25(2) SOV/148-59-1-18/19

AUTHOR: Grebenik, V.M., Candidate of Technical Sciences, Docent

TITLE: The Dependence of Deformation, Straightening Moments and Accuracy on the Adjustment of the Straightening Machine (Zavisimost' deformatsiy, momentov i tochnosti pravki ot nastroyki pravil'noy mashiny)

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy - Chernaya metallurgiya, 1959, Nr 1, pp 155-163 (USSR)

ABSTRACT: Two adjustment methods for straightening machines are used for the analysis of straightening processes ensuring the accurate determination of deformations in the strip: 1) complete elimination of maximum curvature of the strip under each roll; 2) constancy of the magnitude of bend equal to the maximum admissible curvature under which the plastic deformation of the strip does not yet occur. As straightening accuracy is higher in the first method and residual plastic deformation is lower in the second method, the author recommends to combine both methods in order to obtain reduced plastic deformation and increased accuracy of straightening. In both methods the magnitude of residual straightening deformation is constant for

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The Dependence of Deformation, Straightening Moments and Accuracy on the Adjustment of the Straightening Machine

materials not subjected to toughening and depends on the toughening factor for materials subjected to this process. The distribution of plastic deformation between the rollers is subjected to a hyperbolic law which can be expressed by given formulas.
There are 3 graphs, 2 tables and 7 Soviet references.

ASSOCIATION: Sibirskiy metallurgicheskiy institut (Siberian Institute of Metallurgy)

SUBMITTED: May 8, 1958

GREBENIK, V.M., kand. tekhn. nauk, dotsent

Determination of the factor of safety. Izv. vys. ucheb. zav.: chern. met. 2 no.3:137-141 Mr '59. (MIRA 12:7)

1.Sibirskiy metallurgicheskiy institut.
(Strains and stresses)

BAKLUSHIN, I.L., inzh.; VEKSIN, I.N., inzh.; GREBENIK, V.M., dotsent, kand. tekhn. nauk; LYULENKOV, V.I., inzh.; SABANTSEVM, V.P.; SOKOLOV, L.D., prof., doktor tekhn. nauk; SHIROKOV, V.N., prof.

Hydraulic calibration of 1500-ton power presses. Izv. vys. ucheb. zav.; chern. met. 2 no.4:113-121 Ap '59. (MIRA 12:8)

1.Sibirskiy metallurgicheskiy institut. Rekomendovano kafedroy mekhanicheskogo oborudovaniya metallurgicheskikh zavodov Sibirskogo metallurgicheskogo instituta.
(Hydraulic presses) (Calibration)

BAKLUSHIN, I.L., inzh.; VEKSIN, I.N., inzh.; GREBENIK, V.M., dots., kand.tekhn.nauk; LYULENKOV, V.I., inzh.; SABANTSEV, V.P., inzh.; SOKOLOV, L.D., prof., doktor tekhn.nauk; SHIROKOV, V.N., prof.

Investigating the 740 cold rolling mill for thin sheets. Izv. vys.ucheb.zav.; chern.met. 2 no.8:143-148 Ag '59. (MIRA 13:4)

1. Sibirskiy metallurgicheskiy institut. Rekomendovano kafedroy mekhanicheskogo oborudovaniya metallurchiskikh zavodov Sibirskogo metallurgicheskogo instituta.
(Rolling mills)

25.200

77148
SOV/148-59-9-18/22

AUTHOR: Grebenik, V. M. (Candidate of Technical Sciences Docent)

TITLE: Method of Investigation of Straightening Machines

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy. Chernaya metallurgiya, 1959, Nr 9, pp 145-151 (USSR)

ABSTRACT: The article is in response to comments made by V. V. Smirnov concerning the setting up of straightening machines (Smirnov, V. V., Izvestiya vysshikh uchebnykh zavedeniy. Chernaya metallurgiya, 1959, Nr 2). The discussion refers to two methods of setting up which serve as criteria for the quantitative evaluation of the degree of deformation during straightening. Any of the proposed methods allow an analysis of the setting up process by means of appropriate comparison. The author indicates that straightening machines were studied at the Central Scientific-Research Institute of Heavy Machinery (TsNIITMASh). The evaluations of the setting up, method have not been analyzed in the previous work of Moshnin, Ye. N., and Sonin, A. L. According to the

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new methods, the straightening machine must have 9 rolls. The author is against the use of large deformations in order to decrease the number of rolls at the same degree of accuracy of straightening. Although a great number of investigations were made, many problems have not been solved yet. The following points must be studied: (1) Irregularity of stress distribution along the height of the cross section. (2) Applicability of the tension-compression characteristics to the conditions of bending. (3) Tangential stresses during bending. (4) Recurrence of application of loads of different sign and material properties. (5) The magnitude and distribution of elastic and plastic deformations. (6) Displacement of neutral line. (7) Distortion of cross-sectional area. (8) Twisting of cross sections. (9) Taking into account the degree and the rate of deformation. (10) The effect of supplementary phenomena, e.g., relaxation aftereffect. (11) Friction between the strip and the roll. (12) Shape and size of the roll. (13) Residual stresses before and after straightening.

Method of Investigation of Straightening Machines

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SOV/148-59-9-18/22

(14) The length of the curved zone. (15) Difference in strip material properties. (16) Three-dimensional state of stress. (17) Multiple supports of the strip under plastic deformation. (18) The dynamics of the straightening process. (19) Distribution of deformation along the length of the strip. (20) Buckling and its elimination. (21) Simultaneous action of torsion and bending. (22) Forces, moments, and power required for straightening. (23) Methods of setting up parameters for and calculations of straightening machines. There is 1 table; and 6 Soviet references.

ASSOCIATION: Siberian Metallurgical Institute (Sibirskiy metallurgicheskiy institut)

SUBMITTED: June 5, 1959

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GREBENIK, V.M. kand tekhn. nauk dots.

Investigation of straightening machines. Izv.vys.ucheb.zav.; chern.met. 2 no.9:153-156 S '59. (MIRA 13:4)

1. Sibirskiy metallurgicheskiy institut.
(Rolling mills--Equipment and supplies)

GREBENIK, V.M., kand.tekhn.nauk, dots.

Durability testing of parts for resistance to transient, alternating loads. Izv.vys.ucheb.zav.; chern.met. 2 no.10:147-160 O '59. (MIRA 13:3)

1. Sibirskiy metallurgicheskiy institut. Rekomendovano kafedroy mekhanicheskogo oborudovaniya metallurgicheskikh zavodov Sibirskogo metallurgicheskogo instituta.
(Machinery--Testing) (Transients(Dynamics))

ALEYNIKOV, A.I.; BAKLUSHIN, I.L.; VEKSIN, I.N.; GREBENIK, V.M.; LYULENKOV, V.I.; SABANTSEV, V.P.; SEREGIN, S.A.; SOKOLOV, L.D.; SHIROKOV, V.N.

