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S/094/60/000/010/002/002
E073/E335

AUTHORS: Strakhov, K.I., Kachanov, I.I. and Yakovlev, V.A.

TITLE: High-temperature Induction Furnace of Industrial Frequency for Brazing of Components

PERIODICAL: Promyshlennaya energetika, 1960, No. 10, pp. 15 - 16

TEXT: The authors propose a new design of an induction type furnace operating at the supply frequency with a permanent hermetically closed muffle and not an expendable one. The furnace forms a coreless transformer, the primary winding of which is a multiturn solenoid (inductor) and the secondary winding is the hermetic muffle made of a refractory metal. On connecting the inductor to an AC supply, currents are induced in the muffle and partly also in the components inside it which generate the required brazing heat. The temperature control is effected by means of a potentiometer on the basis of temperature values derived from thermocouples fitted inside the furnace. The furnace consists of the following basic parts: housing - 1; inductor - 2; thermal insulation - 3; hermetic muffle - 4; lid - 5 and the magnetic circuit - 6.

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High-temperature Induction Furnace of Industrial Frequency for Brazing of Components

The housing is made of ordinary "steel 5" and its dimensions are 1 000 x 1 000 mm. To prevent heating of the housing separation gaps are provided. The inductor is a two-layer one and has 78 turns of a 16 x 16 mm hollow aluminium conductor. The outer layer has 5 tappings, enabling selection of the necessary thermal regime of the furnace. The dimensions of the inductor are: external diameter 823 mm; internal diameter 785 mm and height 750 mm. The thermal insulation is made of "ultra-lightweight" material (between the internal layer and the external surface of the muffle) and firebrick. The muffle is made of refractory ЭИ-435 (EI-435) sheet steel, 11 mm thick; the joints are fused by argon arc welding. The cover of the furnace is of nonmagnetic steel, 14 mm thick with a pipe connection for fitting a vacuum pump, introducing a gas flux and thermocouples. On the inside the lid is fitted with thermal insulation. On the outside it is water-cooled. The furnace characteristics are as follows: power 65 kW; voltage 380 V; current consumption 180 A; current intensity

Card 2/3

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High-temperature Induction Furnace of Industrial Frequency for Brazing of Components

in the furnace 700 A; rating of the condenser bank 350 kVAr; temperature 1 200 - 1 250 °C. This furnace has the following advantages: the power consumption is only one-quarter of that of a chamber furnace; the process is much less laborious; a great saving is obtained in expensive refractory metal for manufacturing the muffles. The annual saving in electricity amounts to 600 000 kWh. This proposal was awarded second prize in the Fifteenth All-Union Competition for Saving Energy. There is 1 figure.

Card 3/3

TRET'YAKOV, Yu.D.; KACHANOV, I.N.

Isothermal solubility diagram for the quaternary system $FeSO_4 \cdot (NH_4)_2SO_4$–$MnSO_4$–$MnSO_4 \cdot (NH_4)_2SO_4$–$ZnSO_4 \cdot (NH_4)_2SO_4$–$H_2O$ at 40°C. Zhur.neorg.khim. 7 no.7:1708-1715 Jl '62. (MIRA 16:3)

(Systems (Chemistry)) (Solubility) (Sulfates)

KACHANOV, K.S., inzh.

Work practices of the organizations of the Main Administration for the Erection of Metallurgical Plants. Mont. i spets. rab. v stroi 25 no.11:3-8 N '63. (MIRA 17:1)

1. Glavnoye upravleniye po montazhu metallurgicheskikh predpriyatiy.

GLIKMAN, L.A., prof., doktor tekhn.nauk; KACHANOV, L.M., prof., doktor fiz.-matem.nauk

"Residual Stresses" by I.A.Birger. Zav.lab. 30 no.12:1523-1524 '64.
(MIRA 18:1)

APPROVED FOR RELEASE: 07/19/2001 CIA-RDP86-00513R000519810018-8"

KACHANOV, L. M.

KACHANOV, L. M.

Variatsionnye primtsipy dlia uprugo-plasticheskikh sredin. (Prikladnaia matematika i mekhanika, 1942, v. 6, no. 2/3, p. 187-196, bibliography)

Title tr.: Variational principles for elastic-plastic solids.

SO: Aeronautical Sciences and Aviation in the Soviet Union, Library of Congress, 1955.

1ST AND 2ND ORDERS

PROCESSES AND PROPERTIES INDEX

3RD AND 4TH ORDERS

24

B

COMMON ELEMENTS

Creep Phenomena Under Complex Stress Conditions (In Russian.) L. M. Kachanov. *Kotloturbostroenie* (Boiler and Turbine Manufacture), Aug. 1947, p. 6-10.

Discusses several general and particular questions concerning the above. Alterations of deformation and stress per unit of time were studied for in a series of problems. For example, the problem of creep of a spherical container and cylindrical tube with thin walls is solved by a very simple method.

COMMON VARIABLES INDEX

MATERIALS INDEX

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

AUTHOR INDEX

1ST AND 2ND ORDERS

1ST AND 2ND LETTER

KACHANOV, L. M.

USSR/Engineering
Creep
Stress Analysis

Aug 1947

"Creep in Combined Stress," L. M. Kachanov, Candidate of Physical-Mathematical Sciences, Central Scientific Research Boiler Turbine Institute imeni I. I. Polzunov, 5 pp.

"Kotloturbostroyeniye" No 4

Mathematical discussion illustrated with formulae and a few diagrams on general questions on the theory of creep in combined stress, by means of which the change of strain and stress with time and the elasticity of strain are studied. The principle of least work, a generalized principle of Castiliano, are

24T31

USSR/Engineering (Contd)

Aug 1947

formulated. These formulae give in a simple form answers to the problems of creep in spherical bodies and cylindrical pipes with thin walls.

PA 24T31

24T31

KACHANOV, L.M.; LUR'YE, A.I., prof., red.; LOYTSYANSKIY, L.G., prof., red.; DZHANELIDZE, G.Yu., red.; VOLCHOK, K.M., tekhn. red.

[Mechanics of plastic media] Mekhanika plasticheskikh sred. Leningrad, Gos. izd-vo tekhniko-teoret. lit-ry, 1948. 215 p. (MIRA 11:7)
(Deformations (Mechanics)) (Elastic solids)

KACHANOV, L. M.

*Kachanov, L. M. On the mechanics of ... [illegible] ... principles and ... [illegible]

... [illegible] from J. Appl. Math. Mech. [Akad. Nauk SSSR. Zhurnal Prikl. Mat. Mech.] 4, no. 3, 37-42 (1940)
The author's initials are misprinted ... N in the ... [illegible]

...walled hollow ... a nearly...

APPROVED FOR RELEASE: 07/19/2001 CIA-RDP86-00513R000519810018-8"

KACHANOV, L. M.

KACHANOV, L. M.

Nekotorye voprosy teorii polzuchesti. Leningrad, Gostekhizdat, 1949. 164 p., diagrs. (Sovremennye problemy mekhaniki).

Bibliography: p. 163-164.

Title tr.: Some problems in the theory of creep of metals.

Reviewed by IU. N. Rabotnov in Sovetskaia kniga, 1951, no. 1, p. 55-57.

SO: Aeronautical Sciences and Aviation in the Soviet Union, Library of Congress, 1955.

materials of this type is established, and various examples are discussed including flexure and torsion of bars and the general relaxation problem where the displacements are prescribed on part of the surface of a body while ...

KACHANOV, L. M.

33895. O Prilozhyenii Tyeorii Kirkhgofa-Klyebsha K Voprosam Ustoychivosti Dyeformatsii I Kolyevaniy Odnogo Klassa Plastin I Obolochyek. Uchyen. Zpiski, (Lyeningr. Gos. Un-t Im. Zhdanova), Syeria Matyem. Nauk, VYP 17, 1949, C. 95-102. - Bibliogr: 6 Nazv.

SO: Letopis' Zhurnal'nykh Statey, Vol. 46, Moskva, 1949.

KACHANOV, L.M.

Applying the Kirchhoff-Kiebsch theory to problems on the stability, deformation and vibration of a specific class of plates and shells. Uch.zap.Len.un. no.114:95-102 '49. (MLRA 10:3)
(Elastic plates and shells)

[illegible] in Russian.

Paper [illegible] the plastic torsion of a [illegible] prismatic bar. The analysis is based upon a total strain theory of plasticity in which $G\gamma = \tau^{1+2\beta}$ (γ = engineering shear strain, τ = shear stress, G and β = positive constants typifying mechanical behaviour of material under shear). The objective is principally to discuss cases in which the cross-sectional shape exhibits slight deviations from a circle. In particular, some results are obtained for a case when there is a local notch of special shape.

H. G. Hopkins (Sevenoaks).

KACHANOV, L. M.

"Investigations in the Theory of Plasticity." Sub 26 Apr 51, Inst of Mechanics, Acad Sci USSR.

Dissertations presented for science and engineering degrees in Moscow during 1951.

SO: Sum. No. 480, 9 May 55.

KACHANOV, L.M.

