Sedov, L.I.

X. Gas jets. While there are discussions of ordinary linearized compressible flow theory, the general tone is set by consideration of such topics as generalized Prandtl-Meyer flow; non-linearized examples of flows with vorticity; shocks, flame fronts, and condensation; and Chaplygin's method for gas jets. The material selected provides an excellent survey of Russian work in theoretical hydro- and aerodynamics, especially from 1930 to 1950. The book is frequently quoted by Russian authors and its wealth of examples and suggestive explanations must have provided stimulation and inspiration to numerous Russian students of fluid mechanics. *J. H. Giese.*

1-F\W

SEDOV, L. I.

*Sedov, L. I. Metody podobiya i razmernosti v mekhanike. [Similarity and dimensional methods in mechanics.] Gosudarstv. Izdat. Tekh.-Teor. Lit., Moscow, Leningrad, 1951. 193 pp. 10.20 rubles.

This is the second edition of a book published in 1944, but not previously reviewed in Math. Reviews. Intended primarily as an expository survey, the book is notable for the wealth of examples analyzed. Many of the discussions are based on previously published research of the author. Its scope is comparable with that of Chaps. III–IV of the reviewer's "Hydrodynamics: A study in logic, fact and similitude" [Princeton, 1950; these Rev. 12, 365] except that its inclusion of specific experimental data resembles more the exposition of H. L. Langhaar, "Dimensional analysis and theory of models" [Wiley, New York, 1951; these Rev. 12, 580]. Also, the relation of dimensional analysis to group theory is not treated.

Chapter I (30 pp.) is a conventional discussion of dimensional analysis, leading up to the II-theorem. Chapter II (67 pp.) deals with the influence of Reynolds number on pipe resistance (Stanton-Pannell) and on drag, with the influence of Reynolds and Mach number on compressible flow, with the Strouhal number, with the influence of the Froude number on planing and impact of seaplane hulls, with Wagner's discussion of similitude ("automodel" solutions) for cone and wedge impact, and with similitude for gravity waves. Chapter III (50 pp.) deals with viscosity and turbulence. First, he treats the diffusion of vortices, other exact solutions of the Navier-Stokes equations (which seem related to those of Hamel), Blasius' solution of the boundary layer equations. Then homogeneous turbulence is analyzed following the work of Millionščikov [Izvestiya Akad. Nauk SSSR. Ser. Geograf. Geofiz. 1941, 433–446; these Rev. 4, 121] and Kolmogoroff; this is followed by a brief discussion of turbulent flow in pipes, using "mixing length" concepts. Chapter IV (45 pp.), which was apparently added in the second edition, deals with the unsteady motion of gases. Emphasis is placed on the self-similar ("automodel") solutions of the author [C. R. (Doklady) Acad. Sci. URSS (N.S.) 47, 91–93 (1945); these Rev. 7, 140; Akad. Nauk SSSR. Prikl. Mat. Meh. 10, 241–250 (1946)]. The piston problem, spherical blast waves, detonation and burning, and atomic explosions are discussed, the last following G. I. Taylor [Proc. Roy. Soc. London. Ser. A. 201, 175–186

USSR/Physics - Hydrodynamics, Motion of a Gas — 1 Aug 52

"General Theory of the One-Dimensional Motions of a Gas," L.I. Sedov, Corr Mem Acad Sci USSR

"Dok Ak Nauk SSSR" Vol 85, No 4, pp 723-726

Points out several general relationships for one-dimensional motions of a gas, which can be utilized particularly in the construction of approx methods of solving various problems and in the establishment of several asymptotic laws. Considers the one-dimensional nonstationary motions of an ideal gas by means of familiar

227T71

hydrodynamical eqs and solves in integral form, in which the integrand is expressed as in infinite series and hence integrated. Submitted 7 Apr 52.

K obshchey teoriy odnomernykh dvizheniy gaza

227T71

SEDOV, L. I.

SEDOV, L. I.

USSR/Mathematics - Obituary Jul/Aug 52

"Main Data on the Life and Deeds of L. S. Leybenzon (26 June 1879 - 15 March 1952)," L. I. Sedov

"Uspekh Matemat Nauk" Vol VII, No 4 (50), pp 127-134

Report was read by L. I. Sedov at a joint session of the Moscow Math Soc and Sci Council of the Mech-Math Faculty, Moscow State U along with the Dept of Tech Sci, Acad Sci USSR, held 22 Mar 52. Leybenzon was born at Khar'kov; father was on the Med Faculty of Khar'kov U; expert on plasticity theory and pedagogy. Long suffered from infarcts and cardiac asthma.

225T60

SEDOV, L. I.

"Influence of Viscosity and Thermal Conduction on the Flow of Gas Behind a Strongly Warped Shock Wave," by L. I. Sedov, M. P. Mikhaylova, and G. G. Chernyy, Chair of Hydromechanics, Moscow Univerisyt. Vest Mosk Un., Ser. Fizikomat i Yest Nauk, No 3, pp 95-100, Mar 53.

State that during circulation of supersonic flow of gas around small-sized bodies with the formation of the main shock wave, one can expect that the considerable velocity and temp gradients behind it, arising in consequence of the great curvature of the shock wave, now require that greater attention be paid to the influence, mainly on discontinuities (jumps), of those terms in the relations that depend on the gas viscosity and heat conductivity. Attempts to evaluate such influence in the case of symmetrical circulation of the supersonic flow of gas around a body of revolution or profile with the formation of the main shock wave ahead of the body.

257T90

SEDOV, L. I.

USSR/Physics - Models Jul 53

"Modeling, Dimensional Analysis, and Similitude," L. I. Sedov, Corr Mem Acad Sci USSR

Priroda, No 7, pp 13-21

Discusses elements contained in his book "Methods of Similitude and Dimensions in Mechanics" (Metody Podobiya i Razmernosti v Mekhanike), Gostekhizdat, 1951. States that Professors N. N. Davidenko and G. I. Pokorovskiy initiated the idea of centrifuges in modeling, and that Academician A. A. Mikulin is studying the problem of the best rational dimensions for engines and hydraulic machinery. Claims that from the standpoint of specific weight of engine, consumption of critical material, and use of productive forces it is more convenient to construct several small engines than one large one.

SEDOV, L. I.,

"The Effect of Viscosity and Heat Conduction on the flow of Gas Behind a Strongly Curved Shock Wave," Vestnik Moskovskogo Universiteta, Seriya Fiziko-Matematicheskikh i Estestvennykh Nauk, 1953. Vol. 8, Nr 2, pp 95-100, with Mikhaylova, M. P., and Chernyi, G. G.,

SEDOV, L. I.

Applied Mechanics Reviews, Vol. 7 Mar. 1954 Compressible Flow, Gas Dynamics

854. Sedov, L. I., Integration of equations for unidimensional flow of gas (in Russian), Dokladi Akad. Nauk SSSR (N.S.) 90, 5, p. 735, 1953.