Investigating the mechanism of the rotation process of ferroalloy furnace baths. Izv. vys. ucheb. zav.; chern. met. no.8:181-187 '60. (MIRA 13:9)

1. Sibirskiy metallurgicheskiy institut.
(Rotary hearth furnaces) (Iron alloys)

35036
S/143/60/000/010/004/014
D234/D304

10.7400

AUTHOR: Grebenik, V.M., Candidate of Technical Sciences, Docent

TITLE: Fatigue curves and methods of designing components for variable loads

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy. Mashinostroyeniye, no. 10, 1960, 73 - 81

TEXT: The author discusses the existing method of design, stating that it does not agree with experimental data, and proposing

$$N = ab^{\sigma} \qquad (4)$$

for the rectification of the fatigue curve in semi-logarithmic coordinates, N being the number of cycles and σ the stress-amplitude. The constant a and b are determined by taking the logarithm of Eq. (4) and forming the difference of the equation obtained at two values of N and σ. The final equation is

$$\sigma = K \lg N = K \lg N_a = \sigma_d = \text{const}, \qquad (11)$$

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Fatigue ... ves and methods of ...

where K is the inclination of the straight line in semi-logarithmic coordinates. The constant N_a corresponds to the point of intersection of the line with the lg N axis. The author then describes a method of determining the margin of safety and the margin of durability with the aid of experimental fatigue curves. There are 4 figures and 12 Soviet-bloc references.

ASSOCIATION: Dneprodzerzhinskiy vechernIy metallurgicheskiy institut (Evening Institute of Metallurgy, Dneprodzerzinsk)

SUBMITTED: December 21, 1959

Card 2/2

SOKOLOV, L.D.; GREBENIK, V.M.

Determination of forces in blast furnace guns. Izv. vys. ucheb. zav.; chern. met. no.12:162-165 '60. (MIRA 14:1)

1. Sibirskiy metallurgicheskiy institut.
(Blast furnaces—Equipment and supplies)

GREBENIK, V.M.; IVANCHENKO, F.K.

Durability of universal rolling mill spindles under variable loading. Izv. vys. ucheb. zav.; chern. met. no.2:164-171 '61. (MIRA 14:11)

1. Dneprodzerzhinskiy vecherniy metallurgicheskiy institut.
(Rolling mills)

SOKOLOV, L.D.; SHIROKOV, V.N.; GREBENIK, V.M.; VEKSIN, I.N.; BAKLUSHIN, I.L.; LYULENKOV, V.I.; SABANTSEV, V.P.; KAZANTSEV, A.A.

Investigating stresses in models of steel pouring ladles. Izv. vys. ucheb. zav.; chern. met. 4 no.10:147-156 '61. (MIRA 14:11)

1. Sibirskiy metallurgicheskiy institut.
(Smelting furnaces--Equipment and supplies)
(Thermal stresses--Models)

27547
S/148/61/000/004/008/008
E081/E435

10.7400 1327, 2808, 4016

AUTHOR: Grebenik, V.M.

TITLE: Design of components under fatigue loading and fatigue curves

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Chernaya metallurgiya, no.4, 1961, 167-176

TEXT: The paper is a continuation of previous work (Ref.15: Izv.VUZ. Chernaya metallurgiya, 1959, No.10). The design of many machine components subjected to variable loading is based on the fact that some fatigue curves give straight lines when plotted on a logarithmic basis. This leads to the equation

$$\sigma_i^m N_i = \sigma_{-1}^m N_o = \text{const} \qquad (1)$$

where σ_i is the amplitude of the variable stress, N_i is the corresponding number of cycles to fatigue fracture, σ_{-1} is the fatigue limit, N_o is the number of cycles corresponding to the break in the fatigue curve, m is a parameter determining the slope of the fatigue curve in logarithmic coordinates.

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Design of components under ...

However, a number of experimental investigations show that the fatigue curves are straight lines not on a logarithmic, but on a semi-logarithmic plot. The conversion from curves of one type to the other is considered. If the fatigue curve is a straight line on a semi-logarithmic basis, the value of m is variable and depends on the stress level. Experimental data for steel from a number of sources are summarised to give the constants of the fatigue curves on the basis of both methods of plotting. The data are considered in relation to useful life and longevity. As an example, the calculations for the design of a rolling mill are given. There are 5 figures, 1 table and 17 Soviet references.

ASSOCIATION: Dneprodzerzhinskiy vecherniy metallurgicheskiy institut (Dneprodzerzhinsk Evening Metallurgy Institute)

SUBMITTED: January 18, 1960

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S/148/61/000/006/013/013
E193/E480

AUTHORS: Sokolov, L.D., Shirokov, V.N., Grebenik, V.M., Veksin, I.N., Baklushin, I.L., Lyulenkov, V.I., Sabantsev, V.P.

TITLE: Experimental and analytical determination of forces in cold rolling

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Chernaya metallurgiya, 1961, No.6, pp.191-193

TEXT: In the course of an earlier investigation carried out by the present authors (Ref.1: Izvestiya vysshikh uchebnykh zavedeniy, Chernaya metallurgiya, 1959, 8), large discrepancies were found between the laboratory results and the operational data on forces acting on the rolls during cold rolling. It was revealed, however, in the course of further tests that in many cases the roll chocks had become worn (in some places to a depth of 0.4 mm) and it was postulated that this factor may have affected the load cell readings. In an attempt to find a way of eliminating this source of error, both during the calibration of the load cells and later in use, the effect of lead washere approximately 2 mm thick, placed under the dynamometers, was investigated. Fig.1 shows the

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Experimental and analytical ...

experimental conditions: a - an annular washer supporting the load cell along its periphery; б - a solid washer under the central part of the load cell; в - no washer; г - a solid washer of the size equal to that of the load cell. On the right-hand side of Fig.1, the calibrating force is plotted against the load cell readings; most consistent results were obtained when a large solid washer was used (graph г). The latter method was employed in roll force measurements and the results compared with roll force values, calculated according to A.I.Tselikov and A.A.Korolev (Ref.2: Prokatnyye stany, Metallurgizdat, 1958). The results are tabulated. It will be seen that the difference reached occasionally 30 or even 37%, the experimental values being always lower than the calculated figures. One possible explanation of this effect is provided by the fact that the temperature of cold rolled metal increases. Although the strength of the carbon steels and constructional alloy steels increases on heating between 20 and 400°C, this increase takes place during cold rolling at certain rolling speeds only. According to M.I.Manjoine (Ref.5: Journal of the Iron and Steel, v.150, p.3, VI, 1947, 380),

the "ageing peak" is shifted towards higher temperatures when the steel is rolled at high rolling speeds, so that under these conditions the strength of steel between 0 and 400°C decreases with increasing temperature. Consequently, if the temperature attained by the metal during cold rolling at high speeds is 300°C, its resistance to deformation (particularly at heavy drafts) decreases, which explains the discrepancy observed. There are 2 figures, 1 table and 5 references: 4 Soviet and 1 non-Soviet. The reference to an English language publication reads as follows: M.I.Manjoine, Journal of the Iron and Steel, v.150, p.3, VI, 1947, 380.

ASSOCIATION: Sibirskiy metallurgicheskiy institut
(Siberian Metallurgical Institute)

SUBMITTED: March 30, 1960

SOKOLOV, L.D.; SHIROKOV, V.N.; GREBENIK, V.M.; VEKSIN, I.N.; BAKLUSHIN, I.L.; LYULENKOV, V.I.; SABANTSEV, V.P.