BTR

1788*. Stability of Plane Forms of Bending Beyond the Elastic Limit. L. M. Kachanov. *Prikladnaia Matematika i Mekhanika*, v. 15, Mar.-Apr. 1951, p. 195-206.

The theory of small elastic plastic deformations is used to calculate the above. Results are tabulated and charted.

PA 193T60

KACHANOV, L. M.

USSR/Mathematics - Elasticity Sep/Oct 51

"Stability of Plane Form of Deflection beyond Elasticity Modulus (Effect of Strengthening)," L. M. Kachanov, Leningrad State U

"Prik Matem i Mekh" Vol XV, No 5, pp 639, 640

Problem was discussed by author previously (ibid. Vol XV, No 2, 1951). Here he considers the case in which the material is strengthened linearly. In boundary case he obtains stability soln for (1) elastic bands, and (2) elastic bands of ideal plastic material. Submitted 20 Jan 51.

193T60

KACHANOV, L.M.

Kačanov, L. M. Stability of the plane form of bending beyond the elastic limit. III. Influence of complex loading. Akad. Nauk SSSR, Prikl. Mat. Meh. 15, 762-764 (1951). (Russian)

It is pointed out that the theory of small elastic-plastic deformations is not strictly appl[illegible]able to this problem, since the loading is "complex" because the stress components do not increase proportionately to a given parameter. The theory of plastic flow is applied and the solution is [illegible] [illegible] [illegible] [illegible] [illegible] obtained by employing the former theory [illegible] the three preceding reviews].

H. I. Ansoff

Source: Mathematical Reviews, Vol 13 No. 9

AMR

26

3830. Kachanov, L. M., Stability of a plane deflection form beyond the yield point (in Russian). *Doklady Akad. Nauk SSSR* (N.S.) 77, 6, 989-992, Apr. 1951.

Author gives relations between stress couples and components of curvature and twist for a bent rod of rectangular cross section, valid beyond the yield point (analogous to Kirchhoff's relations in elastic range); these, with the known Kirchhoff-Clebsch's equations (equations of equilibrium and relations between components of curvature and displacements), form a complete system of 15 equations with 15 unknowns. The case of a rectilinear rod under the von Mises condition of plasticity is discussed, and indications for a more general theory (curved rod, plasticity with work hardening) are given. For solution of the equations, Ritz's method is proposed. No numerical results are given, nevertheless, author concludes that S. Timoshenko's proposal to calculate with von Kármán's modulus leads to unsatisfactory results.

J. M. Klitchieff, Yugoslavia

Oct. '51

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

KACHANOV, L. M.

Strains and Stresses

Stability of arches beyond the limit of elasticity. Vest. Len. un 7 No. 12, 1952.

An analysis of this stability on the basis of plasticity theory in which Ypung's modulus is replaced by Karman's modulus, as was recommended in the case of plastically-strained arches by A. N. Dinnik, "Stability of Arches,' (Ustoychivost' Arok.,) State Tech. Press, 1946. States that this is xx analogous to the case of longitudinal bending of straight compressed beams.

253T110

9. Monthly List of Russian Accessions, Library of Congress, June 1953, Unclassified

KACHANOV, L. M.

PA 249T47

USSR/Physics - Elasticity 1 Feb 53

"Stability of Elastic-Plastic Equilibrium of a Compressed and Twisted Wall," L. M. Kachanov

DAN SSSR, Vol 88, No 4, pp 627-630

Studies stability of a circular wall compressed and twisted beyond the limit of elasticity. The problem as applied to an ideally elastic wall was discussed in previous articles (see Greenhill, Proc. Inst. Mech. Eng. London (1883); E. L. Nikolai, ibid. 6,30 (1926) and others). Presented by Acad V. I. Smirnov. Received 20 Oct 52.

249T47

KACHANOV, L.M.

USSR/Engineering - Steel pipes

Card 1/1 Pub. 128 - 5/32

Authors : Leleev, N. S.; Troyanskiy, E. A.; Zalkind, E. M.; Kats, Sh. N.; Zakharov, A. A.; and Kachanov, L. M.

Title : Comments and critical review of the article, "A Problem Concerning the Strength of Steel Pipes for High-Pressure Boilers"

Periodical : Vest. mash. 11, 24-27, Nov 1954

Abstract : A discussion and rebuttal of the article, "A Problem Concerning the Strength of Steel Pipes for High-Pressure Boilers", written by N. S. Leleev, and E. A. Troyanskiy, is presented. Graphs; table; diagram.

Institution : ...

Submitted : ...

KACHANOV, L, M.
USSR/Theory of elasticity

Card 1/1

Author : Kachanov, L. M.

Title : Problem of deformation of a plastic layer

Periodical : Dokl. AN SSSR, 96, Ed. 2, 249 - 252, May 1954

Abstract : Report is devoted to an axially symmetrical problem of deformation of a plastic layer. Actually there are two problems involved: 1) problem of the stressed state in a plastic seam and the development of a method determining the resistance of pliable metals to breaking away by means of elongation tests of a thin layer of the tested metal fused with solid parts. Consideration must be given to the composite boundary conditions causing displacement on the surface of the contact. Actual test procedure is described. Five references; 1 USSR 1950.

Institution : ....

Submitted : Presented by Academician V. I. Smirnov, March 15, 1954
February 25, 1954

USSR/Mechanics - Elasticity and Plasticity

FD-2489

Card 1/1 Pub 85-16/19

Author : Kachanov, L. M.

Title : On complex loading

Periodical : Prikl. Mat. i Mekh., 19, 371-375, May-June 1955

Abstract : The author compares the two types of fundamental dependencies used in the theory of plasticity. They are 1) equations of the theory of elastic-plastic deformations which establish a connection between components of deformation and components of stress and 2) equations of the theory of plastic flow, which connect infinitely small increments of these components. The author presents some qualitative indications that results obtained from the two different theories will coincide closely in most cases.

Institution: --

Submitted : November 24, 1954

KACHANOV, Lazar' Markovich; FEL'DMAN, G.I., redaktor; MURASHOVA, N.Ya., tekhnicheskiy redaktor

[Principles of the theory of plasticity] Osnovy teorii plastichnosti. Moskva, Gos. izd-vo tekhniko-teoret. lit-ry, 1956. 324 p. (MIRA 10:2)
(Plasticity)

... with uniform over-pressure p acting ...

KACHANOV, L.M.

status of criteria of stability arriving at the con...

hypotheses including Engesser Karman's and ...
shows that in the elastoplastic range only Shanley's ...

KACHANOV, L. M.

Physicists L. M. Kachanov, Ye. I. Edel'shteyn, G. V. Vinogradov, G. N. Kuznetsov, M. P. Volarovich, and A. V. Stepanov and geologists F. I. Vol'fson, V. A. Aprodov, N. I. Borodayevskiy, and Yu. S. Shikhin -- on the problems of modeling tectonic phenomena.

paper presented at the First All-Union Conference on Tectonophysics, Moscow, 29 Jan - 5 Feb 1957.

Kachanov, L. M.

AUTHOR: Ivlev, D.D. SOV/24-58-4-33/39

TITLE: Conference on Sustained Static Strength of Turbine Components Working at High Temperatures (Soveshchaniye po dlitel'noy staticheskoy prochnosti detaley turbomashin, rabotayushchikh pri vysokoy temperature)

PERIODICAL: Izvestiya Akademii Nauk SSSR, Otdeleniye Tekhnicheskikh Nauk, 1958, Nr 4, pp 149 - 150 (USSR)

ABSTRACT: The Commission on the Strength of Gas Turbines from the Institut mekhaniki AN SSSR (Institute of Mechanics of the Ac.Sc.USSR) (Chairman - Yu.N. Rabotnov) and the Strength Section of the Leningrad Technical Committee on Turbine Construction (Chairman - V.K. Naumov) held a conference during November 20-22, 1957 on the sustained static strength of turbine components working at high temperature.

SOV/24-58-4-33/39

Conference on Sustained Static Strength of Turbine Components Working at High Temperatures

G.A. Tulyakov (TsNIITMASh) described the results of an experimental investigation of creep in the boiler steel 1Kh 8N 9T(EYaIT) under complex stress conditions.
M.N. Kats (TsKTI im. Polzunov) gave a paper on "Investigation of Deformation and Sustained Strength of Tubes" containing results on the study of creep under complex stress conditions.
A.N. Grubin (Vyssheye Voyenno-morskoye uchilishche im. Dzerzhinskogo - Advanced Naval School im. Dzerzhinskiy) read a paper on "Calculation of the "Fir-tree" Roots of Blades of Gas Turbines in the Creep Deformation Region"
L.M. Kachanov (Leningradskiy gosudarstvennyy universitet - Leningrad State University and TsKTI im. Polzunov) dealt with creep under initial plastic deformation, with a view to calculating the deformation state of components made from special heat-resistant steels.
Yu.N. Rabotnov (Moscow State University, Institut mekhaniki AN SSSR - Institute of Mechanics of the Ac.Sc.USSR) described the results of theoretical and experimental investigations on unsteady creep under complex stress conditions. He remarked that there now exists a theory, agreeing satisfactorily with experimental data, which permits the calculation of the stress and deformation state in turbine disks and rotors at high temperatures. In addition he has designed/constructed apparatus for investigating sustained strength and creep of heat resisting alloys under complex stress conditions and a number of valuable results have been obtained with this apparatus.
B.P. Sokolov (TsKTI im. Polzunov) discussed the choice of the nature of loading of components working at high temperatures.
S.V. Serensen (TsIAM) gave a paper "On Constructional Factors of Sustained Static Strength" which described results obtained on low-power turbine equipment.
The paper of N.N. Kalinovskiy dealt with the bearing capacity of turbine rotors.
Many participants remarked on the increasing need for extensive co-ordination of work in the field of strength of gas turbines.