A particular solution is given of the full inviscid equations for unsteady radially symmetric flow (e.g., plane, cylindrical, or spherical). The solution involves four constants and a function that may be chosen arbitrarily and represents "progressing waves" similar to those discussed by Courant-Friedrichs ["Supersonic flow and shock waves," p. 419]. M. D. Van Dyke, USA

8-10 54-LL-CA

SEDOV, L.I.; MARKUZON, I.A. redaktor; GAVRILOV, S.S., tekhnicheskiy redaktor.

[Methods of similitudes and dimensional analysis in mechanics] Metody podobiia i razmernosti v mekhanike. Izd. 3-e, perer. i dop. Moskva, Gos. izd-vo tekhniko-teoret. lit-ry, 1954. 328 p. (Dimensional analysis) (MLRA 8:1)

SEDOV, L.I.

Sedov, L. I. On theoretical formulas for the stellar laws "[illegible]osity" and "mass-radius." Doklady Akad. Nauk SSSR (N.S.) 94, 643–646 (1954). (Russian) nD4

Under somewhat more general assumptions regarding the laws satisfied by the rate of generation of energy and the coefficient of opacity than those adopted by Strömgren [Handbuch der Astrophysik, Bd 7, Springer, Berlin, 1936, p. 159] a corresponding mass-luminosity-radius formula is derived by means of a dimensional analysis.

R. G. Langebartel (Urbana, Ill.).

8C

O teoreticheskikh formulakh dlya zvezdnykh zakonomernostei "svetimost' - massa" i "radius - massa"

SEDOV, L.I.

Sedov, L. I. Theoretical gas dynamics in the Moscow University. Vestnik Moskov. Univ. 10, no. 4-5, 85-99 (1955). (Russian)

1 - F/W

V
62

Tecreticheskaya gazovaya dinamika v Moskovskom universitete

SEDOV, L.I., akademik

[Program in hydromechanics and aeromechanics; for the Mechanics-Mathematics Faculty. Major: mechanical engineering] Programma po gidroaeromekhanike; dlia mekhaniko-matematicheskogo fakul'teta. Spetsial'nost' - mekhanika. 1956. 3 p. (MIRA 11:3)

1. Moscow. Universitet.
(Fluid mechanics--Strudy and teaching)

SOV/124-57-4-3830

Translation from: Referativnyy zhurnal. Mekhanika, 1957, Nr 4, p 3 (USSR)

AUTHOR: Sedov, L. I.

TITLE: Similarity Methods in the Nonlinear Mechanics of a Continuous Medium (Metody podobiya v nelineynoy mekhanike sploshnoy sredy)

PERIODICAL: Tr. 3-go Vses. matem. s"yezda. Vol 1. Moscow, AN SSSR, 1956, p 212

ABSTRACT: Bibliographic entry

Card 1/1

SEDOV, L. Acad.

"Jet Propulsion Conference," New Times, No.12, 15 March 1956

SEDOV, L.I.; NIKITIN, K.A.

International Conference on Rocket Engines. Vest.AN SSSR 26 no.6: 104-106 Je '56. (MLRA 9:9)
(Rockets (Aeronautics))

SEDOV, L.I.

"Examples of Gas Motion and Certain Hypotheses on the Mechanism of Stellar Outburst," 2 p.
paper presented at Third Symposium on Cosmical Gas Dynamics, Cambridge, (Mass.), 24 - 29 June 1957.

Trans. Available
B-3,101,240, 1 Apr 58

CARD 1 / 2 PA - 1932

SUBJECT USSR / PHYSICS
AUTHOR SEDOV,L.I.
TITLE On the Gas Motions on the Occasion of Star Explosions.
PERIODICAL Dokl.Akad.Nauk 111, fasc.4, 780-782 (1956)
Issued: 1 / 1957

The problems connected with phenomena to be observed in variable stars must be investigated and solved in consideration of the mechanic effects of gas dynamics. Observations have above all shown that on the occasion of the flashing up of novae and supernovae radial gas motions with velocities of the orders 1000 to 6000 km/sec occur. The following problem first arises on this occasion: What is it we observe ? Is it the front edge of the expanding star surface or the front of a shock which expands in the comparatively cold fog which surrounds the star ? The most probable hypothesis is that of the expansion of the star after the fashion of a sphere of gas in a vacuum (or in a very thin atmosphere). When investigating the explosions preceding the star explosions and causing the explosions, those detonation phenomena must be investigated which are connected with the existence of"jumps" (= compression shocks ?). The latter expand within the gas masses of the stars and transport a considerable amount of energy on to the star surface.
The author investigated the adiabatic automodellike, explosionlike and spherically symmetric motion. According to the solutions found for $\gamma = 5/3$ a cavity forms in the center of the star, within which pressure is different from zero ("expanding spherical piston"). For $\omega = 1,4$; 2 and 2,5 (where

Dokl. Akad. Nauk, 111, fasc. 4, 780-782 (1956) CARD 2 / 2 PA - 1932

$\varrho_0 = A/r^{\omega}$ denotes the initial density while A and ω are constants) constant conditions r^*/r_2 and p^*/p_2 were found. Here r^* denotes the radius of the piston, r_2 - the radius of the shock wave, p^* - the pressure on the piston, p_2 - the pressure on the shock wave. At $\omega = 1,4$ and 2 the work transferred from the piston to the gas was of the same order as the initial energy of the gas behind the shock wave. This caused doubts as to the physical reality of such models.

In the case of $\gamma = 4/3$ and at $\omega = 2,5$ the author obtained solutions with finite initial energy and finite energy of the disturbed motion. On this occasion cavities form in the center of the star in the case of strong shock waves with the pressure zero, but in the case of weak shock waves no cavities are formed. The spherically symmetric gas motion is also investigated without taking the forces of gravitation into account at the variable initial density of $\varrho_0 = A/r^{\omega}$. This investigation shows possible ways and means of producing high pressures and temperatures. (According to the reviewer's opinion these and similar works are connected with the intended excitation of thermonuclear reactions).

INSTITUTION:

SEDOV, Leonid Ivanovich; MEL'NIKOVA, N.S., redaktor; AKHLAMOV, S.N., tekhnicheskiy redaktor.

[Methods of similitudes and dimensional analysis in mechanics] Metody podobiia i razmernosti v mekhanike. Izd.4-oe, perer.i dop. Moskva, Gos.izd-vo tekhniko-teoret.lit-ry, 1957. 375 p. (MIRA 10:11)

(Dimensional analysis)

Name : SEDOV, L. I.

Title : Academician

Affiliation: Chairman, Standing Interdepartmental Commission on Coordination and Control of Scientific-Theoretical Work in the Preparation and Execution of Space Flights, USSR Academy of Sciences

Remarks: Academician Sedov in his article, "The Artificial Earth Satellite", refers to the launching of the Soviet ICBM (announced 26 August 1957), and the sending up of the first artificial earth satellite on 4 October 1957. These events, he states, are a forerunner to planned attempts to send a rocket to the moon, as well as to orbit the moon with a rocket which will return to earth.