Experimental and rated determination of forces in cold rolling. Izv.vys.ucheb.zav.; chern.met. 4 no.6:191-193 '61. (MIRA 14:6)

1. Sibirskiy metallurgicheskiy institut.
(Rolling (Metalwork))

38390
S/148/62/000/004/005/006
E193/E383

18.8200
AUTHOR: Grebenik, V.M.

TITLE: Laws governing the variation in parameters of fatigue curves under the influence of various factors

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Chernaya metallurgiya, no. 4, 1962, 170 - 184

TEXT: Studies of fatigue are normally concerned with the effect of various factors on the fatigue limit, little attention being paid to the shape of the stress/number-of-cycles curves. This approach is not entirely satisfactory because the knowledge of laws governing the effect of various factors on the shape of the S/N curves would make it easier to avoid errors in interpreting experimental results and would make it possible to obtain more accurate data on the fatigue properties of metals. It was in order to establish these laws that the present author analyzed a large volume of experimental data pertaining to the effect of various factors on fatigue properties of several steels. If the effect of one or more of these factors on the

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Laws governing ...:

fatigue of metal is studied, a set of S/N curves (in semi-logarithmic coordinates) is obtained and the possible types of such curves are demonstrated in Fig. 1. In the same way, the manner in which the fatigue limit σ_{-1} and the slope $k = tg\ \alpha$ of the curve can be affected by a given factor is demonstrated in Fig. 2. The causes of variation in fatigue properties due to various factors can be divided into three main groups: 1) factors affecting the state of stress; 2) factors affecting the surface condition and 3) factors affecting the structure of metals. How these three main groups, various individual factors, types of S/N curves, σ_{-1} and k are interrelated is shown in Table 2. The remainder of the paper is devoted to detailed values of the effect of each factor listed in column 1 of Table 2 on the shape of the parameters of the S/N curves. The conclusions, other than those listed in Table 2, can be summarized as follows:
1) if the variation in a given factor causes variation in the slope of the fatigue curves, it means that the structure of the

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Laws governing ....

metal has changed under the action of the factor studied.
2) Since the angle of slope of the S/log N curve depends always on the properties of the metal only, it should be considered as an important property of metals. The term "fatigue modulus" could be ascribed to this property, which can be calculated from $K = tg\ \alpha = \sigma_n - \sigma_{n+1} = \Delta\sigma$ kg/mm^2 .
3) Since it has been shown that various parameters of the S/N curves vary in a regular manner under the action of a particular factor, the laws deduced by the present authors and summarized in Table 2 can be used to check the accuracy of experimental data obtained in the course of any particular study of fatigue properties of a metal.
There are 9 figures and 2 tables.

ASSOCIATION: Dneprodzerzhinskiy metallurgicheskiy zavod-vtuz
(Dneprodzerzhinsk Metallurgical Works

SUBMITTED: October 21, 1960

Card 3/3

S/148/62/000/005/008/009
E111/E135

AUTHORS: Tylkin, M.A., and Grebenik, V.M.

TITLE: Influence of oxyacetylene hardening on fatigue strength

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy. Chernaya metallurgiya, no.5, 1962, 146-151

TEXT: The fatigue strength and the wear resistance of parts can be increased by surface hardening. The most suitable for large parts is oxyacetylene hardening. The increase in fatigue strength is due to the generation of compressive stresses in the surface layer, which counteract to some extent the harmful tensile stresses produced there by bending. This is true only if the hardened layer follows exactly the contour of the part. Numerous examples from practice show that even small deviations as regards uniformity and depth give rise to stresses which lower the fatigue strength. There are 5 figures.

ASSOCIATION: Dneprodzerzhinskiy metallurgicheskiy zavod-vtuz (Dneprodzerzhinskiy Metallurgical Works - Technical High School)

Card 1/1

SUBMITTED: December 21, 1960

S/148/62/000/006/004/005
E193/E383

AUTHOR: Grebenik, V.M.

TITLE: Evaluation of the fatigue strength of machine parts in which the specific effects of various factors on the shape of the fatigue diagram is taken into account

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Chernaya metallurgiya, no. 6, 1962, 182 - 190

TEXT: Fatigue tests carried out on actual parts under actual operating conditions, although most valuable, are seldom practicable. Data for design calculations are therefore obtained mostly from standard tests, supplemented by data on the effect which various factors (size, shape, mechanical and thermal treatment, etc.) have not only on the fatigue limit but also on the slope of the inclined branch of the fatigue curve and on the location of the position where this curve becomes horizontal. The effect of each such factor is usually expressed in terms of a coefficient:

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S/148/62/000/006/004/005
E193/E383

Evaluation of ....

$$K = \frac{\sigma_{-1}}{\sigma'_{-1}} \qquad (1)$$

where σ_{-1} is the fatigue limit determined under standard conditions, and

σ'_{-1} is the fatigue limit obtained when a given factor is operating.

The present author derived new equations which made it possible to evaluate the effect of various factors on the fatigue strength of machine parts operating under stresses higher than the fatigue limit. He analyzed the effect of the variation of several parameters of fatigue curves on the magnitude of K pertaining to various factors and showed that the values of K, determined under stresses higher than the fatigue limit are substantially different from those determined in tests under a stress equal to the fatigue limit. He established also that when the effect of various factors on the fatigue properties was

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Evaluation of ....

calculated, the term "service stress higher than the fatigue limit" should mean a stress higher than the fatigue limit attained when the given factor is operating and not that determined under standard conditions. Finally, he proposed a method of calculation which utilized the values of K relating to the various factors operating at stresses higher than the fatigue limit and which took into account the difference in the location of the deflection points on the fatigue curves. This made it possible to choose the values of K in accordance with the conditions of stress in service and with the specific characteristics of the fatigue curve, as a result of which the performance of highly stressed parts can be more accurately predicted. There are 6 figures.

ASSOCIATION: Dneprodzerzhinskiy metallurgicheskiy zavod-vtuz (Dneprodzerzhinsk Metallurgical Works)

SUBMITTED: November 19, 1960

GREBENIK, V.M.; TYLKIN, M.A.; KUCHERENKO, V.F.; CHERNEVICH, Ye.M.

Analysis of the breakage of metallurgical equipment parts. Izv. vys. ucheb. zav.; chern. met. 5 no.8:175-182 '62. (MIRA 15:9)

1. Dneprodzerzhinskiy metallurgicheskiy zavod-vtuz i Metallurgicheskiy zavod im. F. E. Dzerzhinskogo.

S/148/63/000/001/014/019
E073/E451

AUTHORS: Grebenik, V.M., Tylkin, M.A.