Card5/7

AUTHOR: Kachanov, L.M. and Nemchinskiy, A.L.

TITLE: On a method of determining the fracture strength. (Ob odnom sposobe opredeleniya soprotivleniya otryvu)

PERIODICAL: "Fizika Metallov i Metallovedenie" (Physics of Metals and Metallurgy), 1957, Vol. IV, No. 1 (10), pp. 151-160 (U.S.S.R.)

ABSTRACT: Existing methods of testing the fracture strength of ductile metals, particularly of low carbon steel, have a number of disadvantages. In earlier work (Zav. Lab., 1952, Vol.XVIII, 1381), one of the authors described results of fracture tests carried out with cylindrical specimens of high strength steel containing a thin transverse layer of a steel to be investigated; the strength figures were obtained on the assumption that the load distribution was uniform. It was later found that this was not the case, and in this paper formulae are derived which enable one to calculate the real ratio of these stresses. It was found dilatometrically that carbon steel had a linear contraction of 0.228% on cooling down from +20 to -190 °C, whilst hardened chromium-nickel steel containing 0.3% C contracted under the same conditions by 0.236%. This slight difference of 3.5% in the thermal expansion of the two steels affect appreciably the results of the investigations. The authors carried out experiments with specimens which were manufactured by forge welding of a packet consisting of two sheets of chromium-nickel steel with an

24-5-4/25

AUTHOR: Kachanov, L. M. (Leningrad).

TITLE: On plastic bending of curved thin walled tubes.
(O plasticheskom izgibe krivykh tonkostennykh trub).

PERIODICAL: "Izvestiya Akademii Nauk, Otdeleniye Tekhnicheskikh Nauk" (Bulletin of the Ac.Sc., Technical Sciences Section, 1957, No.5, pp. 42-47 (U.S.S.R.)

ABSTRACT: Bending of curved thin walled tubes is accompanied by flattening of their profile and as a result of that, their flexibility increases sharply. A theoretical analysis of this phenomenon was first carried out by Karman in 1911 and a number of authors have dealt with the problem in more recent years. In earlier work of the author (6) attempts were made to analyse bending of curved thin walled tubes in the case of plastic deformations whereby the solution is constructed on the basis of the principle of minimum total energy; the difficulties caused by the non-linearity of the problem were overcome on the basis of the assumption that the relation between the intensities of stresses and strains T and Γ can be approximated by the parabola $T = 2A_1 \Gamma - 4A_2 \Gamma^3$, whereby $A_1 > 0$, $A_2 > 0$ are constants. Thus, $dT/d\Gamma > 0$, so that this

Card 1/3

On plastic bending of curved thin walled tubes. (Cont.)
24-5-4/25

approximation allows relatively small deviations from the linear law. It was found that during plastic deformations the flexibility of the tube increases only slightly. In this paper the solution is based on a different variational principle, the principle of minimum additional work; it is in this case possible to arrive at a solution of the problem for cases when $\Gamma = BT^m$, whereby B is a constant and m is an odd number larger than zero; flexibility values for other magnitudes of m can be obtained by interpolation. This approximation enables establishment of the fact that the flexibility of the tube increases sharply with increasing m. The given results indicate that the flexibility coefficient δ increases sharply on transition into the region of plastic deformations. This is attributed to the fact that flattening causes reduction of the longitudinal deformation and a reduction in the stress σ. For balancing a given bending moment, the required increase in σ is larger in the plastic range of deformations than in the elastic one. The obtained solution can be directly applied to the case of bending of a curved tube under conditions of steady state creep. The limit carrying capacity of such tubes is also considered.

Card 2/3

On plastic bending of curved thin walled tubes. (Cont.) 24-5-4/25
There are four figures, 7 references, 4 of which are Slavic.

SUBMITTED: March 1, 1957.

AVAILABLE:

Card 3/3

Kachanov, L. M.

AUTHORS: Kats, Sh. N. and Kachanov, L. M. (Leningrad) 24-11-22/31

TITLE: On plastic deformation in the case of complicated loading. (O plasticheskoy deformatsii pri slozhnom nagruzhenii)

PERIODICAL: Izvestiya Akademii Nauk SSSR, Otdeleniye Tekhnicheskikh Nauk, 1957, No.11, pp. 172-173 (USSR)

ABSTRACT: The results of various authors, for instance, of Neal, B. (Ref.5) relating to the determination of the torsion resistance of an initially bent rod prove indirectly the usefulness of the plastic flow theory. Therefore, the authors considered it of interest to accumulate various experimental data on this problem and here results are described of torsion experiments on tubes which were first plastically deformed by internal pressure. Inside a special set-up a vertically disposed tube was fixed which was stressed by internal hydraulic pressure. The measurement of the pressure was accurate to a degree 0.35%. The change in the tube diameter under the effect of internal pressure was recorded in six points along the circumference of the tube with an indicator having scale divisions of 1 μ. The torsion was effected by loads applied to arms of 1 m length. Seven tubes were investigated, all of which were produced from

Card 1/2

24-11-22/31

On plastic deformation in the case of complicated loading.

Steel 20 which was first annealed to obtain given mechanical properties. The experimentally determined curves show that in presence of a plastic deformation in the tube, caused by internal pressure, the initial shear modulus will equal the elastic shear modulus as follows from the theory of plastic flow; thereby, the degree of plastic deformation caused by the internal pressure does not manifest itself greatly on the values of the shear modulus and torsion. The coefficient of proportionality between the torque and the twist angle is strongly dependent on the magnitude of accumulated deformation; these conclusions of the theory of elastic-plastic deformations contradict the above mentioned experimental data.
There are one figure and 5 references, one of which is Slavic.

SUBMITTED: May 22, 1957.

ASSOCIATION: Central Boiler-Turbine Institute. (Tsentral'nyy Kotloturbinnyy Institut).

Card 2/2

KACHANOV, L.M. (Leningrad)

Elastic and plastic equilibrium of a wedge under conditions of flat tension. Prikl.mat. i mekh. 21 no.3:413-418 My-Je '57. (MIRA 10:10)

(Wedges) (Elasticity)

AUTHOR: Kachanov, L. M. (Leningrad) SOV/24-58-8-5/37

TITLE: On the Rupture Time in Creep Conditions (O vremeni razrusheniya v usloviyakh polzuchesti)

PERIODICAL: Izvestiya Akademii Nauk SSSR, Otdeleniye Tekhnicheskikh Nauk, 1958, Nr 8, pp 26-31 (USSR)

ABSTRACT: Recently Hoff (Ref.1) defined the rupture time of a bar in tension as the time at which the cross-sectional area of the bar vanished as a result of unbounded quasi-viscous flow. Kats (Ref.2) has studied by the same method the strength of thick-walled pipes under an internal pressure. The rupture time of a rotating disc with a hole has been calculated by Rosenbloom (Ref.3). In this paper the author describes an attempt at defining the rupture time taking account of embrittlement. The effect of stress concentration has been evaluated by means of the analysis described. If at a given temperature the material can undergo considerable deformation, the stress distribution is noticeably evened out and hence the effect of a stress concentration on the strength of the material is weakened. Conversely, for small deformations the sensitivity of the material to stress concentration

On the Rupture Time in Creep Conditions SOV/24-58-8-5/37

is increased. It is also possible to make a comparatively simple approach to the definition of the rupture time and the conclusions generally agree with the observations. In some cases (for instance, inside an aggressive medium) a preferential formation of cracks emanating from the surface of the body was observed; for such cases the time to failure can be determined according to the method described in the paper provided it is supplemented by an equation which determines the speed of failure along the normal to the surface. The author expresses his thanks to I. G. Sobolev and Ya. B. Fridman for their useful advice.

There are 2 figures and 11 references, 8 of which are Soviet, 2 English and 1 German.