Source : P: Neue Zeit (Moskva), No. 41, 10 October 1957, pp. 11-12

AUTHOR: SEDOV, L.I. PA - 2090

TITLE: On the Dynamic Destruction of Equilibrium. (Russian)

PERIODICAL: Doklady Akademii Nauk SSSR, 1957, Vol 112, Nr 2, pp 211-212 (U.S.S.R.)

Received: 3 / 1957 Reviewed: 3 / 1957

ABSTRACT: The present work investigates the motion of a perfect gas which corresponds to equilibrium and has not become steady, in consideration of the interior forces of gravity. This paper furnishes an exact solution of the nonlinear equations of motion and of the conditions of equilibrium. Here the distribution of density and of pressure represents the initial state for the non-steady explosion-like motion of a gas (in a gas which is at rest and in equilibrium) which is created and develops in the resting gas without giving up energy. The phenomenon [illegible] steadiness of a mechanical nature, which may be used for the explanation of some effects in variable stars. The equations of the onedimensional unsteady motion of gas with spherical symmetry are written down as follows:

$$\partial M/\partial r = 4\pi r^2 \rho; \quad \partial \rho/\partial t + \partial \rho v/\partial r + 2\rho v/r = 0;$$

$$\partial v/\partial t + v(\partial v/\partial r) + (1/\rho)\partial p/\partial r + fM/r^2 = 0; \quad \partial(p/\rho^\gamma)/\partial t + v\partial(p/\rho^\gamma)/\partial r = 0.$$

Card 1/3

On the Dynamic Destruction of Equilibrium. (Russian)

Denotations are as usual: f here denotes the gravitation constant, and γ - the deflection constant (?). A resting gas is investigated here in which the state characteristics are determined by the following equations. The aforementioned formulae determine the solution of the above equations in the case of any positive value of the constant A. The aforementioned laws of equilibrium also satisfy the equations for the energy balance and for the radiation transfer in consideration of some particular properties of the coefficients characterizing energy absorption and energy deposition. On the front of the shock wave which propagates with the velocity c in the resting gas, the following equations are obtained:

$$M_2 = M_1, \quad \varrho_2 = \frac{\gamma+1}{\gamma-1}\varrho_1\left(1 + \frac{2}{\gamma-1}\frac{a_1^2}{c^2}\right)^{-1}, \quad v_2 = \frac{2}{\gamma+1}c\left(1-\frac{a_1^2}{c^2}\right)$$

$$p_2 = \frac{2\gamma}{\gamma+1}\, p_1 \frac{c^2}{a_1^2}\left(1 - \frac{\gamma-1}{2\gamma}\frac{a_1^2}{c^2}\right).$$ Here it holds that

$a_1^2 = \gamma\, p_1/\varrho_1$. The equations mentioned first have the

Card 2/3

PA - 2090

On the Dynamic Destruction of Equilibrium. (Russian)

following particular exact solution:

$M = (2/9)r^3/ft^2$; $\varrho = 1/6\pi ft^2$; $v = (2/3)r/t$; $p = (K/f)(1/t^2)^\gamma$

Next it is shown that a gas which is at rest may pass over into the motion characterized by the last-mentioned equations by the formation of a shock wave. Formulae for the law of motion of the shock wave are given.

ASSOCIATION: Not given
PRESENTED BY:
Submitted:
AVAILABLE: Library of Congress

Card 3/3

SEDOV, L. I.

O dinamicheskom vzryve ravnovesiya (On dynamic balanced detonation) Doklady AN SSSR, Vol. 112, No. 2, pp. 398-9, 1957

SOV/124-58-1-21

Translation from: Referativnyy zhurnal, Mekhanika, 1958, Nr 1, p 3 (USSR)

AUTHOR: Sedov, L. I.

TITLE: Problem of Cosmic Flying (Problemy kosmicheskikh poletov)

PERIODICAL: Gaz. "Pravda," June 12, 1957, Nr 163, p 6

ABSTRACT: Bibliographic entry

Card 1/1

SEDOV, L. I. (Academician)

"Dynamic Effects in the Movement of Artificail Earth Satellites."

paper presented at the Assembly of the IGY Special Committtee, Moscow, Aug 1958

SEDOV, Leonid [1.]

"Some Contributions of Mixed Problems in Trans-Sonic Flight."

paper presented at the 1st Intl. Congress of Aeronautical Sciences, 8-13 Sept 1958, Madrid, Spain.

S/124/62/000/004/001/030
D251/D301

3 9300

AUTHOR: Sedov, L. I.

TITLE: Dynamic effects in the motion of artifical earth satellites

PERIODICAL: Referativnyy zhurnal, Mekhanika, no. 4, 1962, 8, abstract 4A40 (V sb. Iskusstv. sputniki Zemli, no. 2, M., AN SSSR, 1958, 3-9)

TEXT: This is a survey and analysis of the results of an investigation into the effects of compression anomalies of the force of gravity, the atmosphere and the electromagnetic field of the earth on the motion of artificial satellites. Given are a table of the values of the parameters of motion of the first, second and third Soviet earth satellites for the beginning of the motion (the period of revolution around the earth, the minimum height, maximum height, inclination, mean diurnal motion of the point of acsension, the variation in longitude of the point of ascension, the distance of the perigee from this point and its period after 24 hours) and

Card 1/2

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D251/D301

Dynamic effects in ...

graphs illustrating the variation of the period, of the height of the perigee and of the height of the apogee in dependence on the number of revolutions of the satellite. A method is given of determining the density of the earth's atmosphere by observing the evolution of the satellite's orbit. The value of the density ρ_{π} on the latitude of the perigee is obtained as equal to 3×10^{-13} - 4×10^{-13} g/cm^2 (for h = 225 km) which agrees with the value obtained in the results of rocket measurements. 9 references. [Abstracter's note: Complete translation.]

Card 2/2

SEDOV, Leonid I.

"The Orbits of Cosmic Rockets Toward the Moon."

report presented at the 14th Annual Meeting of American Rocket Society, 16-20 Nov 1959, Wash., D.C.

YANKE, Ye.; EMDE, F.; SEDOV, L.I. [translator]; TOLSTOVA, D.V. [translator]; BRONSHTEYN, I.N., red.; GAVRILOV, S.S., tekhn.red.

[Tables of functions with formulas and curves] Tablitsy funktsii s formulami i krivymi. Izd.3. Moskva, Gos.izd-vo fiziko-matem. lit-ry, 1959. 420 p. Translated from the German. (MIRA 13:3) (Functions)

SOV/4282

PHASE I BOOK EXPLOITATION

Akademiya nauk SSSR

Iskusstvennyye sputniki zemli, vyp. 5 (Artificial Earth Satellites, No. 5) Moscow, Izd-vo AN SSSR, 73 p. Errata slip inserted. 7,000 copies printed.

Resp. Ed.: L. V. Kurnosova; Ed. of Publishing House: M. I. Fradkin; Tech. Ed.: O. M. Gus'kova.