TITLE: Extension of the relations between static and fatigue characteristics to the case of hardening and tempering of steels

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy. Chernaya metallurgiya, no.1, 1963, 125-127

TEXT: The effect of heat treatment on the fatigue limit has not been adequately studied and, therefore, it is difficult to lay down satisfactory heat-treatment conditions to obtain a required fatigue strength. One method of determining the fatigue limit is by using empirical formulas which correlate the fatigue limit with the static characteristics. Of the formulas which show satisfactory agreement with experimental data, that of Zhukov is the most extensively used:

$$\sigma_{-1} = 0.3S_k - 1 \qquad (1)$$

where σ_{-1} is the fatigue limit. The real breaking strength at $\psi \geqslant 50\%$ is

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Extension of the relations ...

$$S_k = \sigma_b(6.9\psi^2 = 4.85\psi + 2.21) \quad (2)$$

Thus we obtain

$$\sigma_{-1} = 0.3\sigma_b(6.9\psi^2 - 4.85\psi + 2.21) - 1 \quad (3)$$

For steels with $\psi \leqslant 50\%$

$$\sigma_{-1} = 0.3\sigma_b(0.294 + 0.39\psi) \quad (5)$$

Recent work shows that the above relations also hold for steels that have been subjected to heat treatment throughout their volume, the error not exceeding 5 to 10%. The difference in σ_{-1} values is somewhat larger for hardened steels in which a saturated solid solution of carbon is present in the α-iron of the martensite. As the martensite crystals are in an elastically deformed state caused by considerable volume changes at temperatures where the rate of stress relaxation is low, they have a high resistance to plastic deformation, which is increased as a

Extension of the relations ...

result of considerable crystal lattice distortion caused by saturation with carbon. This upsets the relationship between static and fatigue characteristics. During tempering, the solid solution decomposes and carbon is rejected from the martensite, forming carbides; as a result, the degree of distortion of the α-phase lattice decreases. Tempering at 300 to 350°C leads to an almost complete elimination of the carbon from the solid solution regardless of the carbon content in the initial martensite. Although at these temperatures a coherent relationship is retained between the crystal lattice of the carbide and the α-phase, the structure of the steel approaches equilibrium. At the given tempering temperatures, residual austenite is completely eliminated from the structure and a ferrite-cementite mixture is formed for which the experimental fatigue limit results are in good agreement with calculated values. Thus, from static test results it is possible to determine approximately the fatigue limit of hardened steel tempered above 350 to 400°C. Published results are reproduced showing that with increasing tempering temperature at 450 to 550°C the contraction slightly decreases without a corresponding increase in the static or fatigue strength of the

Extension of the relations ...

steels investigated, similar results being obtained for other steels. The method here described of using results of static tests for determining the fatigue characteristics over the entire range of tempering temperatures can be utilized for evolving heat treatments and for estimating the fatigue strength of machine components. There is 1 figure.

ASSOCIATION: Dneprodzerzhinskiy metallurgicheskiy zavod-vtuz (Dneprodzerzhinsk Metallurgical Works-Technical High School)

SUBMITTED: August 21, 1961

GREBENIK, V.M.

Determining the probable coefficient of safety and life under the effect of variable loads. Izv. vys. ucheb. zav.; chern. met. 6 no.4:171-174 '63. (MIRA 16:5)

1. Dnepropetrovskiy metallurgicheskiy institut.
(Metals—Fatigue) (Strains and stresses)

GREBENIK, V.M.; ZHERNACHUK, V.D.; IVANCHENKO, F.K.; PAVLENKO, B.A.

Experimental investigation of converter tilting moments.
Izv. vys. ucheb. zav.; chern. met. 6 no.2:165-175 '63.
(MIRA 16:3)

1. Dneprodzerzhinskiy metallurgicheskiy zavod-vtuz.
(Converters--Models)

GRECHNIK, V.M.; TYLKIN, M.A.

Distribution of relations between static and fatigue characteristics in the steel hardening and tempering process. Izv.vys. ucheb.zav.; chern.met. 6 no.1:125-127 '63. (MIRA 16:2)

1. Dneprodzerzhinskiy metallurgicheskiy zavod-vtuz.
(Steel—Heat treatment) (Strains and stresses)

TYLKIN, M. A., kand. tekhn. nauk; GREBENIK, V. M., kand. tekhn. nauk; KUCHERENKO, V. F., inzh.; ALPEYEV, V. G., inzh.; NIKITSKAYA, V. A., inzh.

Heat treatment of crane wheels. Mashinostroenie no.5:57-60 S-O '62. (MIRA 16:1)

1. Dneprodzerzhinskiy metallurgicheskiy zavod-vtuz im. M. I. Arsenicheva (for Tylkin, Grebenik, Kucherenko). 2. Metallurgicheskiy zavod im. Dzerzhinskogo (for Alpeyev, Nikitskaya).

(Steel--Heat treatment)
(Cranes, derricks, etc.)

GREBENIK, V.M.; ZHERNACHUK, V.D.; IVANCHENKO, F.K.; PAVLENKO, B.A.

Investigating the turning mechanism of a 1300-ton mixer. Izv. vys. ucheb. zav.; chern. met. 6 no.7:183-190 '63. (MIRA 16:9)

1. Dneprodzerzhinskiy metallurgicheskiy zavod-vtuz.
(Mixing machinery--Electric driving)

GREBENIK, V.M.; TATARNIKOV, V.V.

Effect of the curvature radius at the base of a saw tooth and the material of which it is made on the durability of circular saws for hot metal cutting. Izv. vys. ucheb. zav.; chern. met. 6 no.10:169-177 '63. (MIRA 16:12)

1. Dnepropetrovskiy metallurgicheskiy institut i Zhdanovskiy metallurgicheskiy institut.

GREBENIK, V.M., kand. tekh. nauk, dotsent; [illegible], V.P., inzh.

Fatigue strength in case of repeated changes of loads and conditions for summing the breakages. Izv. vys. ucheb. zav.; mashinostr. no.11:47-54 '63. (MIRA 17:10)

1. Dnepropetrovskiy metallurgicheskiy institut i Dneprodzerzhinskiy metallurgicheskiy zavod-vtuz.

GREBENIK, V.M.; KUCHERENKO, V.F.

Experimental verification of conditions in summing-up damages.
Izv. vys. ucheb. zav.; chern. met. 6 no.12:212-220 '63.
(MIRA 17:1)

1. Dnepropetrovskiy metallurgicheskiy institut.

SOKOLOV, Lev Dmitriyevich; GREBENIK, Viktor Mikhaylovich; TYLKIN, Mikhail Arkad'yevich; Prinimal uchastiye BAKLUSHIN, I.L.; SMIRNOVA,V.V., kand. tekhn. nauk, dots., retsenzent; ROKOTYAN, Ye.S., doktor tekhn. nauk, prof., retsenzent; MOROZOV, B.A., doktor tekhn. nauk, retsenzent

[Study of the equipment of rolling mills] Issledovanie prokatnogo oborudovaniia. Moskva, Metallurgiia, 1964. 487 p. (MIRA 17:11)

1. Moskovskoye vysshoye tekhnicheskoye uchilishche im. N.E. Baumana (for Smirnova).

ACCESSION NR: AP4043310 S/0145/64/000/006/0051/0059

AUTHOR: Grebenik, V. M. (Candidate of technical sciences, Docent)

TITLE: An accelerated method of fatigue testing and the parameters of fatigue curves

SOURCE: IVUZ. Mashinostroyeniye, no. 6, 1964, 51-59

TOPIC TAGS: metal fatigue testing, accelerated fatigue test method, fatigue curve parameter, fatigue curve calculation constant, critical cycle base, fatigue limit, tensile strength, fatigue curve incidence angle, steel fatigue