SUBMITTED: April 5, 1958

1. Metals--Mechanical properties 2. Metals--Failure 3. Metals--Creep 4. Metals--Stresses

Card 2/2

SOV/179-59-3-13/45

AUTHOR: Kachanov, L. M. (Leningrad)

TITLE: Approximate Solution of Steady Creep Problems (Priblizhennoye resheniye zadach ustanovivsheysya polzuchesti)

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh nauk, Mekhanika i mashinostroyeniye, 1959, Nr 3, pp 84-95 (USSR)

ABSTRACT: The paper is a continuation of earlier work (Refs 1 and 5). It is assumed that in steady creep the shear strain and shear stress are connected by the power relationship

$$H = BT^m .$$

The strain components are related to the stress components by the equations (Ref 1)

$$\xi_x = \frac{1}{2} BT^{m-1}(\sigma_x - \sigma) = \frac{\partial \Lambda}{\partial \sigma_x} , \dots \quad (1.2)$$

$$\eta_{xy} = BT^{m-1}\tau_{xy} = \frac{\partial \Lambda}{\partial \tau_{xy}} , \dots$$

Card 1/2

where

$$\Lambda = \frac{B}{m+1} T^{m+1} \qquad (1.3)$$

and $\sigma = {}^1/3\ (\sigma_x + \sigma_y + \sigma_z)$.

An approximate method of solving creep problems based on these equations is proposed and applied to a hollow sphere under the action of internal pressure; the pure bending of a bar of rectangular cross-section; the torsion of a bar of rectangular cross-section, and the axially symmetric bending of a plate. The results are illustrated graphically (Figs 5-10) and numerically. There are 10 figures and 6 references, 5 of which are Soviet and 1 English.

SUBMITTED: February 27, 1959

Card 2/2

KACHANOV, L.M. (Leningrad)

Variational methods for the solution of plasticity problems. Prikl. mat. i mekh. 23 no.3:616-617 My-Je '59. (MIRA 12:5)

(Plasticity)

KACHANOV, L.M.

report presented at the 1st All-Union Congress of Theoretical and Applied Mechanics, Moscow, 27 Jan - 3 Feb '60.

134. A. A. Ilyushin (Moscow): Problems of the theory of plasticity under combined loading.

135. V. K. Kabulov (Tashkent): Elastic-plastic vibrations of rods of non-circular cross section.

136. V. G. Kalinin (Leningrad): The forced non-linear flexural vibrations of a homogeneous prismatic rod and a very long rectangular plate.

137. S. Kaliski (Warsaw): On a method of solving the equations of motion for an infinite anisotropic medium in the presence of a magnetic field.

138. A. E. Kan, V. A. Kabulov (Kharkov): An engineering method for the design of open prismatic shells.

139. I. I. Kandaurov (Leningrad): The distribution of vertical compressive stresses and strains in foundations in homogeneous or stratified soils.

140. B. Ya. Kantor (Kharkov): Bending of cantilever plates of variable stiffness.

141. K. S. Karapetian (Erevan): The effect of aging and anisotropy on the creep of concrete.

142. L. M. Kachanov (Leningrad): On the time of rupture in creep.

143. L. M. Kachanov (Leningrad): On some variational principles and methods in the theory of plasticity.

144. K. A. Kerimov (Baku): A procedure of determining an impact tension diagram for large deformations.

145. N. A. Kil'chevskii (Kiev): Some generalizations of the formulation of elasto-static and elasto-dynamic contact problems and methods for their solution.

146. A. Kh. Kim (Minsk): The flow of a visco-plastic medium in a cone.

147. L. A. Kitover (Leningrad): On the elastic equilibrium of thin, infinite orthotropic plates.

148. K. V. Kovalev (Kharkov): Models of the influence surfaces for the intensity of the bending moment in thin plates and shells.

149. A. D. Koval'enko (Kiev): Shallow shells of revolution of variable thickness in a three-dimensional temperature field.

150. M. Kozarov (Sofia): Dynamic stability of cylindrical and spherical shells.

151. M. Kozarov (Sofia): The influence of initial imperfections of shape on the stability of thin elastic cylindrical sandwich shells under axial compression.

152. W. T. Koiter (Delft): Elastic stability and post-buckling behavior.

153. A. S. Kondratyev (Kuibyshev), Yu. P. Markov (Orenburg): The effect of support elasticity on the natural vibrations of rods.

154. I. M. Kopev, I. A. Oding (Moscow): Strength and plasticity of "whiskers".

155. B. G. Korenev (Moscow): The design of flexible plates and beams on elastic foundation.

156. M. S. Kornishin (Kazan): Bending of rectangular shallow shells with elastic ribs.

157. M. S. Kornishin (Kazan): On the solution of the nonlinear algebraic equations of shell theory.

158. Yu. G. Korotkin, D. M. Tartakovskii (Leningrad): The one-dimensional problem of the consolidation of a sediment layer with variable specific weight and variable water permeability.

159. A. S. Kosmodamianskii (Saratov): The elastic equilibrium of anisotropic plate with a finite number of elliptical holes.

160. Yu. I. Kosterin (Yaroslavl), I. V. Kragel'skii (Moscow): Rheological phenomena in dry friction.

161. Yu. V. Krotov (Stalinsk): Lateral stability of coupled arches with double curvature.

162. A. I. Kuznetsov (Leningrad): On the theory of plane plastic stress.

163. V. M. Kukudzhanov, L. V. Nikitin (Moscow): Propagation of elastic, visco-plastic waves in bars.

164. T. D. Kupradze (Tbilisi): The investigation of contact problems in the theory of elasticity by the method of singular integral equations.

165. F. Ya. Landsberg (Moscow): The investigation of the deformations of drains on models by the X-ray method.

166. A. Langenbach (Berlin): Application of the non-linear variational principle to some problems of the theory of elastic-plastic strains.

167. S. M. Levi (Moscow): The investigation of rheological properties of gelatin solutions.

SHIKHOBALOV, S.P., otv.red.; GUTMAN, S.G., red.; KACHANOV, L.M., red.; KRASNOV, V.M., red.; MAKSUTOVA, T.D., red.; PRIGOROVSKIY, N.I., red.; PROSHKO, V.M., red.; ROZANOV, N.S., red.; EDEL'SHTEYN, Ye.I., red.; SHCHERBAKOVA, Ye.V., red.; VODOLAGINA, S.D., tekhn.red.

[Polarization optical method for stress analysis; proceedings of the conference of February 13-21, 1958] Poliarizatsionno-opticheskii metod issledovaniia napriashenii; trudy konferentsii 13-21 fevralia 1958 goda. Leningrad, Izd-vo Leningr.univ., 1960. 450 p. (MIRA 13:6)

(Strains and stresses) (Optical measurements)

PHASE I BOOK EXPLOITATION SOV/4494

Kachanov, Lazar' Markovich

Teoriya polzuchesti (Theory of Creep) Moscow, Fizmatgiz, 1960. 455 p. 6,500 copies printed.

Ed.: G.I. Fel'dman; Tech. Ye. A. Yermakova.

PURPOSE: This book is intended for technical personnel, engineers and designers concerned with metallic creep.

COVERAGE: The author gives an account of the basic theory of creep of metals. He examines creep according to the comparatively simple scheme of quasi-viscous flow. Considerable space is alloted to the working out of simple approximate solutions of problems which, according to the author, are of immediate practical interest. Along with the solutions the author gives graphs, examples, and instructions for applying the methods of calculation. Recognition is given to V.I. Rozenblyum, A.N. Grubin, and G.V. Ivanov for help in compiling the book. There are 159 references: 85 Soviet, 68 English, 5 German, and 1 French.

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KACHANOV, L.M. (Leningrad)

Rupture time under creep conditions. Izv.AN SSSR. Otd.tekh.nauk.Mekh.i mashinostr. no.5:88-92 S-O '60. (MIRA 13:9)
(Creep of materials)

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AUTHOR: Kachanov, L.M., (Leningrad)

TITLE: Creep of a Thin Layer Compressed by Rigid Plates

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh nauk, Mekhanika i mashinostroyeniye, 1960, No. 6, pp. 138-140

TEXT: The paper is a continuation of previous work (Ref.2). The well known Prandtl solution (see e.g. Ref.1) of the problem of the flow of an ideally plastic layer compressed by rough, rigid plates forms the basis of a number of methods for the approximate calculation of the compression of a plastic layer. The present note derives a solution of the creep problem for a thin layer compressed by rigid rough plates at sufficiently high pressures. Under plane deformation conditions the deformation velocity $\xi_z = 0$ and the flow occurs in the xy plane; the layer occupies the region $x > 0$, $|y| \leq h$; and each of the plates moves into the layer with velocity c. On the basis of the Coulomb law, the shear stress τ_{xy} at the surface of contact is given by:

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$$\tau_{xy}\big|_{y=\pm h} = \pm k \tag{1.1}$$

where k is the yield value, and for slow flow the differential equation of equilibrium is:

$$\frac{\partial\sigma_x}{\partial x} + \frac{\partial\tau_{xy}}{\partial y} = 0, \qquad \frac{\partial\tau_{xy}}{\partial x} + \frac{\partial\sigma_y}{\partial y} = 0 \tag{1.2}$$

The relation of steady creep is taken in the form:

$$\xi_x = f(T^2)(\sigma_x - \sigma), \quad \xi_y = f(T^2)(\sigma_y - \sigma), \quad \eta_{xy} = 2f(T^2)\tau_{xy} \tag{1.3}$$