PURPOSE: The booklet is intended for scientists and engineering and scientific personnel working in the field of space travel and satellite flight.

COVERAGE: The collection of 10 articles deals with problems of satellite orbits, magnetic measurements, radiation, the visibility of space vehicles, the upper atmosphere, and meteoric substances. No personalities are mentioned. References accompany some of the articles.

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Artificial Earth Satellites (Cont.) SOV/4282

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SEDOV, L.

Dynamic effects of the motion of the earth satellites. Tr. from the Russian. p. 65

Bulgarska akademiia na naukite. Fizicheski institut. FIZIKO-MATEMATICHESKO SPISANIE. Sofia, Bulgaria. Vol. 2, no. 2, 1959 Bulgaria.

Monthly Lists of East European Accessions (EEAI), LC, Vol. 8, no. 11, Nov. 1959 Uncl.

Name : SEDOV, L. I.

Title : Academician, USSR Academy of Sciences.

Remarks : L. I. SEDOV is the author of an article entitled "The Flying Laboratory".

Source : M: Stantsii v Kosmose (Stations in Outer Space), a collection of articles, published by the USSR Academy of Sciences, Moskva, 1960, with foreword by Academicians A. N. Nesmeyanov and A. V. Topchiyev, p. 66.

95 10

Name : SEDOV, L. I.

Title : Academician, USSR Academy of Sciences.

Remarks : L. I. SEDOV is the author of an article entitled "The Flight to Mars is Becoming Real".

Source : M: Stantsii v Kosmose (Stations in Outer Space), a collection of articles, published by the USSR Academy of Sciences, Moskva, 1960, with foreword by Academicians A. N. Nesmeyanov and A. V. Topchiyev, p. 234.

78 10

SEDOV, L. I. (Moscow)

"On the Theory of Construction of Mechanical Models for the Representation of Physical Situations in the Domain of Continuous Media."

report presented at the First All-Union Congress on Theoretical and Applied Mechanics , Moscow, 27 Jan - 3 Feb 1960.

S/030/60/000/007/004/011
B016/B058

AUTHOR: Sedov, L. I., Academician

TITLE: On the Theory of the Design of Mechanical Models of Solid Media

PERIODICAL: Vestnik Akademii nauk SSSR, 1960, No. 7, pp. 26-28

TEXT: The paper under abstraction deals with general methodic problems of the mechanics of solid media by the example of an elastic body in which physicochemical processes are taking place. The author discusses the scientific and technical necessity of developing mathematical models with complicated physicochemical properties. With respect to the theory of finite deformations he notes that the geometrical problems are certainly solved, but the kinetic and dynamic problems require further development. The representation of solid media by differential equations is discussed. An explicit representation of the characteristic quantities and the basic laws is considered to be necessary. The system of equations should contain no functions pertaining to the antecedents of the process. In consideration of temperature effects, chemical reactions, phase

transformations, and polymerization, the generally valid equations I - IV expressing the correlation between inner energy, free energy, temperature, and enthalpy are derived for the model of an elastic body which is exposed to finite deformations. Additional equations are necessary for irreversible processes. The necessity of conformance between the mathematical model and the real body to be investigated is pointed out. New models of solid media are necessary for the investigation of such properties as plasticity, residual deformation, solidification, plastic anisotropy, creeping, and relaxation. For this purpose, general statistical and thermodynamic considerations are to be applied to a greater extent than has so far been done. There are 2 Soviet references.

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VB

SEDOV, L.I.; KRASOVSKIY, V.I.

Congress on Astronautics in Stockholm. Vest.AN SSSR no.12:45-46 D '60. (MIRA 13:12)

(Astronautics—Congresses)

83141

H/016/60/010/008/003/003
B009/B057

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AUTHOR: Sedov, L. I.

TITLE: On the Trajectories of Moon Rockets

PERIODICAL: Fizikai Szemle, 1960, Vol. 10, No. 8, pp. 241-245

TEXT: The paper is a translation by Abonyi, Iván from the Russian original published in Acta Astronautica, 1960. For particular points of the northern hemisphere, optimum launching conditions are determined in first approximation considering the gravitational force of the earth only. Hitting the moon is considered first. From the solution of the two-body problem the relationship $V^2/V_n^2 = f(\vartheta, \Phi)$ is derived, where V is the initial velocity, V_n the path velocity, ϑ the launching angle, and Φ the angular distance. Figure 2 shows this relationship for different values of constant Φ. Optimum timing, associated with maximum payload, corresponds to Φ_{max}. For points on the northern hemisphere, Φ_{max} corresponds to the deepest position of the moon below the equatorial plane. The full rocket

Card 1/3

On the Trajectories of Moon Rockets

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B009/B057

power at the start having been prescribed, the possible payload and the ballistic conditions of launching around the most suitable day are determined. For the northern hemisphere, this corresponds to the minimum inclination of the moon at the instant of maximum approach. Characteristics of the trajectories the medium path of which leads to the center of the moon: 1) Near the moon, in close neighborhood of the central trajectory considered as a straight line, up to about a distance of 20,000 km from the moon the trajectories form a system which is rotation-symmetrical with regard to the central trajectory. 2) In the vicinity of the moon, the trajectories approximate conic sections in meridional planes. For the latter, the relationship of $\varrho_{min} = f(\lambda)$ is deduced, where ϱ_{min} is the shortest distance of the trajectory from the center of the moon. On this basis, two multitudes of trajectories are represented by polar coordinates (λ, ω) in Fig. 3. Angle ω determines the meridional planes of the trajectories. This system was used for the determination of the automatic interplanetary station, for which the following values were found: ϱ_{min} = 7,900 km, apogee 480,000 km, perigee 47,500 km (the latter at the first revolution). A circumlunar orbiting at a distance of 40,000-100,000 km

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On the Trajectories of Moon Rockets

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B009/B057

has the trend of an ellipse, one focus of which is the earth. Such a trajectory, starting from the northern hemisphere and having circled the moon, would fall below the equator and make it impossible for the Soviet Union to observe the rocket. For observation and radio reception, a trajectory would be expedient as would approach the moon as close as 5,000-20,000 km, with a perigee at 40,000 km and an apogee at 500,000 km, with the rocket returning toward the earth above the higher latitudes of the northern hemisphere. Launching should take place at about new moon to allow for picture-taking of the far side of the moon. The trajectory of the third cosmic rocket was chosen on this basis. Finally, data on the trajectories of the three Soviet cosmic rockets are summed up. There are 4 figures.

4

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Sedov, L. I.