ABSTRACT: Data for 46 experimentally obtained fatigue curves (on 22 grades of steel) were processed statistically to establish the principles governing the dependence of the critical cycle base N_k, a primary factor employed in the accelerated fatigue testing method suggested previously by V. S. Ivanova, on the grade of steel and its properties, as well as to establish parameters of fatigue curves for standard testing conditions, i. e., the fatigue limit σ_{-1}, angle of fatigue curve slope α° or, the parameter governing that angle in semi-logarithmic coordinated $k=tg\ \alpha$, and the break point of a fatigue curve N_0. As a result, the author presents expressions for $k=tg\ \alpha$ in relation to fatigue limit ($k=0.24\ \sigma_{-1}$

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ACCESSION NR: AP4043310

$\pm 0.4 \pm 0.8$ kg/mm^2) and in relation to tensile strength ($k = 0.124\sigma_B - 0.7 \pm 0.8$ kg/mm^2). The relationship of fatigue limit to tensile strength is written as $\sigma_{-1} = 0.52\sigma_B - 4.8 \pm 3.8$ kg/mm^2 (correlation factor 0.86) for experimental values of σ_{-1} or $\sigma_{-1} = 0.46\sigma_B + 0.4 \pm 2.8$ kg/mm^2 (correlation factor 0.83) for experimental and calculated σ_{-1}, and $\sigma_{-1} = 0.47\sigma_B - 2.5 \pm 1.5$ kg/mm^2 (correlation factor 0.98) for GOST data. N_0 was found to range between $0.9 \cdot 10^6$ and $3.3 \cdot 10^6$ and the value of 10^6 should be accepted in the absence of any experimental data. Values of N_k can be written in relation to σ_{-1} and σ_B as $N_k = 7 \cdot 10^3 \cdot \sigma_{-1}$ and $N_k = 3.5 \cdot 10^3 \cdot \sigma_B$ respectively. Curves plotted by using these constants show good coincidence with processed data from standard tests. It is concluded that the cited hypothesis and constants employed in it are proper in cases where a given factor does not produce structural variations in the test sample (i.e., stress concentration, scale factor, etc.). Orig. art. has: 11 equations, 6 graphs and 3 tables.

ASSOCIATION: Dnepropetrovskiy metallurgicheskiy institut (Dnepropetrovsk Metallurgical Institute)

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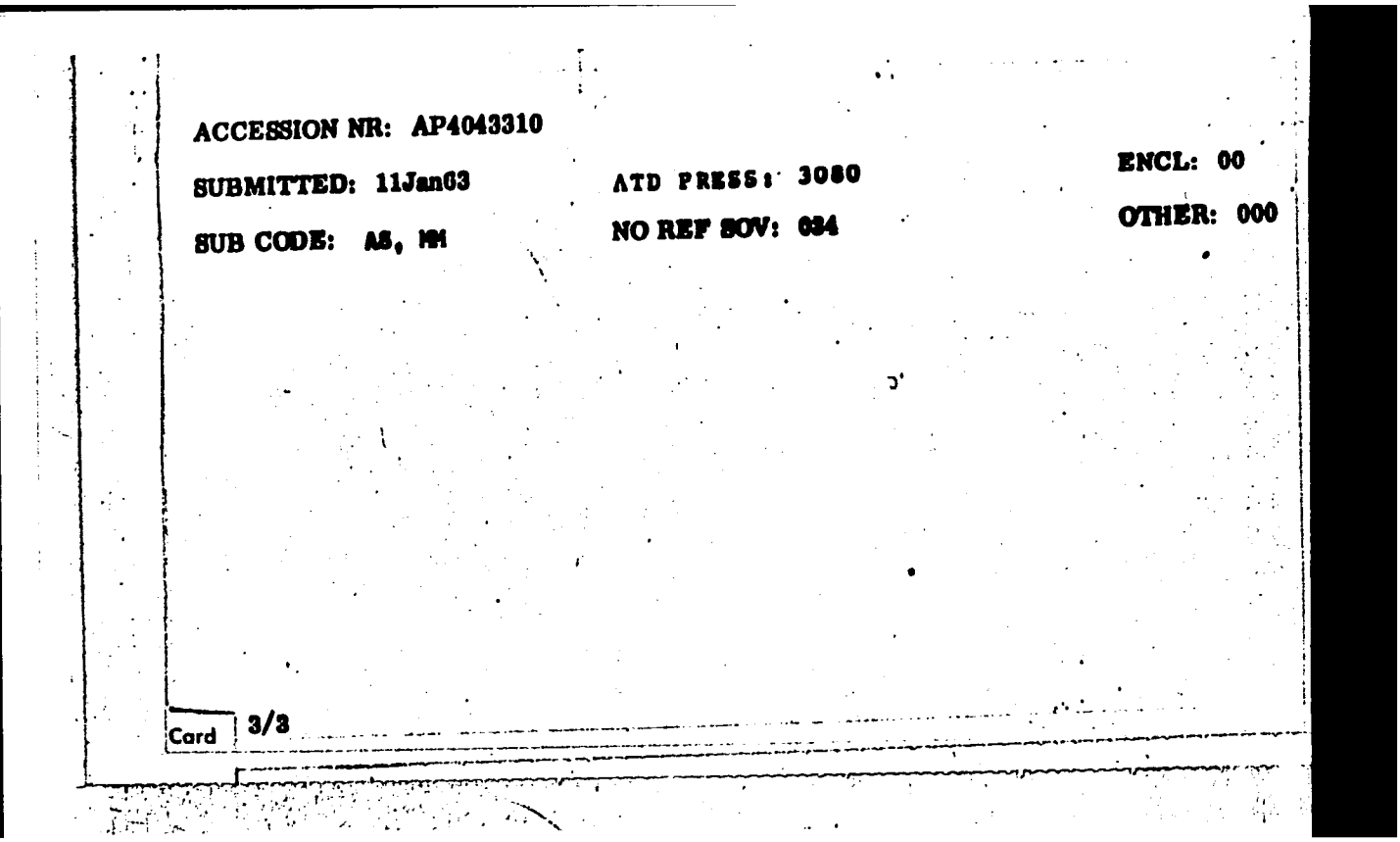

ACCESSION NR: AP4043310

SUBMITTED: 11Jan63 ATD PRESS: 3080 ENCL: 00

SUB CODE: AS, MM NO REF SOV: 004 OTHER: 000

Card 3/3

ACCESSION NR: AP4014386 S/0145/63/000/011/0047/0054

AUTHORS: Grebenik, V. M. (Candidate of technical sciences, docent); Kucherenko, V. F. (Engineer)

TITLE: Fatigue strength under repeated load change and conditions for summation of failures

SOURCE: IVUZ. Mashinostroyeniye, no. 11, 1964, 47-54

TOPIC TAGS: fatigue strength, repeated load change, notch, flexural test, initial stress

ABSTRACT: Three types of steel 15 specimens were fatigue-tested under repeated load change conditions. The three types were: unnotched, smooth-notched, and sharp-notched. Pure flexural tests under rotating conditions were accomplished on the MUI-6000 machine. These tests were conducted at two stress levels, under mechanical softening $\sigma_{initial} > \sigma_{final}$, and hardening conditions, $\sigma_{final} > \sigma_{initial}$. Two loading cycles up to failure were used for all three specimens, $N_1 = 5 \times 10^5$ and $N_2 = 0.7 \times 10^5$, and the base numbers of cycles N_o for each specimen