The deformation velocities ξ_x, ξ_y, η_{xy} are connected with the velocities v_x, v_y by the known formulae:

$$\xi_x = \partial v_x/\partial x, \quad \xi_y = \partial v_y/\partial y, \quad \eta_{xy} = (\partial v_x/\partial y) + (\partial v_y/\partial x) \tag{1.4}$$

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E081/E135

Creep of a Thin Layer Compressed By Rigid Plates

and the equation of incompressibility is $\xi_x + \xi_y = 0$. As in the Prandtl solution, it is assumed that $\tau_{xy} = k\eta$, $\sigma_y = \psi(\xi)$, where $\xi = x/h$, $\eta = y/h$, and $\psi(\xi)$ is the function to be found. These assumptions, together with Eq.(1.3), lead to:

$$f\left(\frac{1}{4}s^2 + k^2\eta^2\right) = \frac{2c}{s} \qquad (2.8)$$

in which $s = \sigma_x - \sigma_y$. The roots s_* of this equation are determined numerically or graphically. We obtain finally:

$$\sigma_y = -k\xi - \int_0^1 s_*(k\eta, c)\,d\eta; \quad \sigma_x = \sigma_y + s_*(k|\eta|, c)$$

The equations show that with increasing velocity c, the roots s_* increase and the contact pressure also increases. If the creep law is linear, s_* does not depend on η.
There are 2 Soviet references.
SUBMITTED: June 6, 1960

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B125/B204

AUTHOR: Kachanov, L. M. (Leningrad)

TITLE: Solving the problem of non-steady creeping

PERIODICAL: Prikladnaya matematika i mekhanika, v. 25, no. 1, 1961, 162-163

TEXT: The present report describes a method of determining more exact solutions (i.e. more exact than the first approximation) of the problems mentioned in the title. P. S. Kuratov and V. I. Rozenblvum (Ref. 1) recently investigated (Ref. 1) a numerical method of solving such problems. Still earlier, the author of the present paper suggested a simple approximation method, which is based upon determining the minimum of the additional power $\Lambda + \frac{\partial \Pi}{\Pi t}$ = min of the body in the form $\sigma_{ij} = \sigma_{ij}' + \tau(t)(\sigma_{ij}'' - \sigma_{ij}') = \sigma_{ij}^{(o)}$ (i,j = 1,2,3) (2). (Λ - the additional spread of the body, Π - the elastic potential energy of the body, t - time, σ_{ij} - the components of the stress, σ_{ij}', σ_{ij}'' - the components of the stress in the elastic problem and in the problem of steady creeping X

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respectively). The function $\tau(t)$ increases monotonously and tends towards unity with $t \rightarrow \infty$. The solution (2) is essentially a first approximation. The present article describes, as already mentioned, the determination of more exact solutions. The solution of the problem $\Lambda + \frac{\partial \Pi}{\partial t}$ is set up in the form $\sigma_{ij} = \sigma_{ij}^{(o)} + \sum_{k=1,2,\dots} c_k(t)\sigma_{ij}^{(k)}$ (3). $\sigma_{ij}^{(k)}$ here denotes the particular solutions of the homogeneous differential equations of equilibrium, which satisfy the zero-boundary conditions on S_F, $c_k = c_k(t)$. In this case, any functions of time are concerned. The solution $\sigma_{ij}^{(o)}$ is best separated, because it is a good approximation. The additional power of the body is now a function of τ and c_k, and the necessary conditions for the minimum lead to a system of differential equations $B(t)\frac{\partial \Lambda_1}{\partial c_i} + \frac{\partial^2 \Pi}{\partial \tau \partial c_i}\frac{d\tau}{dt} + \sum_{k=1,2..} \frac{\partial^2 \Pi}{\partial c_i \partial c_k}\frac{dc_k}{dt} = 0$ $(t=1,2,\dots)$ (4). The curves of creeping are here assumed to be similar, and then $\Lambda = B(t)\Lambda_1$

holds, where Λ_1 is a function of the stresses alone. The initial conditions for c_k are $c_k = 0$ with $t = 0$. The second derivations in the equations (4) are constant, and for the determinant $\Delta = \left|\frac{\partial^2 \Pi}{\partial c_i \partial c_k}\right| > 0$ holds. If the condition just given holds, the system (4) may always be brought to the normal form $\frac{dc_i}{dt} = -\frac{1}{\Delta}\sum_{k=1,2,\dots} \Delta_{ik}\left[B(t)\frac{\partial \Lambda_1}{\partial c_k} + \frac{\partial^2 \Pi}{\partial \tau \partial c_k}\frac{d\tau}{dt}\right]$ $(i = 1,2,\dots)$ (7), where Δ_{ik} is the algebraic complement of the corresponding element of the determinant Δ. If the solution of the variation equation $\delta\Lambda_1 = 0$ is set up in the form (3), the values $\tau = 1$, $c_i = 0$, $(i = 1,2,\dots)$ correspond to the exact solution, and here $\frac{\partial \Lambda_1}{\partial c_i} = 0$, $\delta^2\Lambda_1 = \sum_{i,j=1,2,\dots} \frac{\partial^2 \Lambda_1}{\partial c_i \partial c_j}\delta c_i \delta c_j > 0$ (9) holds. For $\sigma_{ij} = \sigma_{ij}''$, the additional deviation from Λ_1, according to considera-

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Solving the problem of...

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tions made by R. Khill [abstracter's note: probably Hill], attains the absolute minimum, and the solution given here is unique. Finally, the behavior of the functions $c_k(t)$ in the case of high values of t are considered. The additional spread of the body is limited, and also the stresses in a sufficiently large volume are limited. Also the functions $c_k(t)$ may be assumed to be limited. The equation (7) in integral form reads

$$-\int_0^{c_i} \Big(\sum_{k=1,2,..} \Delta_{ik} \Big[B(t)\frac{\partial\Lambda_1}{\partial c_k} + \frac{\partial^2 \Pi}{\pi \partial c_k} \frac{d\tau}{dt} \Big] \Big)^{-1} dc_i = \frac{1}{\Delta} \int_0^t dt \quad (i=1,2,\ldots) \quad (10).$$

System (9) is best numerically or graphically solved by means of the Euler method. The method discussed may easily be applied to relaxation problems, mixed problems, to non-uniformly heated bodies, to cases with lacking similarity of creep curves, and to elastic-plastic deformations. There are 4 Soviet-bloc references.

SUBMITTED: October 8, 1960

Card 4/4

KACHANOV, L.M.

Note to L.M.Kachanov's article "Creep of a thin layer compressed by rigid plates." Izv.AN SSSR.Otd.tekh.nauk.Mekh.i mashinostr. no.2: 172 Mr-Ap '61. (MIRA 14:4)

(Creep of materials)

KACHANOV, L.M. (Leningrad)

Kinetics of the growth of cracks. Prikl. mat. i mekh. 25 no.3:498-502 My-Je '61. (MIRA 14:7)
(Strength of materials)

KACHANOV, L.M.

Example of the solution of the problem of elastoplastic torsion by means of the variational method. Issl.po uprug.i plast. no.1:157-161 '61. (MIRA 15:2)

(Torsion)

DIKOVICH, Igor' Leonidovich; KACHANOV, L.M., prof., doktor fiz.-mat. nauk, retsenzent; FILIN, A.P., prof., doktor tekhn. nauk, retsenzent; NOVOZHILOV, V.V., red.; KUSKOVA, A.I., red.; SHISHKOVA, L.M., tekhn. red.

[Dynamics of elastoplastic beams]Dinamika uprugo-plasticheskikh balok. Leningrad, Sudpromgiz, 1962. 291 p. (MIRA 15:10)

(Beams and girders)

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S/179/62/000/005/003/012
E031/E135

AUTHOR: Kachanov, L.M. (Leningrad)

TITLE: On the stressed state of a plastic filling

PERIODICAL: Akademiya nauk SSSR. Izvestiya. Otdeleniye tekhnicheskikh nauk. Mekhanika i mashinostroyeniye, no.5, 1962, 63-67

TEXT: The problem of the tension of an axisymmetric filling was studied in earlier work of the author. In this paper the flow of a plastic filling in conditions of plane deformation under tension (and compression) and the problem of strengthening are considered. The filling is assumed to be thin and joining two sufficiently rigid parts which have approximately the same moduli of elasticity as the filler, but considerably higher yield point values. If a moderate force is applied per unit length perpendicular to the sandwich construction, all the joints will suffer elastic deformation. It is assumed that the surfaces of contact between the filling and the outer layers remain plane. An approximate solution is sought for the stress on the surface of the filling. An expression is derived relating the mean stress p

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to the parameter

$$C = -\frac{1}{2}\frac{v''(\delta)}{v'(\delta)}$$

where v is the displacement in the axial direction and δ is the ratio of the thickness of the filling to its width. For C = 0, corresponding to the onset of plastic flow, p = 2k (k - yield point). For small C the tangential stress distribution is nearly linear. As C tends to infinity the tangential stress tends to the constant value k. This corresponds to the boundary conditions of the layer for which the Prandtl solutions were obtained. For $C \rightarrow \infty$ the derived formulae yield the well known Prandtl equations. The normal stress component has a maximum value on the axis of the filling. The relation between this maximum value and p is depicted graphically. To examine the effect of strengthening the material it is assumed that for tangential stresses $T \leqslant k$ the material is elastic but that for $T \geqslant k$ a linear strengthening applies, i.e. for $T \leq k$, $T = G\Gamma$ and for $T \geqslant k$, $T = A + B\Gamma$, where Γ is the intensity of the shear deformation and G is the shear modulus. The resulting

On the stressed state of a plastic.. S/179/62/000/005/003/012
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changes in the various expressions previously derived are considered. As B tends to G, C tends to zero. As C tends to C' = (G/B - 1) 6δ, p/2k tends to infinity. With strengthening there is no limiting load, the quantity p/2k being bounded only by the strength.
There are 5 figures.