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C 111/ C 333

AUTHOR: Sedov, L. J. (Moscow)

16

TITLE: The Notions of Different Rates of Acceleration of Tensors

PERIODICAL: Prikladnaya matematika i mekhanika, 1960, Vol. 24, No. 3, pp. 393-398

TEXT: The present contribution is a detailed representation of the discussion contribution of the author to the lecture of Prager "On the elementary definition of stress velocities", given in January 1960 in Moscow on the First All-Union Congress on theoretic and applied mechanics. In arbitrary curvilinear coordinate systems the internal connection between the different definitions of tensor velocities is established. The author introduces tensor velocities which are of essential importance and have not been mentioned by Prager. He proves that the intuitive considerations of Prager, who recommends the definition of the tensor velocity due to Jaumann (Ref.3) in the theory of plastic and viscoelastic bodies, are not sufficient in order to determine the notion of velocity of the stress tensor. The author gives additional considerations which are to lead to rules in the ranges

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The Notions of Different Rates of Acceleration of Tensors

of application according to which the different possible tensor derivatives are to be applied.

The author mentions V. D. Bonder, Aspirant.

There are 6 references: 1 Soviet, 2 German, 1 English and 2 American.

SUBMITTED: March 15, 1960

Card 2/2

SEDOV, L.I., akademik

Conference on mechanics; interview with Academician L.I. Sedov. (MIRA 13:6)
Nauka i zhizn' 27 no.3:25 Mr '60.
(Mechanics--Congresses)

S/030/60/000/011/002/026
B021/B059

AUTHOR: Sedov, L. I., Academician

TITLE: The Development of Cosmic Research in the USSR

PERIODICAL: Vestnik Akademii nauk SSSR, 1960, No. 11, pp. 10-14

TEXT: In the present article the author reports on the development of space flight and of space research in the USSR. On October 4, 1957, the first artificial Earth satellite, 83.6 kg, was launched, the second, with 508 kg of useful load and the dog Layka, on November 3, 1957. The third Soviet satellite with a useful load of 1327 kg was launched into orbit on May 15, 1958. In about two years it revolved about the Earth for more than 10,000 times. On January 2, 1959 the first space rocket, weighing 1472 kg without fuel, with a space velocity of 11.2 km/sec, was started. After 1.5 days it became the first solar satellite. On September 12, 1959, the second space rocket whose final stage weighed 1511 kg was set off and, according to calculation, hit the moon's surface 1.5 days later. On October 4, 1959, the third space rocket was started. The weight of its final stage was 1553 kg, without fuel. This rocket launched an automatic interplanetary station into orbit, which photographed the far side of the moon from a

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distance of 6200 km and radio-transmitted the photographs to the Earth. Various formations on the far side of the moon were discovered and named by a special commission of the Akademiya nauk SSSR (Academy of Sciences USSR). On May 15 and August 19, 1960 heavy satellites weighing 4.5 tons each and with hermetic cabins for the flight of a man were launched. In that case the difficult problem of return to the Earth was practically solved; two dogs and other animals and plants were safely carried back to the Earth. By means of artificial terrestrial satellites and space rockets, important data on the physical consistency of the upper atmospheric strata, their density, temperature, composition, electric and magnetic properties can be obtained. Radiation belts of the Earth were discovered and investigated, and the absence of a lunar magnetic field was detected. Danger of a collision with large meteors does practically not exist. Danger of various radiations for organisms in space has been investigated. Wireless connection over several millions of kilometers offers considerable difficulties. The development of space flight is important in the struggle for peace since it excludes the possibility of a war. There is a trend to advance the international relations among scientists of all countries. Moreover, it is stated that K. E. Tsiolkovskiy, a pioneer of rocket engineering, was not recognized in his lifetime by the official staff of

scientists. Further successes in astronomy, physics, and biology are closely related to space research.

SEDOV, Leonid Ivanovich; GOL'DENBERG, G.S., red.; YERMAKOV, M.S., tekhn. red.

[Fundamental principles of the mechanics of a continuum] Ob osnovnykh printsipakh mekhaniki sploshnoi sredy; publichnaia lektsiia, prochitannaia v Aktovom zale MGU 4 ianvaria 1961 g. Moskva, Izd-vo Mosk. univ., 1961. 25 p. (MIRA 14:8)
(Mechanics, Analytic)

S/763/61/000/000/012/013

AUTHOR: Sedov, L. I.

TITLE: On fundamental conceptions of the mechanics of a continuous medium.

SOURCE: Nekotoryye problemy matematiki i mekhaniki. Novosibirsk, Izd-vo Sib. otd. AN SSSR, 1961, 227-235.

TEXT: This survey encompasses the requirements of further scientific processes in the science of the physico-mechanical phenomena occurring in continuous media. Few models are needed to provide the necessary tools for the description of important effects that concern the interaction of the motions of media in the presence of physico-chemical and thermal processes: (1) The theory of the motion of a plasma; characteristic conditions: The presence of powerful magnetic fields and elevated temperatures. Methods are required for the study of the motion of a plasma with due account for the physico-chemical transformations and radiation. (2) Problems of the motion of highly rarefied gases. Rarefied gases may be regarded as continuous media, but with properties that are at variance with those assumed in the classical problems of aerodynamics and gasdynamics. (3) The motion of solid, liquid, and gaseous bodies with phase transformations and chemical reactions. A theory is required for the consideration of irreversible processes for the instance in which tangential stresses obtain. This type of problem also includes important

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questions on the motion of liquid suspensions, emulsions, and the cavitation problem. (4) The theory of plasticity. (5) The theory of creep. (6) The problem of mechanical models for polymers. This little-developed field, apparently, requires the use of the general concepts of the nonlinear theory of elasticity under finite deformation and the use of the theories of plasticity and creep. (7) The mechanics of sand and other soils, comprising also subterranean hydrodynamics or gas dynamics relative to a porous medium. There are no figures or references.

LAVRENT'YEV, M.A., otv.red.; MIKHAYLOV, G.K., red.; BITSADZE, A.V., red.; VEKUA, I.N., red.; DZHANELIDZE, G.Yu., red.; LUR'YE, A.I., red.; MANDZHAVIDZE, G.F., red.; MIKHAYLOV, G.K., red.; SEDOV, L.I., red.; SOBOLEV, S.L., red.; SOKOLOVSKIY, V.V., red.; KHRISTIANOVICH, S.A., red.; SHERMAN, D.I., red.; RYVKIN, A.Z., red.izd-va; VOLKOVA, V.V., tekhn.red.

[Problems in the mechanics of solids] Problemy mekhaniki sploshnoi sredy; k semidesiatiletiiu akademika N.I.Muskhelishvili. Moskva, 1961. 577 p. (MIRA 14:3)

1. Akademiya nauk SSSR.
(Mechanics, Analytic) (Elastic solids)

SEDOV, L.I., akademik

Fact surpasses fancy. Vest. Vozd. Fl. no.9:58-59 S '61.
(MIRA 14:11)

1. Prezident mezhdunarodnoy astronavticheskoy federatsii.
(Astronautics)

SEDOV, L.I., akademik

Space and scientific progress; International Congress of Astronautics in Stockholm. Priroda 50 no.1:84-86 Ja '61. (MIRA 14:1)

1. President Mezhdunarodnoy astronavticheskoy delegatsii Kongresse v Stokgol'me.
(Astronautics—Congresses)

SEDOV, L. I.

