. and Yagud, S. L.

Tagging of diphtherial toxin by means of radioactive substances (isotopes) p. 229

Materialy nauchnykh konferentsii, Kiev, 1959. 288pp
(Kievskiy Nauchno-issledovatel'skiy Institut Epidemiologii i Mikrobiologii)

GROMASHEVSKAYA, L.L.; DEMIN, V.I.; SHAPARENKO, V.N.; SOKOLOVSKAYA, A.P.

Evaluation of some biochemical indicators in the diagnosis of aborted forms of infectious hepatitis. Nauch. inform. Otd. nauch. med. inform. AMN SSSR no.1:27-28 '61. (MIRA 16:11)

1. Institut infektsionnykh bolezney (direktor - chlen - korrespondent AMN SSSR prof. I.L.Bogdanov) AMN SSSR, Kiyev.

*

DEMIN, V.I.; SOKOLOVSKAYA, A.P.

Importance of determining bile acids in blood serum for the diagnosis of aborted forms of hepatitis. Nauch. inform. Otd. nauch. med. inform. AMN SSSR no.1:26-27 '61 (MIRA 16:11)

1. Instytut infektsionnykh bolezney (direktor - chlen-korrespondent AMN SSSR prof. I.L.Bogdanov) AMN SSSR, Kiyev.

*

DEMIN, V.I. (Kiyev); PLETNEV, V.M. (Kiyev)

Protein fractions of the blood serum in complicated and uncomplicated influenza. Sbor.nauch.trud. Inst.infek.bol. no.4:173-179 '64.
(MIRA 18:6)

GROMASHEVSKAYA, L.L.; DEMIN, V.I.; GETTE, Z.P.; DEMCHENKO, V.N.; MIRONOVA, Ye.M.

Serum enzymes in Botkin's infectious hepatitis. Vop.med.khim. 10 no.3:246-252 My-Je '64. (MIRA 18:2)

1. Institut infektsionnykh bolezney Ministerstva zdravookhraneniya UkrSSR, Kiyev.

DEMIN, V. M.

15-1957-7-8965D

Translation from: Referativnyy zhurnal, Geologiya, 1957, Nr 7, p 13 (USSR)

AUTHOR: Demin, V. M.

TITLE: Upper Permian and Lower Triassic Variegated [Rocks] of the Northeastern Border of the Great Donets Basin (Verkhnepermskiye i nizhnetriasovyye pestrotsvety severo-vostochnoy okrainy Bol'shogo Donbassa)

ABSTRACT: Bibliographic entry on the author's dissentation for the degree of Candidate of Geological and Mineralogical Science, presented to the Rostov-na-Donu University (Rostovsk. n/D. un-t), Rostov-na-Donu, 1956.

ASSOCIATION: Rostovsk. n/D. un-t (Rostov-na-Donu University)

Card 1/1

DEMIN, V.M.

Stratigraphy of variegated sediments in the Don Bend. Uch. zap. RGU 44:43-54 '59. (MIRA 14:1)

(Don Valley--Geology, Stratigraphic)

DEMIN, V.M.;POTAPOV, I.I., prof., otv. red.; KOVALENKO, Yu.V., red. izd-va; PAVLICHENKO, M.I., tekhn. red.

[Radiometric methods of searching for uranium ores; land survey]Radiometricheskie metody poiskov uranovykh rud; peshekhodnaia s"emka. Rostov-na-Donu, Izd-vo Rostovskogo univ., 1962. 105 p. (MIRA 15:9)
(Uranium ores) (Radioactive prospecting)

DEMIN, V.M., dotsent kand. tekhn. nauk, polkovnik

Determining the position of an airplane over the ocean by the measured altitudes of heavenly bodies. Mor. sbor. 47 no.4:51-57 Ap '64. (MIRA 18:7)

DEMIN, V.M.; KHRUSTALEV, Yu.P.

Some characteristics of the early history of the Sea of Azov.
Okeanologiia 4 no.5:850-855 '64 (MIRA 18:1)

1. Rostovskiy-na-Donu gosudarstvennyy universitet.

ABRAMOV, Sh.I., prof.; BAIROV, G.A., prof.; BLINOV, N.I., prof.; GADZHIYEV, S.A., prof.; GODUNOV, S.F., prof.; GOMZYAKOV, G.A., prof.; DEMIN, V.N., prof.; ZVORYKIN, I.A., prof.; KAPITSA, L.M., kand. med. nauk; MOKROVSKAYA, S.P., kand. med. nauk; POSTNIKOV, B.N., prof.; PORKSHEYAN, O.Kh., prof.; SIDORENKO, L.N., kand. med. nauk; TAL'MAN, I.M., prof.; FEDOROVA, A.D., kand. med. nauk; FILATOV, A.N., prof.; KHROMOV, B.M., prof.; SARKISOV, M.A., red.

[Errors, hazards and complications in surgery] Oshibki, opasnosti i oslozhneniia v khirurgii. Leningrad, Meditsina, 1965. 563 p. (MIRA 18:7)

1. DEMIN, V. N., LITVINOVA, YE. V., PETROV, YU. V., CHAKLIN, A. V.

2. USSR (600)

4. Stomach-Cancer

7. All-Russian conference on diagnosis and therapy of gastric cancer, on precancerous conditions of the stomach, andon methods in control and organization of prevention of gastric cancer.
Khirurgiia No. 11, 1952

9. Monthly Lists of Russian Accessions, Library of Congress, March 1953, Unclassified.

DEMIN, V. N.

Rectum - Cancer

Experimental and pathologo-anatomical study of retrograde metastasis in cancer of the rectum, Arkhiv pat., 14, No. 2, 1952.

Monthly List of Russian Accessions, Library of Congress, October 1952, Unclassified

V.DEMIN AND OTHERS

"An all-Union conference on problems of the diagnosis and treatment of gastric cancer and precancerour stages as well as on methods and organization of the struggle against gastric cancer" Tr. from the Russian p.86 (ANALELE ROMANO-SOVIETICE. SERIA MEDICINA GENERALA Vol. 6, No. 3, May/June 1953 Bucuresti, Rumania)

SO: East European, LC, Vol. 2, No. 12, Dec. 1953

DEMIN, V.N.

Restoration of recto-anal reflexes and functions of the sphincters following resection of the rectum and the sigmoid flexure in cancer. Vest.khir.74 no.2:53-57 Mr '54. (MLRA 7:4)

1. Iz kafedry onkologii (zaveduyushchiy - professor A.I.Rakov) Leningradskogo instituta usovershenstvovaniya vrachey im. S.M.Kirova.
(Rectum--Surgery) (Colon (Anatomy)--Surgery)