SUBMITTED: June 20, 1962

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Kachanov, L. M.

PHASE I BOOK EXPLOITATION SOV/6201

Vsesoyuznyy s"yezd po teoreticheskoy i prikladnoy mekhanike. 1st, Moscow, 1960.

Trudy Vsesoyuznogo s"yezda po teoreticheskoy i prikladnoy mekhanike, 27 yanvarya -- 3 fevralya 1960 g. Obzornyye doklady (Transactions of the All-Union Congress on Theoretical and Applied Mechanics, 27 January to 3 February 1960. Summary Reports). Moscow, Izd-vo AN SSSR, 1962. 467 p. 3000 copies printed.

Sponsoring Agency: Akademiya nauk SSSR. Natsional'nyy komitet SSSR po teoreticheskoy i prikladnoy mekhanike.

Editorial Board: L. I. Sedov, Chairman; V. V. Sokolovskiy, Deputy Chairman; G. S. Shapiro, Scientific Secretary; G. Yu. Dzhanelidze, S. V. Kalinin, L. G. Loytsyanskiy, A. I. Lur'ye, G. K. Mikhaylov, G. I. Petrov, and V. V. Rumyantsev; Resp. Ed.: L. I. Sedov; Ed. of Publishing House: A. G. Chakhirev; Tech. Ed.: R. A. Zamarayeva.

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(25)

PURPOSE: This book is intended for scientific and engineering personnel who are interested in recent work in theoretical and applied mechanics.

COVERAGE: The articles included in these transactions are arranged by general subject matter under the following heads: general and applied mechanics (5 papers), fluid mechanics (10 papers), and the mechanics of rigid bodies (8 papers). Besides the organizational personnel of the congress, no personalities are mentioned. Six of the papers in the present collection have no references; the remaining 17 contain approximately 1400 references in Russian, Ukrainian, English, German, Czechoslovak, Rumanian, French, Italian, and Dutch.

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AVAILABLE: Library of Congress

SUBJECT: Physics

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KACHANOV, L.M. (Leningrad)

Stressed state of a plastic interlayer. Izv.AN SSSR. Otd.tekh.nauk.Mekh. i mashinostr. no.5:63-67 S-O '62. (MIRA 15:10)
(Deformations (Mechanics))

GRIGORYAN, S.S.; GRIB, A.A.; ZVOLINSKIY, N.V.; KACHANOV, L.M.; PETROSHEN, G.I.

E.I.Shemiakin's article "Expansion of a gas cavity on a noncompressible elastoplastic medium; study of the action of an explosion on the ground" and N.S.Medvedeva and E.I.Shemiakin's article "Strain waves caused by underground explosion in rocks. Izv.AN SSSR.Otd.tekh.nauk. Mekh.i mashinostr. no.5:173-177 S-O '62. (MIRA 15:10)
(Explosions) (Shemiakin, E.I.) (Medvedva, N.S.)

Kachanov, L. M. (Prof)

Analytical Methods of Creep Design, Especially Within the Nonlinear Range.

THIRD SYMPOSIUM ON NAVAL STRUCTURAL MECHANICS

INTERNATIONAL CONFERENCE ON ELEVATED TEMPERATURE MECHANICS

NEW YORK, N, Y,

First Day: January 23, 1963

KACHANOV, L.M. (Leningrad)

Shear and compression of a thin plastic layer. Izv. AN SSSR Otd. tekh. nauk. Mekh. i mashinostr. no.2:172-173 Mr-Ap '63. (MIRA 16:6)

(Plasticity)

KACHANOV, L.M.

Kinetic theory of the increase of cracks. Issl. po uprug. i plast. no.2:66-73 '63. (MIRA 16:8)

(Deformations (Mechanics))

KACHANOV, L.M. (Leningrad)

Creep of a thin layer subjected to compression and bending. Izv. AN SSSR. Mekh. i mashinostr. no.4:86-91 Jl-Ag '63. (MIRA 17:4)

KACHANOV, L.M. (Leningrad)

"Variational methods in the theory of plasticity"

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

ACCESSION NR: AT4034319 S/2753/64/000/003/0052/0061

AUTHOR: Kachanov, L. M.

TITLE: Bending of an elastic-plastic lamina

SOURCE: Leningrad. Universitet. Matematiko-mekhanicheskiy fakul'tet. Issledovaniya po uprugosti i plastichnosti, no. 3, 1964, 52-61

TOPIC TAGS: lamina, elastic lamina, plastic lamina, lamina bending, bending stress, planar deformation, laminar fastening

ABSTRACT: The author calls attention to the fact that the stress state of thin plastic laminas, used in the fastening of rigid parts, is distinguished by a number of specific features of great practical importance. After noting in passing that the problem of the elongation (compression) of the thin lamina has been studied elsewhere, the author takes up the question of bending in the present article. Specifically, he considers the problem of the bending of a soft plastic lamina under conditions of planar strain (deformation). It is assumed that the lamina is thin; that is, $\delta = \frac{h}{L} \ll 1$. The twisting moment M is referred to unit length in the direction perpendicular to the plane of the drawing. The yield point of the lamina material k is, moreover, assumed to be

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ACCESSION NR: AT4034319

considerably lower than the yield point of the "rigid" parts, connected by the lamina. In his discussion, the author assumes the elastic properties of both parts to be identical and accepts the condition of incompressibility. The flow in the plastic zones is constricted by the contact surfaces. This is expressed in the origination of tangential stresses on the contact surfaces, since there is no slippage along the latter. Since the lamina is thin, the contact surfaces remain planar, while the section $\eta = 0$ remains in plane symmetry; the author therefore accepts the hypothesis of plane sections. The elastic kernel and plastic zones are considered and the corresponding equations are derived. The arbitrary constants ξ_1, c, d are determined from the conditions of stress continuity when $\xi = \xi_1$ and the condition of static equivalence of the stresses σ_y to the bending moment M. Particular cases in which q is equal to and greater than 1 are considered, and tabular results are given for the numerical solution of the pertinent complex transcendental equation. The author concludes with a brief discussion of the limiting state in the bending of the lamina. "The author takes the opportunity to express his gratitude to O. A. Baksh', whose initiative was responsible for this work, and to A. I. Kuznetsov for a number of valuable comments." Orig. art. has: 6 figures and 36 formulas.

Card 2/3

ACCESSION NR: AT4034323 S/2753/64/000/003/0225/0231

AUTHOR: Kachanov, L. M.

TITLE: Failure time under the influence of a liquid metal medium

SOURCE: Leningrad. Universitet. Matematiko-mekhanicheskiy fakul'tet. Issledovaniya po uprugosti i plastichnosti, no. 3, 1964, 225-231

TOPIC TAGS: metal fatigue, failure time, metal flux, molten metal medium, metallic heat carrier, metal diffusion, creep, corrosion, steel failure, metal injection

ABSTRACT: The author calls attention to the increased use, in recent years, of liquid-metal heat carriers, noting that molten fusible metals may exert a considerable effect on the strength of structural metals. The character of this interaction may vary. The present article deals with a strength analysis under creep conditions for metals which exhibit a sufficient degree of resistance to the effect of liquid-metal media so that the problem of interaction need not be considered. Particular attention is directed at the problem of the diffusion "removal" or "injection" of certain elements which have a substantial influence

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on the strength properties of the metals (e.g., lead penetration). It is pointed out that this process may change the creep characteristics and the long-term strength of the metal. Of less significance is the surface effect of the molten metal, this being, essentially, one of the froms of corrosion. In steels which are rather stable with respect to surface influences (fusion, adsorption), the long-term strength is frequently influenced primarily by the diffusion of certain elements. The transfer of these elements is related to their concentration gradient and, generally speaking, is a function of the stress state level. In the case of a liquid-metal environment, there is normally no perceptible dependence of the diffusion process on the stress state. This fact makes it possible to consider the phenomenon of diffusion separately from the stress field. The failure process, on the other hand, depends essentially on the stress state and on the element concentration level, which varies as a result of diffusion in the course of time. The author analyzes the problem of the failure of a circular rod (initial diameter 2a), extended by a force P. A solution is derived which permits the determination of the scale factor in the failure of rods of different diameters. Under identical physical conditions, this scale factor is shown to depend on the effect of the rod dimensions on the diffusion process. The fusion of the surface layer of the metal is stated by the author to be one of the forms of corrosion and to

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depend, in general, on the stress state level. However, in the case of a liquid-metal medium, there is no difference between the potentials of the metal and the medium, as a result of which there are also no electrochemical processes. Under these conditions the effect of the stress state on the fusion process is negligible. The process of brittle failure of a rod gradually fused in a liquid-metal medium is analyzed. Surface cracks are shown to have a considerable effect, on occasion, on the strength of a body. In order to describe this process, the author suggests a phenomenological scheme which leads to the derivation of a specific formula for the process of brittle failure. Thus, while in this article, for the sake of simplicity problems relating to the elongation of a rod have been considered, the author notes that a similar analysis might be made for different problems; for example, pipe strength, rod bending and twisting, etc. "The author expresses his thanks to A. V. Stanyukovich for his comments." Orig. art. has: 20 formulas and 1 diagram.