"The State-of-the-art of the Space Efforts in the World Today."

report presented at the 4th Intl. Symposium on Space Technology and Science, Tokyo, Japan, 27-31 Aug 1962.

PHASE I BOOK EXPLOITATION SOV/6099

Sedov, Leonid Ivanovich

Vvedeniye v mekhaniku sploshnoy sredy (Introduction to the Mechanics of a Continuum). Moscow, Fizmatgiz, 1962. 284 p. 8000 copies printed.

Ed.: N. S. Mel'nikova; Tech. Ed.: K. F. Brudno.

PURPOSE: This book is intended for scientific personnel, as well as for graduate students engaged in the theoretical study of continuum mechanics.

COVERAGE: The book is based on special lectures given by the author at Moscow State University in 1955-1958. The main object of the investigation was to arrive at a correct statement of problems pertaining to the motion of a continuum. Theoretical means, basic concepts, and principles used for constructing the physicomathematical models for the study of motion of a material continuum are outlined. Theories developed in this work exclude the assumption of geometrical smallness of the deformation of particles of a continuum. The proposed interpretation of geometric and kinematic characteristics of motion with

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Introduction to the Mechanics of a Continuum

finite deformation with respect to form and quality contains certain innovations. Some examples of classic models of gaseous, liquid, and solid continua, already in use, as well as some new ones, are examined. In particular, a model of a continuum for a plastic body is examined. There are 96 references: 43 Soviet , 40 English, 8 German, and 5 French.

TABLE OF CONTENTS:

Sedov, L. I.

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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)

Transactions of the All-Union Congress (Cont.) SOV/6201

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.

TABLE OF CONTENTS:

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KELDYSH, M.; SEDOV, L., akademik

Earth, space, earth. Nauka i zhyttia 12 no.9:2-4 S '62. (MIRA 16:1)

1. Prezident AN SSSR (for Keldysh). (Astronautics)

S/020/62/142/001/008/021
B104/B102

24.4200 (1103, 1327)

AUTHORS: Sedov, L. I., Academician, and Eglit, M. E.

TITLE: The design of nonholonomic models of continua with allowance for the finiteness of the deformations and for some physicomechanical effects

PERIODICAL: Akademiya nauk SSSR. Doklady, v. 142, no. 1, 1962; 54-57

TEXT: Models of a continuum are developed within the nonlinear theory of finite deformations. These models permit the investigation of the liberation and absorption of heat during the deformation of a body, of the effect of temperature on the mechanical properties of bodies, etc. The states of small elements and the corresponding thermodynamic functions in this model are described by the tensor ε_{ij} of the finite deformations, by the temperature T, by $\chi(\xi^i, t)$, ξ^i being cyclic coordinates, and by the stress tensor $\sigma^{ij} = p^{if}/\varrho$. After formulating the first and second laws of thermodynamics, the nonholonomic relation

$$d\sigma^{ij} = A^{ij}d\chi + B^{ij}dT + A^{ij\alpha\beta}de_{\alpha\beta}, \qquad (11)$$

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The design of nonholonomic ...

is set up, where $d\chi$, dT, and $d\varepsilon_{\alpha\beta}$ are assumed to be linearly independent of one another, and where the tensor components B^{ij} and A^{ij} are functions of the above-mentioned four parameters. The generalizations of the equations of state of the common theory of elasticity

$$\frac{\partial F}{\partial \sigma^{ij}} A^{ij\alpha\beta} + \frac{\partial F}{\partial \varepsilon_{\alpha\beta}} - \sigma^{\alpha\beta} = 0 \quad (\alpha, \beta = 1, 2, 3); \qquad \frac{\partial F}{\partial \sigma^{ij}} B^{ij} + \frac{\partial F}{\partial T} + S = 0 \qquad (12)\text{-}(13)$$

and of the kinetic equation

$$\frac{\partial F}{\partial \chi} + \frac{\partial F}{\partial \sigma^{ij}} A^{ij} = -\varkappa \frac{d\chi}{dt}. \qquad (14)$$

for determining χ are set up. S and F are the entropy and free energy per unit of mass. The equation of the second law of thermodynamics, the relations (11) and (14), the dynamic equations, the deformation tensor, and the equation of continuity form a closed system of equations describing the

The design of nonholonomic ...

mechanical, thermal, and physical processes for continua. The system differs from those obtained by other authors in that the laws of thermodynamics and the free energy are allowed for. Finally, an isotropic body is investigated in short. There are 8 references: 2 Soviet and 6 non-Soviet. The three references to English-language publications read as follows: C. Truesdell, J. Rat. Mech. Analysis, 4, 83 (1955); W. Noll, J. Rat. Mech. Analysis, 4, 3 (1955); Bernstein Barry, Arch. Ration. Mech. Analysis, 6, no. 2, 89 (1960).

SUBMITTED: December 12, 1961

Card 3/3

L 10761-63 EWT(d)/FCC(w)/BDS--AFFTC/APGC--IJP(G)

ACCESSION NR: AP3003235 S/0040/63/027/003/0393/0417

54
53

AUTHOR: Lokhin, V. V.; (Moscow); Sedov, L. I. (Moscow)

TITLE: Nonlinear tensor functions of several tensor arguments

SOURCE: Prikladnaya matematika i mekhanika, v. 27, no. 3, 1963, 393-417

TOPIC TAGS: nonlinear tensor functions, functions of tensor arguments, construction of tensor functions, symmetry groups, textures and crystals, syngony of crystals

ABSTRACT: By applying similarity and dimensional analysis, methods are developed for automatic determination of properties of linear and nonlinear systems from their characteristic parameters. Two basic problems are solved: a) it is shown that properties of textures and crystals can be defined by means of tensors, and b) general expressions are established for arbitrary-rank tensors considered as functions of a number of scalars and of several

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independent tensors. It is shown that for the construction of tensor functions it is necessary and sufficient to use the complete system of functionally independent compatible invariants formed of the vector components defining the symmetry groups and of other tensor arguments. For the solution of these problems the authors present the general concepts of tensors, tensor bases, and tensor functions. The tensor is represented by the formula:

$$H = \sum_{s=1}^{p} k_s H_s, \qquad (1)$$

where k_s are scalars and H_s are tensors of rank r. The methods of constructing general formulas of form (1) for tensor functions are derived on the basis of constructing the tensor base in terms of tensor arguments by means of multiplication and convolution operations. The pecularities of symmetry groups of constructed tensor functions are analyzed. With the formulas derived, tensors defining the geometric symmetry of textures and crystals are studied. Simple systems of tensors defining the properties of 7 types of textures and 32 classes of crystals as well as the formulas for their determination are presented in tables. Tensors defining the symmetry group of the cubic, tetragonal,

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ACCESSION NR: AP3003235

hexagonal, trigonal, rhombic, monoclinic, and triclinic syngonies are presented, and their properties are analyzed. General formulas are derived for components of the second, third, and fourth rank tensor functions of tensor arguments characterizing the geometrical properties of textures and crystals. Tensor functions for textures and crystals with additional tensor arguments are also considered. "The authors thank Yu. A. Sirotov for his valuable advice in crystallography." Orig. art. has: 42 formulas and 1 table.