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ACCESSION NR: AP4014386

were: $N_{01} = 10^6$, $N_{02} = 1.1 \times 10^6$, and $N_{03} = 1.2 \times 10^6$. To establish an equivalence criterion for all three specimens, the initial stress and final stress cycles were identical in number. The results were tabulated and plotted on graphs. At low values of λ - number of loading periods (reversal), the rule

$$\sum n_i/N_i = a = 1 \text{ where } a = \lambda \sum n_i/N_i$$

fails (n_i - total number of load cycles, N_i - number of load cycles up to failure). However, upon increasing λ the value of $\sum n_i/N_i$ does tend to unity. Furthermore, for the notched specimens the strengthening effect was higher, and it increased with the sharpness of the notch. Finally, in the softening region, where $\sum n/N = 1$, the number of reversals was lower in the unnotched than in the notched specimens. The opposite was true in the hardening region. Orig. art. has: 5 figures, 3 tables, and 1 formula.

ASSOCIATION: Dnepropetrovskiy metallurgicheskiy institut (Dnepropetrovsk Metallurgy Institute); Dneprodzerzhinskiy metallurgicheskiy zavod-vtuz (Dneprodzerzhinsk Metallurgical Works and Institute of Technology)

ACCESSION NR: AP4014386

SUBMITTED: 24Oct62 ENCL: 00

SUB CODE: MM NO REF SOV: 010 OTHER: 000

3/3

Card

GREBENIK, V. M.; LEONOVA, A. V.; STOROZHIK, D. A.; NECHIPORENKO, V. N.

Investigating regularities of the gas flow and the wear of coupled parts in blast furnace charging arrangements. Izv.vys.ucheb.zav.; chern.met. 7 no. 4:182-185 '64. (MIRA 17:5)

1. Dnepropetrovskiy metallurgicheskiy institut.

GREBENIK, V.M., kand. tekhn. nauk, dotsent

Rapid fatigue tests and the parameters of fatigue curves. Izv. vys. ucheb. zav.; mashinostr. no.6:51-59 '64. (MIRA 17:12)

1. Dneporpetrovskiy metallurgicheskiy institut.

TYLKIN, M.A., kand. tekhn. nauk, dotsent; GREBENIK, V.M., kand. tekhn. nauk, dotsent; MEL'NICHENKO, G.P., inzh.; ZASPITSKIY, N.A., inzh.; KORDABNEV, I.L., inzh.

Temperature changes in the cup of a large blast furnace cell. Stal' 24 no.5:408-411 My '64. (MIRA 17:12)

1. Dneprodzerzhinskiy metallurgicheskiy zavod-vtuz, Dnepropetrovskiy metallurgicheskiy institut i Dneprovskiy metallurgicheskiy zavod im. Dzerzhinskogo.

GREBENIK, V. M.; KUCHERENKO, V. F.

Experimental investigation of the effect of alternating overloads on fatigue strength and durability with and without stress concentrations. Report No. 1. Izv. vys. ucheb. zav.; chern. met. 7 no.6:199-206 '64. (MIRA 17:7)

1. Dnepropetrovskiy metallurgicheskiy institut i Dneprodzerzhinskiy metallurgicheskiy zavod-vtuz.

L 8667-65 EWT(m)/T/EWP(b)/EWP(w) Pb-4 ASD(f)-2/BSD/AFWL/AFETR/SSD JD/EM

ACCESSION NR: AP4044121 S/0148/64/000/008/0188/0194

B

AUTHOR: Grebenik, V.M., Kucherenko, V.F.

TITLE: Experimental investigation of the effect of alternating overloads on the fatigue resistance and life span of parts, with and without stress concentrators. Part II

SOURCE: IVUZ. Chernaya metallurgiya, no. 8, 1964, 188-194

TOPIC TAGS: fatigue, fatigue resistance, stress concentration, stress concentrator, overload, alternating overload, steel/steel 15

ABSTRACT: Using a procedure described in a previous paper, the authors tested three types of specimens (9.48 mm in diameter) of steel 15: smooth, or with an annular cut having a radius of 0.4 or 0.9 mm, under both strengthening (initial stresses σ_{in} less than ultimate stresses σ_{ul}) and destrengthening ($\sigma_{in} > \sigma_{ul}$) conditions with a single one-step change in load. Varying the duration of original use (n_{or}), the stress difference ($\Delta\sigma_a$), σ_{in} and σ_{ul}, the ultimate number of cycles n_{ul} tolerated by the sample before failure was determined. From complex diagrams relating the initial cycle number (N_{in}), the final cycle number (N_f) and the above parameters, it is concluded that: 1. in all the samples, the strengthening effect when $\sigma_{in} > \sigma_{ul}$ and the destrengthening effect when

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ACCESSION NR: AP4044121

2

$\sigma_{in} < \sigma_{ul}$ increase as the difference $\sigma_{in} - \sigma_{ul}$ increases; 2. at equal values of $\sigma_{in} - \sigma_{ul}$, the destrengthening effect is more marked at higher stresses than at lower stresses when $\sigma_{in} > \sigma_{ul}$, while with $\sigma_{in} < \sigma_{ul}$ the strengthening effect is higher at lower stresses; 3. the strengthening effect in notched samples tends to be stronger than in smooth samples; and 4. the net life span $\sum \frac{n}{N}$ depends markedly on the particular type of metal, the mode of applying the stress and the sample shape. Orig. art. has: 1 table and 5 figures.

ASSOCIATION: Dnepropetrovskiy metallurgicheskiy institut (Dnepropetrovsk Metallurgical Institute); Dneprodzerzhinskiy metallurgicheskiy zavod-vtuz (Dneprodzerzhinsk Metallurgical Plant -vtuz)

SUBMITTED: 02Jan64 ENCL: 00 SUB CODE: MM

NO REF SOV: 011 OTHER: 000

Card 2/2

YERMOLOV, I.N.; GREBENNIK, V.S.; RAYKHMAN, A.Z.

Reflection of the ultrasound from an angle defect. Zav. lab. 30 no.11:1351-1355 '64 (MIRA 18:1)

1. Tsentral'nyy nauchno-issledovatel'skiy institut tekhnologii i mashinostroyeniya.

GREBENIK, V.M., kand. tekhn. nauk, dotsent

Using coefficients accounting for the effect of various factors in calculating for a limited durability. Izv. vys. ucheb. zav.; mashinostr. no.5:49-57 '65.
(MIRA 18:11)

GREBENIK, V.M.; IVANCHENKO, F.K.; TYLKIN, M.A.; KUCHERENKO, V.F.

Strength and causes for the rupture of a drive shaft for the mechanism of a propelled car on a floor-type charging machine. Izv. vys. ucheb. zav.; chern. met. 8 no.1:169-175 '65 (MIRA 18:1)

1. Dneprodzerzhinskiy metallurgicheskiy zavod-vtuz.

GREBENIK, V.M.