ASSOCIATION: Matematiko-mekhanicheskiy fakul'tet, Leningradskiy Universitet (Department of Mathematical Mechanics, Leningrad University.)

SUBMITTED: 00

ENCL: 00

SUB CODE: MM

NO REF SOV: 005

OTHER: 000

ACCESSION NR: AP4043890 S/0179/64/000/004/0063/0067

AUTHOR: Kachanov, L. M. (Leningrad)

TITLE: Creep of anisotropic solids

SOURCE: AN SSSR. Izvestiya. Mekhanika i mashinostroyeniye, no. 4, 1964, 63-67

TOPIC TAGS: metal creep, creep, plastic creep, anisotropic solid creep, anisotropic metal creep

ABSTRACT: Creep of anisotropic metals is considered, since the results are useful for solving problems concerning the creep of plastics. Anisotropic properties in relation to creep may be caused, for example, by rolling (or other plastic treatment methods), leading to changes of texture. While variations in texture have little effect on the coefficient of elasticity, the material remaining isotropic, they do affect strength and plastic properties. The established equation for residual creep of an isotropic solid is:

$$\xi_{ij} = \frac{\partial \Lambda}{\partial \sigma_{ij}} \quad (i, j = x, y, z) \tag{1}$$

When T is the intensity of tangential stress and Λ is the additional dissipation:

$$6T^2 = (\sigma_x - \sigma_y)^2 + (\sigma_y - \sigma_z)^2 + (\sigma_z - \sigma_x)^2 + 6(\tau_{xy}^2 + \tau_{yz}^2 + \tau_{zx}^2) = 6T_e^2 \tag{2}$$

ACCESSION NR: AP4043890

For an orthotropic solid, equation (2) is transformed into:

$$6T^2 = A_1(\sigma_x - \sigma_y)^2 + A_2(\sigma_y - \sigma_z)^2 + A_3(\sigma_z - \sigma_x)^2 + 6(A_{12}\tau_{xy}^2 + A_{23}\tau_{yz}^2 + A_{13}\tau_{xz}^2) \qquad (3)$$

When the main axes of stress coincide with the main axes of anisotropy, only the first three members remain in equation (3). The deformation rate is:

$$\xi_x = \frac{1}{3}\Lambda' [A_1(\sigma_x - \sigma_y) + A_3(\sigma_x - \sigma_z)], \qquad \eta_{xy} = 2\Lambda' A_{12}\tau_{xy} \qquad (4)$$

On the basis of the evolved equations the author, using his previously published equation, finds that

$$N = \int T H dV \qquad (5)$$

$$N = (m + 1)\Lambda^{m} = (\mu + 1)L^{\mu} \qquad (6)$$

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where N is the power of the given external forces. Irregular creep equations are then derived:

$$\left(\frac{1\varphi}{\Pi\theta} + V\right)\frac{\eta_{\theta\theta}}{\theta} = \eta_3 \qquad \int\left(\Lambda + \frac{\partial\Pi}{\partial t}\right)dV = \min \qquad (7)$$

The first of these shows the creep and the second shows the minimum additional dissipation. Sometimes the anisotropy is weak even with significant variation in the deformation rate. Equations for this case are also solved. An example is then given for a pipe under the influence of internal pressure. The radial velocity is found on the basis of noncompressibility:

$$v = \frac{C}{r} + \frac{1}{2}cr \qquad (8)$$

By transformations:

$$\sigma_r = \int_a^r \frac{R}{r}\,dr - p_1; \quad \sigma_\varphi = \sigma_r + R \qquad (9)$$

$$\int_a^b \frac{R}{r}\,dr - p = 0 \quad \text{spu } r = b \qquad (10)$$

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where P is the axial force on the pipe. These equations are solved either numerically or by using curves. If the axial force caused by pressure at the pipe bottom $P = p\pi a^2$, then, when $A_2 = A_3$, the rate of axial elongation c equals zero. Orig. art. has: 29 equations.

ASSOCIATION: none

SUBMITTED: 06Mar64 ENCL: 00

SUB CODE: MM, MT NO REF SOV: 002 OTHER: 003

Card 4/4

L 52543-65

ACCESSION NR: AP5010185 UR/0373/65/000/001/0050/0055

AUTHOR: Kachanov, L. M. (Leningrad)

TITLE: Creep at oscillating temperature and load

SOURCE: AN SSSR. Izvestiya. Mekhanika, no. 1, 1965, 50-55

TOPIC TAGS: temperature field, creep mechanism, variational calculus, ... method, ... distribution, ...

ABSTRACT: The creep mechanism in a stable metallic body under the action of a slowly v... load and in a variable temperature field was investigated analytically. ...rature field is denoted by $\theta = \theta_0 + \lambda\theta_1$ where θ_0 is the stationary field and $\theta_1 = \theta_1(x,y,z,t)$. The creep deformation rate is given by

$$\dot{\varepsilon}_{ij}^{c} = \frac{1}{2} B(\theta) f_1(T) s_{ij} \qquad \left(s_{ij} = \sigma_{ij} - \sigma\delta_{ij},\ T = \left(\frac{1}{2} s_{ij}s_{ij}\right)^{1/2}\right)$$

where $B(\theta) = B_* e^{c\theta}$. The secondary dissipation and the elastic potential are defined by

$$B(\theta)\int_0^T f_1(s)\, s\, ds \equiv B(\theta)\Lambda_1(T)$$

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ACCESSION NR: AP5010185

and

$$\Pi = \frac{3}{2} k\sigma^2 + \frac{1}{2G} T^2 \qquad \left(k = \frac{1-2\nu}{E}\right)$$

respoctively. These are incorporated into the creep equation which in the variational form is given by

$$\delta \int_V \left(\Lambda + \frac{\partial \Pi}{\partial t} + 3\alpha\sigma\lambda \frac{\partial \theta}{\partial t}\right) dV = 0$$

The general solution is expressed by the sum of a stationary stress σ^{0}_{ij} and the auxiliary stress tensor σ'_{ij}. The expression under the integral sign above is expanded in powers of λ up to three terms (i.e., up to λ^2). In this manner the auxiliary stress satisfies the variational equation

$$\delta \int_V \left[\frac{d\Lambda_0}{dT_0^2} T'^2 + \frac{1}{2} \frac{d^2\Lambda_0}{d(T_0^2)^2} N^2 + c\theta_1 \frac{d\Lambda_0}{dT_0^2} N + \frac{\partial \Pi'}{\partial t} + 3\alpha\sigma' \frac{\partial \theta_1}{\partial t}\right] dV = 0$$

The case of a fast and a slowly varying temperature field is discussed, and it is shown that for the latter case σ'_{ij} contains only the first two terms of the λ expansion. An approximate solution is proposed for the variational equation using the Ritz method. The problem is then extended to the case of a variable load F_n defined by

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$$F_n = F_{n0} + \lambda F_{n1} \sin \omega t$$

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The corresponding variational equation takes the form

$$\delta \int_{0}^{l} \left(\frac{dA_0}{dT_0^2} T^2 + \frac{1}{2} \frac{d^2 A_0}{d(T_0^2)^2} N^2 - \frac{\partial H}{\partial t} \right) dl = 0$$

The cases of high and low frequency loads are discussed briefly and solutions proposed. Orig. art. has: 27 equations.

ASSOCIATION: none

SUBMITTED: 23Jul64 ENCL: 00 SUB CODE: ME

NO REF SOV: 002 OTHER: 003

Card 3/3

BAKSHI, O.A.; KACHANOV, L.M.

Stressed state of a plastic interlayer in axisymmetric deformation. Izv. AN SSSR. Mekh. no.2:134-137 Mr-Ap '65.

(MIRA 18:6)

L 47310-66 EWT(d)/EWT(m)/EWP(w)/EWP(v)/EWP(k) IJP(c) WW/EM

ACC NR: AT6014514 SOURCE CODE: UR/2753/65/000/004/0065/0071

52
B

AUTHOR: Kachanov, L. M.