ASSOCIATION: none

SUBMITTED: 28Feb63 DATE ACQ: 23Jul63 ENCL: 00

SUB CODE: 00 NO REF SOV: 017 OTHER: 014

Card 3/3

S/020/63/149/004/005/025
B104/B186

AUTHORS: Sedov, L. I., Academician, Lokhin, V. V.

TITLE: Description with tensors of the point groups of symmetry

PERIODICAL: Akademiya nauk SSSR. Doklady, v. 149, no. 4, 1963, 796 -797

TEXT: It is indicated that the geometric characteristics of the symmetry of textures or crystals may be given completely and uniquely by a small set of simple tensors. This assumption can be proved by showing that the demand of invariant properties of the tensor basis is equal with the problem of a system of transformation matrices defining the given group of symmetry. Denotations and definitions of the basis tensors illustrating the symmetry of textures and of 32 classes of crystals given in a voluminous table may be used for the construction of general formulas expressing the dependence of scalars and tensors on a series of scalar and tensor quantities whereby the geometric properties of symmetry are taken into account. These formulas can be considered as a generalization of the Hamilton-Kely formula. There is 1 figure.

SUBMITTED: - February 7, 1963

Card 1/1

SEDOV, L.I. (Moscow)

"On teaching of mechanics of continua"

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

MUSKHELISHVILI, N.I., red.; SEDOV, L.I., red.; MIKHAYLOV, G.K., red.

[Transactions of the International Symposium on Applications of the Theory of Functions in Continuum Mechanics] Trudy Mezhdunarodnogo simpoziuma prilozheniia teorii funktsii v mekhanike sploshnoi sredy. Moskva, Nauka. Vol.2. 1965. 476 p. (MIRA 18:11)

1. International Symposium on Applications of the Theory of Functions in Continuum Mechanics, Tiflis. 1963.

SEDOV, L. I.

"Effect of astronautics on education in engineering science with special reference to fluid mechanics."

"Theoretical mechanics."

reports submitted for 15th Intl Astronautical Cong, Warsaw, 7-12 Sep 64.

SEDOV, L. I.

"Some problems of designing new models of continuum media."

report submitted for 11th Intl Cong of Theoretical & Applied Mechanics & General Assembly, Munich, 30 Aug-5 Sep 64.

SEDOV, Leonid Ivanovich, akademik; GUS'KOV, G.G., red.izd-va; GUSEVA, A.P., tekhn. red.

[Galileo and the fundamentals of mechanics; on the 400 anniversary of his birth] Galilei i osnovy mekhaniki; k 400-letiiu so dnia rozhdeniia. Moskva, Izd-vo "Nauka," 1964. 39 p. (MIRA 17:3)

KELDYSH, Mstislav Vsevolodovich; SEDOV, Leonid Ivanovich

[Application of the theory of functions of a complex variable to hydrodynamics and aerodynamics; review of some works of the Moscow school] Prilozheniia teorii funktsii kompleksnogo peremennogo k gidrodinamike i aerodinamike; obzor nekotorykh rabot Moskovskoi shkoly. Moskva, Izd-vo "Nauka," 1964. 45 p. (MIRA 17:5)

L 17792-65 EEO-2/EWG(j)/EWT(d)/FBD/FSF(h)/FSS-2/EWG(r)/EWT(l)/EWA(m)/EWA(c)
FS(v)-3/EWP(w)/EEC(k)-2/EEC(f)/EWG(v)/EWP(v)/EWG(a)/EWP(t)/EWG(c)/EWA(h)/FS(b)
Po-4/Pd-1/Pe-5/Pq-4/Pac-4/Pf-4/Pae-2/Peb/Pi-4/Pb-4 BSD/ASD(a)-5/AFMDC/SSD/
AMD/AFTC(a)/AFETR/APGC(f)/ESD(c)/ESD(dp)/ESD(gs)/ESD(si) JKT/TT/DD/EM/GW
ACCESSION NR: AP5000617 S/0029/64/000/011/0021/0021

AUTHOR: Sedov, L. I. (Academician) B

TITLE: Orbiting space institute

SOURCE: Tekhnika - molodezhi, no. 11, 1964, 21

TOPIC TAGS: orbital spacecraft, space station, orbital space institute, orbital platform, multipassenger spacecraft

ABSTRACT: According to Academician Sedov, the Voskhod spaceship's successful flight has shown that interplanetary flights with large crews are becoming feasible. The most immediate task, however, is to establish an orbital station, i. e., a numerously staffed space (research) institute. The orbital space institute could also serve as a platform for organizing future extensive space flights.

ASSOCIATION: none

SUBMITTED: 00 ENCL: 00 SUB CODE: SV

NO REF SOV: 000 OTHER: 000 ATD PRESS: 3153

Card 1/1

SIEDOW, Leonid, [Sedov, Leonid], prof. dr

Mechanics as a basis of contemporary engineering. Problemy 20 no. 6: 322-328 '64.

1. Member of the Academy of Sciences U.S.S.R., M. Lomonosov Univeristy, Moscow.

SEDOV, L.I., akademik; KRASOVSKIY, V.A., kand.fiz.-matem.nauk

Fourteenth Congress of the International Astronautical Federation (IAF). Vest. AN SSSR 34 no.3:120-121 Mr '64. (MIRA 17:4)

L 3526-66 EWT(1)/EWP(m)/EWA(d)/ECS(k)/EWA(1)
AM5013298 BOOK EXPLOITATION UR/
533.601.11 38
37
B71

Sedov, Leonid Ivanovich

Methods of similitude and dimensions in mechanics (Metody podobiya i razmernosti v mekhanike) 5th ed. [rev, and enl.] Moscow, Izd-vo "Nauka", 1965. 386 p. illus., indices. 7500 copies printed.

TOPIC TAGS: similarity theory, similarity method, dimensional analysis, turbulent flow, fluid dynamics, unsteady gas flow

PURPOSE AND COVERAGE: This book is the fifth edition of Sedov's well known work on similarity theory and dimensional analysis. The fourth edition of the book has been translated into English. (Similarity and dimensional methods in mechanics, translated by Morris Friedman, edited by Maurice Holt. New York, Academic Press, 1954.) The fifth edition contains additions and improvements, also citations of previously published works, particularly the book Teoriya tochechnogo vzryva (Theory of point explosions) by V. P. Korobeynikov and others.