Computations for limited life in a general case of nonstationary asymmetric cycles of stress application. Izv. vys. ucheb. zav.; chern. met. 8 no.2:188 '65. (MIRA 18:2)

1. Dnepropetrovskiy metallurgicheskiy institut.

GREBENIK, V.M.

Strength and limited durability during discrete and continuous changes in the loading conditions. Izv. vys. ucheb. zav.; chern. met. 8 no.10:162-169 '65. (MIRA 18:9)

1. Dnepropetrovskiy metallurgicheskiy institut.

GREBENIK, V.M., kand. tekhn. nauk, dotsent

Evaluating the fatigue strength in case of a continuous variation of loading conditions. Izv. vys. ucheb. zav.; mashinostr. no. 10:35-43 '65 (MIRA 19:1)

1. Submitted December 26, 1963.

VINOGRADOV, B.N., inzh.; GREBENIK, Ye.A., inzh.; GLADKIKH, K.V., inzh.

Hardening processes of binding materials made of granulated blast-furnace slags subject to heat and moisture treatment. Stroi. mat. 9 no.4:12-15 Ap '63. (MIRA 16:5)
(Binding materials) (Slag)

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

From Earth to Mars. Av.i kosm. 45 no.4:22-26 Ap '63. (MIRA 16:3)
(Space flight to Mars)

3(1) SOV/33-35-6-10/18

AUTHOR: Grebenikov, Ye.A.

TITLE: Analytical Theory of the Motion of Japetus

PERIODICAL: Astronomicheskiy zhurnal,1958,Vol 35,Nr 6,pp 904-916 (USSR)

ABSTRACT: The author proposes a theory of motion for the eighth satellite of Saturn, Japetus. Former attempts in this direction are due to H. and G. Struve and in recent times to G.N. Duboshin. The author applies the classical method of Hill. However, this is modified so that the motion of a celestial body (also of a sputnik) can be considered under the following influences : 1. Attraction by a homogeneous ellipsoid of revolution (central planet, especially Saturn) 2. Attraction by other satellites of the central planet running on orbits 3. Attraction of the sun which moves on an orbit around the central planet. The perturbations of first order obtained by the author are explicitly given at the end of the paper. In his detailed statements the author uses the analytic methods of Poincaré and abandons the application of Fourier analysis. He thanks Professor G.N. Duboshin for supervising this work.

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Analytical Theory of the Motion of Japetus SOV/33-35-6-10/18

There are 1 figure, and 9 references, 4 of which are Soviet, 2 French, 1 English, 1 German, and 1 Dutch.

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

SUBMITTED: October 16, 1957

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GREBENIKOV, Ye. A., Cand of Phys-Math Sci (diss) "Analytical Theory of Motion of Yapet," Mos, 1959 8 pp (Mos State Univ im Lomonosov, and State Astronomical Institute im P. K. Shternberg) (KL, 1-60, 119)

3(1) SOV/33-36-2-20/27

AUTHOR: Grebenikov, Ye.A.

TITLE: The Perturbed Motion of the Eighth Saturn Satellite Japetus

PERIODICAL: Astronomicheskiy zhurnal,1959,Vol 36,Nr 2,pp 361-369 (USSR)

ABSTRACT: The author describes the results of a calculation of the Japetus perturbations according to the method of Hill [Ref 1]. In § 1 the system of the used fundamental units and the system of elements on which the calculations are based, are described. §§ 2-4 contain general formulas for the perturbation coefficients caused by the geometric figure of the Saturn, by influence of the sun and titanium. The numerical values of the coefficients are collected in tables. § 5 contains equations for the determination of the arbitrary constants and the values of the constants. Final formulas for the perturbed Japetus coordinates are given in § 6. The obtained data are compared with former data of Hermann Struve, Bernevitz, Alden, and Georg Struve in § 7.
The author thanks Professor G.N. Duboshin for the guidance of the paper.

Card ~~1/2~~ 1/1

State Astronomical Inst. im. P.K. Shternberg

3(1),29(2)
AUTHORS: Yarov-Yarovoy,M.S., and Grebenikov,Ye.A. SOV/33-36-3-19/29

TITLE: On the Computation of Precise and Approximate Ephemerides of Artificial Earth Satellites

PERIODICAL: Astronomicheskiy zhurnal,1959,Vol 36,Nr 3,pp 524-534 (USSR)

ABSTRACT: The paper contains the analytic solution of the following problems: 1. the determination of the interval of latitude in which optical observations of an artificial earth satellite are possible; 2. the calculation of the rigorous ephemerides; 3. an approximate solution which is especially recommended since the calculation can be carried out 4-5 times quicker and the sufficient exactness of 1° is obtained; 4. the answer of the question whether in the given moment the earth satellite can be observed (consideration of the disturbing action of the brightness of the sky and possible vanishing in the earth's shadow). All derived formulas are due to Yarov-Yarovoy. Grebenikov examined their applicability and constructed a practical example. There are 7 figures, and 2 Soviet references.

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

SUBMITTED: July 18, 1958

Card 1/1

GREBENIKOV, Ye.A.

Applying Hill's method in investigating the motion of an artificial earth satellite. Biul.Inst.teor.astron. 7 no.10:811-814 '60. (MIRA 14:3)
(Artificial satellites--Orbits)

S/033/60/037/02/013/013
E032/E914

AUTHOR: Grebenikov, E. A.

TITLE: Conference on the Mathematical Theory of Motion of Artificial Celestial Bodies

PERIODICAL: Astronomicheskiy zhurnal, 1960, Vol 37, Nr 2, pp 362-368 (USSR)

ABSTRACT: The conference took place on December 22-29, 1959, at the State Astronomical Institute im. P. K. Shternberg (Moscow State University). The conference was organized by the Department of Celestial Mechanics and Gravimetry of the Moscow State University, whose head is Prof. G. N. Duboshin. The Organizing Committee was headed by Prof. Duboshin and included Member-Correspondent of the Ac. Sc. USSR L. N. Sretenskiy (Ministry of Specialized Education), Deputy Chairman of the Astronomical Council A. G. Masevich, Head of the Department of Applied Celestial Mechanics of the Institute of

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S/033/60/037/02/013/013
E032/E914

Conference on the Mathematical Theory of Motion of Artificial Celestial Bodies

Theoretical Astronomy of the Ac. Sc. USSR G. A. Chebotarev, Doctor of Physico-Mathematical Sciences T. M. Eneyev, and other members of the Department of Celestial Mechanics and Gravimetry of the Moscow State University. Over one hundred persons took place in the Conference. Twentyeight papers were read and were devoted to the mechanics of artificial Earth satellites and cosmic rockets. The following papers were read:

1) I.D.Zhongolovich (Institute of Theoretical Astronomy), 'New formulae relating to the motion of artificial Earth satellites'.
'Numerical calculation of certain parameters of the Earth's gravitational field'.
2) E. A. Grebenikov (Shternberg Institute), 'Secular and periodic perturbations in the motion of artificial Earth satellites due to the resistance of the atmosphere'.
3) A. A. Orlov (Shternberg Institute)

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S/033/60/037/02/013/013
E032/E914

Conference on the Mathematical Theory of Motion of Artificial Celestial Bodies

'Review of non-Soviet work on the theory of motion of artificial Earth satellites'.