ORG: none

TITLE: Creep of momentless shells of revolution under large deformations

SOURCE: Leningrad. Universitet. Matematiko-mekhanicheskiy fakul'tet. Issledovaniya po uprugosti i plastichnosti, no. 4, 1965, 65-71

TOPIC TAGS: shell, shell of revolution, creep, creep rate, creep deformation, shell deformation, approximation method

ABSTRACT: The problem of large creep deformations of a thin momentless shell of revolution is studied under the effects of an internal pressure p and an axial force P. The values of p and P can, in general, vary with time. The stated problem is of interest for two reasons: 1) significant deformations sometimes occur during creep, and 2) analysis of large deformations is needed for determining the time of "viscous" failure. The problem is stated as follows: At an initial moment in time t = 0 the median surface of the shell is given by the equation

$$r = r_0(z) \quad (0 < z < z_{10}),$$

where r, z are cylindrical coordinates, and the initial thickness of the shell is given by $h_0 = h_0(z)$. At a time t the median surface is characterized by

$$r = r(z, t),$$

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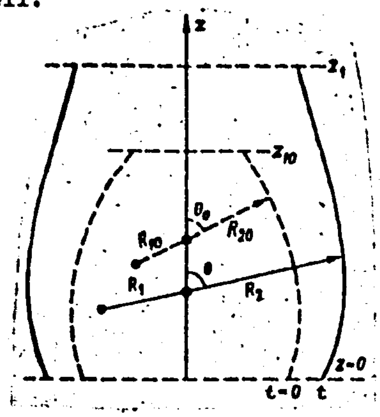
ACC NR: AT6014514

where z is bounded by $0 < z < z_1$. Figure 1 shows the coordinate relationships for the deformed and undeformed shell.

Fig. 1.



Denoting the meridianal and annular stresses as σ_1 and σ_2, the principal radii of curvature as R_1 and R_2, and the angle between the normal to the surface and the axis z as θ, the author states the equilibrium and differential geometry conditions

$$\frac{\sigma_1}{R_1} + \frac{\sigma_2}{R_2} = \frac{p}{h};$$

$$2\pi r_z h \sigma_1 \sin\theta = P,$$

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ACC NR: AT6014514

$$R_1 = -\frac{1}{r''}(1+r'^2)^{3/2};\ R_2 = r(1+r'^2)^{1/2};$$

$$\sin\theta = \frac{1}{\sqrt{1+r'^2}};\ \mathrm{ctg}\,\theta = r'.$$

An integral expression for the time to reach a particular state of deformation is derived. A "stepped" system of numerical integration may be used to solve this equation, or, in several cases, an approximate solution is obtainable from a variational equation of shell creep. Orig. art. has: 27 equations and 1 figure.

SUB CODE: 20/ SUBM DATE: 23Mar64/ ORIG REF: 004/ OTH REF: 001

Card 3/3 bdh

KACHANOV, N.F., inzh., red.; SHOPENSKIY, L.A., inzh., red.; IFTINKA, G.A., red.izd-va; MOCHALINA, Z.S., tekhn. red.

[Construction specifications and regulations] Stroitel'nye normy i pravila. Moskva, Gosstroiizdat. Pt.2. Sec.G. ch.8. [Hot-water supply; standards of design] Goriachee vodosnabzhenie; normy proektirovaniia (SNiP II-G. 8-62). 1963. 11 p. (MIRA 16:9)

1. Russia (1923- U.S.S.R.) Gosudarstvennyy komitet po delam stroitel'stva. 2. Gosudarstvennyy komitet Soveta Ministrov SSSR po delam stroitel'stva (for Kachanov). 3. Nauchno-issledovatel'skiy institut sanitarnoy tekhniki Akademii stroitel'stva i arkhitektury SSSR (for Shopenskiy).

(Hot-water supply)

KACHANOV, N.F., inzh.; SHOPENSKIY, L.A., inzh.

New standards for the design of hot-water supply. Vod.i san. tekh. no.4:32-34 Ap '63. (MIRA 16:4)
(Hot-water supply—Standards)

KOP'YEV, Sergey Fedotovich, prof., doktor tekhn. nauk; KACHANOV, Nikolay Filippovich, inzh.; ZAMYSHLYAYEVA, I.M., red.

[Principles of heat supply and ventilation] Osnovy teplogazosnabzheniia i ventiliatsii. Moskva, Stroiizdat, 1964. 227 p. (MIRA 17:8)

KACHANOV, N.F., inzh.; SHOPENSKIY, L.A.

Calculating the circulation pipelines of hot water supply systems in the direct supply of water from a heating network. Vod. i san. tekh. no.2:14-16 F '64 (MIRA 18:2)

KACHANOV, N. F., inzh., red. [illegible]

[Instruction on the selection of all-purpose centrifugal fans with A2 and AO2 electric motors for sanitary engineering systems] Instruktsiia po podboru tsentrobezhnykh ventiliatorov obshchego naznacheniia s elektrodvigateliami serii A2 i AO2 dlia sanitarno-tekhnicheskikh sistem. Moskva, No.2. 1965. 27 p. (MIRA 18:8)

1. Russia (1923- U.S.S.R.) Gosudarstvennyy komitet po delam stroitel'stva. Glavnoye upravleniye po stroitel'nomu proyektirovaniyu predpriyatiy, zdaniy i sooruzheniy.

KACHANOV, N. N.

Category : USSR/Solid State Physics - Structural crystallography E-3

Abs Jour : Ref Zhur - Fizika, No 1, 1957, No 1102

Author : Kachanov, N.N.

Title : Instrument for Mechanical Determination of the Setup Parameters of Backward-Photography X-Ray Cameras

Orig Pub : Zavod. laboratoriya, 1955, 21, No 2, 241-242

Abstract : No abstract

Card : 1/1

КАЧАНОВ Н.Н.

137-58-4-8525

Translation from: Referativnyy zhurnal, Metallurgiya, 1958 Nr 4, p 315 (USSR)

AUTHORS: Kachanov, N.N., Mirkin, L.I.

TITLE: X-ray Tubes for High-speed and Super-speed Photography and X-ray Research Procedures (Rentgenovskiye trubki dlya skorostnoy i sverkhskorostnoy s"yemki rentgenogramm v praktike rentgenostrukturnykh issledovaniy)

PERIODICAL: Tekhnol. avtomobilestroyeniya, 1957, Nr 5, pp 72-76

ABSTRACT: A survey. A brief description is presented of the design of Soviet and foreign sharp-focus tubes with punctuate and linear focus. The modes of operation of various parts for tubes with controllable focus, with magnetic focusing, with rotating plates, etc., are presented. It is noted that the use of sharp-focusing tubes permits exposure to be reduced by 98-98.4%. On pulse operation from batteries, exposure is reduced to 0.03-0.05 sec: this makes it possible to investigate fast-moving processes (structural changes in heating, impact stresses, etc.). Bibliography: 15 references.

V.Sh.

Card 1/1

1. X-ray tubes--Design 2. X-ray photography--Equipment 3. X-ray analysis--USSR

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SOV/123-59-12-47059

Translation from: Referativnyy zhurnal. Mashinostroyeniye, 1959, Nr 12, p 159 (USSR)

AUTHORS: Kachanov, N.N., Mirkin, L.I.

TITLE: X-ray Tubes for the High-speed and Superhigh-speed Taking of Roentgenograms in the Practice of X-ray Investigation

PERIODICAL: Tekhnol. avtomobilestroyeniye, 1957, Nr 5, pp 72-76

ABSTRACT: The authors describe sharp-focusing X-ray tubes (XT) with spot focus which make it possible to shorten considerably the time of exposure in carrying out X-ray analyses of metals and their alloys. Two versions of Soviet-made XT are mentioned, possessing an adjustable focus and a grounded cathode, with which focuses of very small dimensions can be obtained with a high specific load per surface unit of the anode. A description is also given of 2 XT with a trans-anode space, one of the XT possessing a magnetic focusing. Moreover an XT is described, with a particularly long and sharp line focus for investigating crystalline structures of monocrystalline specimens; with the aid of this tube convergent

Card 1/2

KACHANOV, N.N.

137-58-4-8519

Translation from: Referativnyy zhurnal, Metallurgiya, 1958, Nr 4, p 313 (USSR)

AUTHORS: Kachanov, N.N., Mirkin, L.I.

TITLE: An Ionization Method of X-ray Structural Analysis of Metals (Ionizatsionnyy metod dlya rentgenostrukturnogo analiza metallov)

PERIODICAL: Tekhnol. avtomobilestroyeniya, 1957, Nr 5, pp 76-79

ABSTRACT: An ionization method of recording X-ray radiation is described and comparison thereof with the photographic method is made. This method requires ionizing X-ray apparatus with an automatic recording arrangement. Ionizing X-ray apparatus have come into use in the investigation and inspection of materials used in the construction of machinery, phase analysis of metals and alloys, and also in the determination of residual stresses in metals. In studying the structure of the material, the level of accuracy is higher than by the photographic method, with a very pronounced reduction in the total time required for an investigation. This makes it possible to study transformations in alloys directly during the process of heat treatment or in the process of elastic and plastic deformation. Z.F.

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1. Metals--X-ray analysis 2. Metals--Phase studies 3. X-rays --Ionizing effects