4) G. M. Bazhenov (Institute for Mechanization of Agriculture, Khar'kov)
'On the determination of an artificial satellite orbit from three observations'.

5) Yu. V. Batrakov (Institute of Theoretical Astronomy)
'Processing of the "observations" of the third Soviet satellite at the Institute of Theoretical Astronomy'.

6) G. P. Taratynova (Mathematical Institute, AN SSSR),
'Methods of calculation of artificial satellite orbits for large time intervals'.

7) D. K. Kulikov (Institute of Theoretical Astronomy)
'Integration of the equations of motion in stellar mechanics by the Cowell method using high speed computers'.

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S/033/60/037/02/013/013
E032/E914

Conference on the Mathematical Theory of Motion of Artificial Celestial Bodies

8) G. N. Duboshin 'Integration of the differential equations for the rotational motion of artificial celestial bodies'.
9) V. T. Kondurar' (Ivanovsk Energetics Institute) 'Translational and rotational motion of a spheroidal satellite'.
10) V. V. Beletskiy (Mathematical Institute AN SSSR) 'The motion of an artificial Earth satellite about its center of mass'.
11) L. N. Sretenskiy 'The motion of a mass point in the gravitational field of a pulsating spheroid'.
12) A. A. Orlov 'On periodic motions of a mass point in the gravitational field of a spheroid in the critical case'.
13) Ye. P. Aksenov (Moscow State University) 'Almost circular orbits of a particle in the gravitational field of a rotating body'.
14) A. V. Yegorova (Moscow State University) 'Perturbations in the motion of a satellite due to the oblateness of the Earth and to the Sun'.

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S/033/60/037/02/013/013
E032/E914

Conference on the Mathematical Theory of Motion of Artificial Celestial Bodies

15) M. M. Pospergelis (Moscow State University) 'The trajectory of the flight to the Moon'.
16) M. S. Yarov-Yarovy (State Astronomical Institute im. P. K. Shternberg) 'On the motion of a rocket in the vicinity of the Moon'.
17) Ye. P. Aksenov and V. G. Demin (Moscow State University) 'Periodic orbits of an artificial satellite of the Moon'.
18) Ye. A. Grebelnikov 'On the application of the Hill method to the theory of motion of artificial earth satellites'.
19) N. G. Magnaradzhe (Tblisi State University) 'Translational and rotational motion of two bodies with variable mass'.
20) V. A. Brumberg (Institute of Theoretical Astronomy) 'Collision trajectories in the limited problem of three bodies'.

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S/033/60/037/02/013/013
E032/E914

Conference on the Mathematical Theory of Motion of Artificial Celestial Bodies

21) V. G. Demin 'On periodic orbits round the Moon'.
22) Ye. P. Aksenov 'The effect of the tri-axiality of the Earth on the motion of an artificial earth satellite'.
23) D. M. Shchtigolev (Moscow State University) 'Approximate solutions of some problems in celestial mechanics'.
24) R. A. Liakh (Institute of Theoretical Astronomy) 'A modification of the expansion of the perturbation function into a series'.
25) N. B. Yelenevskaya (Moscow Evening Machine Building Institute) 'On the expansion of the perturbation function into a series in the case when the eccentricity is close to unity'.
26) M. S. Yarovoy 'Improving the convergence of series representing the motion of artificial earth satellites'.

G. A. Chebotarev spoke on the future programmes of the Department of Applied Celestial Mechanics of the Institute of

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S/033/60/037/02/013/013
E032/E914

Conference on the Mathematical Theory of Motion of Artificial Celestial Bodies

Theoretical Astronomy of the Academy of Sciences USSR. A. I. Ribakov (State Astronomical Institute im P. K.Shternberg), U. V. Batrakov, T. M. Nayev (Mathematical Institute of the Ac. Sciences), V. A. Yegorov (Mathematical Institute of the Ac. Sc.), U. A. Lyabov (Moscow Energetics Institute), M. S. Yarov-Yarovoy, V. V. Radzayeveskiy (Yaroslav Education Institute), I. P. Kreshkov (Moscow Institute of Transportation Engineering), I. D. Zhongolovich, A. A. Batirev (Rostov State University), L. Ya. Anonyeva (Kazan State University), and Ye. P. Aksenov took part in the discussion. An All-Union

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S/033/60/037/02/013/013
E032/E914

Conference on the Mathematical Theory of Motion of Artificial Celestial Bodies

conference on the theory of motion of artificial earth satellites and their scientific uses will take place in 1961 and the Astronomical Council was instructed to set up a special commission to plan research into celestial mechanics.

SUBMITTED: January 12, 1960.

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

3,2300

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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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

An outstanding scientific experiment...

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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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)

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26815
S/560/61/000/008/004/010
E032/E514

3.2200 2412 4512 1121 1132

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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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

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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

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by:

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

where w is given by

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

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
Card 5/5

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)

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)

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 ν; 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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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: Gosudarstvenny*y 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.; 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)

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:

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

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:

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

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

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

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

GRIBENIKOV, V.A.

Using series in solving the generalized restricted problem of three bodies. Trudy Un. druzh. nar. 5 Teor. mekh. no.2: 125-135 '64. (MIRA 18:9)

ACCESSION NR: AP4040849 S/0033/64/041/003/0567/0578

AUTHOR: Grebenikov, Ye. A.

TITLE: Stability of Lagrangian triangular solutions of the restricted three-body problem

SOURCE: Astronomicheskiy zhurnal, v. 41, no. 3, 1964, 567-578

TOPIC TAGS: celestial mechanics, Lagrangian triangular solution, restricted three-body problem, three-body problem, orbital eccentricity

ABSTRACT: It was demonstrated by A. M. Lyapunov (Sobr. sochin., 1, Izd-vo AN SSSR, 1954) that Lagrangian solutions of the unrestricted three-body problem are unstable if the criterion for stability is the infinite closeness of perturbed and unperturbed triangles formed by attracting masses and that the sides of a triangle in perturbed motion differ by an infinitely small value from the corresponding lengths in unperturbed motion at the same time. These solutions posses stability of a different kind. A triangle in which the attracting masses are situated at the vertices changes little in form and dimensions. After infinitely small perturbations the triangle always differs little from an equilateral triangle and the lengths of the sides of the perturbed triangle differ by an infinitely small

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ACCESSION NR: AP4040849

value from the corresponding sides in unperturbed motion. On the basis of this work by Lyapunov, Grebenikov has investigated the stability of triangular Lagrangian solutions in restricted problems in celestial mechanics. It is shown in this paper that at sufficiently small values of eccentricity of the orbits of attracting masses, and with certain conditions imposed on the masses, the Lagrangian solutions in this case are stable if the criterion used for stability is the infinite closeness of the perturbed and unperturbed triangles at whose vertices the masses are situated. Orig. art. has: 57 formulas.

ASSOCIATION: Gosudarstvenny*y astronomicheskiy institut imeni P. K. Shternberga (State Astronomical Institute)

SUBMITTED: 21Oct63 ENCL: 00

SUB CODE: AA NO REF SOV: 006 OTHER: 001

Card 2/2

GREBENIKOV, Ye.A.

Methods for averaging equations of celestial mechanics. Astron. zhur. 42 no.1:190-194 Ja-F '65. (MIRA 18:2)