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AM5013298

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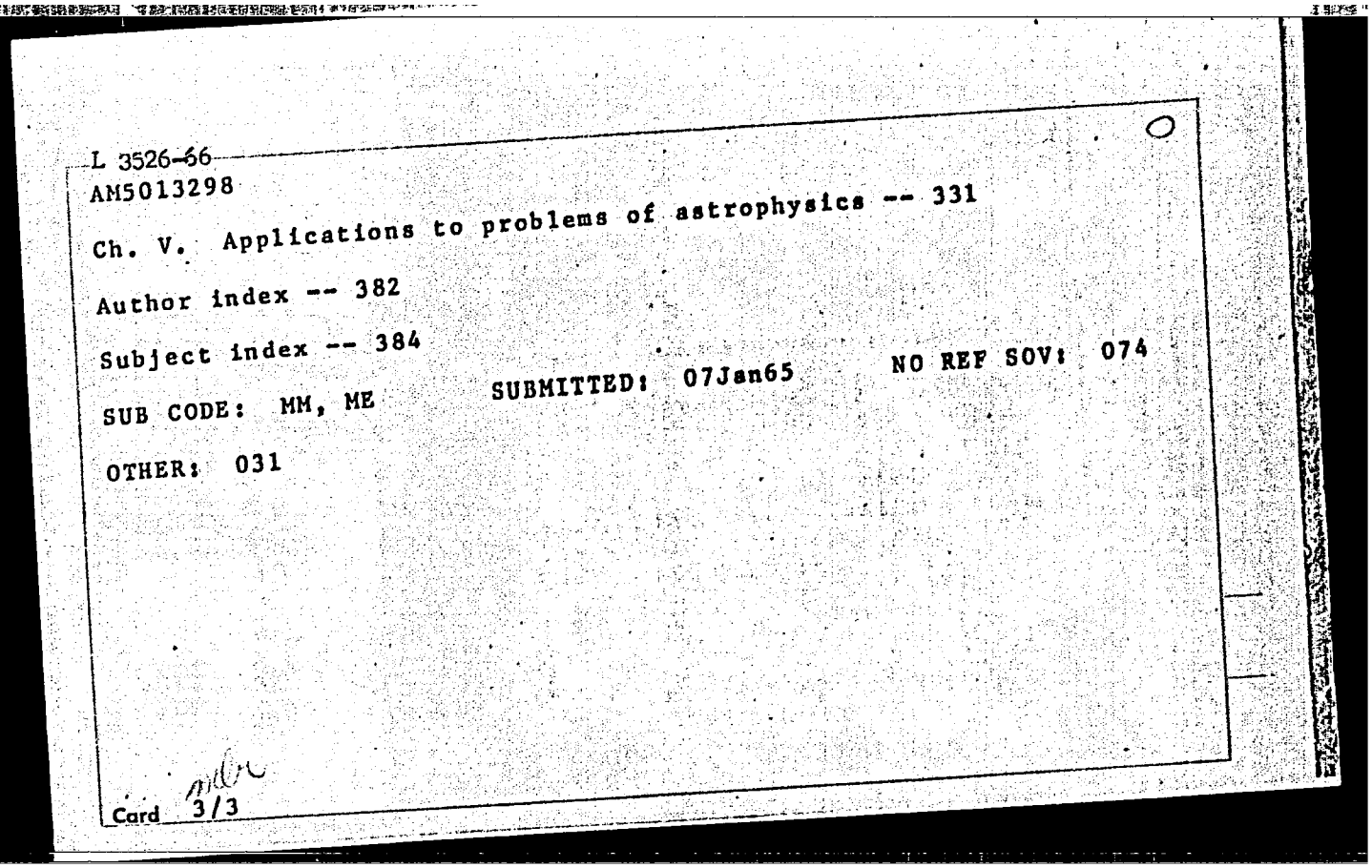

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AM5013298

Ch. V. Applications to problems of astrophysics -- 331

Author index -- 382

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SUB CODE: MM, ME SUBMITTED: 07Jan65 NO REF SOV: 074

OTHER: 031

Card 3/3

SEDOV, L.I.; STEPANOV, G.Yu.

Reviews. Izv. AN SSSR.Mekh. no.4:186-187 Jl-Ag '65.
(MIRA 18:12)

L 22674-66 EWT(d)/T/EWP(1) LJP(c)
ACC NR: AP6004660 SOURCE CODE: UR/0042/65/020/005/0121/0180

AUTHOR: Sedov, L. I.

ORG: none

TITLE: Mathematical methods for constructing new models of continuous media [Basic results of this paper were reported at a session of the Moscow Mathematical Society, 8 December 1964]

SOURCE: Uspekhi matematicheskikh nauk, v. 20, no. 5, 1965, 121-180

TOPIC TAGS: mathematic method, mathematic model, statistic mechanics, thermodynamics, continuum mechanics, electrodynamics, tensor analysis, variational method, electromagnetic theory, magnetohydrodynamics

ABSTRACT: A survey has been made of mathematical methods in the physics of continuum mechanics. The complex nature of physical phenomena in continuum mechanics is outlined, and the interaction between various disciplines, e.g., as fluid mechanics, plasma physics, polymer sciences, is stressed. The need for mathematical models to explain these phenomena is borne out both in the microscopic and macroscopic domains of continuum mechanics. The fundamental equations are stated

UDC: 53.072+519.92

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as mass, momentum, and energy conservation, plus the universal laws of thermodynamics. First, the geometric and kinematic characteristics of the internal structure of small deformable particles are discussed. A tensor notation is used throughout with curvilinear Lagrangian coordinates. Basic equations are obtained as conceptual models whose interpretation comprises the fundamental theory of dislocations. In part three, the fundamental equations of dynamics and thermodynamics are derived in tensor notation. General concepts in nonequilibrium thermodynamics are investigated, using the free energy notation

$$F(T, \mu^1, \mu^2, \ldots, \mu^n) = U - TS,$$

and the second law of thermodynamics

$$T\,dS = \frac{dQ^{(e)}}{dm} + dq_i'.$$

Two cases are studied, one where π_k depends on $\left(\frac{d\mu^k}{dt}\right)$, and one where it does not. π_k is defined as

$$\pi_k = \Lambda_k - \frac{\partial F}{\partial \mu^k} - \alpha_k.$$

In part four, the methods of variational principles are introduced in the framework of the special theory of relativity so as to take into account the effects of electromagnetic phenomena, as expressed by Maxwell's equations, on continuum mechanics. The generalized variation equation is given by

$$\int_V \delta\Lambda\, d\tau + \Lambda\delta\, d\tau + \int_V \left(Q_k \delta\mu^k + \frac{\partial Q_k^j \delta\mu^k}{\partial x^j} \right) d\tau + \int_\Sigma P_k \delta\mu^k\, d\sigma = 0.$$

When applied to the laws of motion in continuum mechanics, where $\delta x^i = \delta\mu^k = 0$, this results in the Lagrange equations of motion

$$\frac{\partial}{\partial x^j}\left(\frac{\partial \Lambda}{\partial x^j_i} x^j_i\right) + \frac{\partial \Lambda}{\partial x^j_j}\frac{\partial x^j_j}{\partial x^i} = Q_i + Q_k \mu^k_i \quad (i = 1, 2, 3, 4)$$

$$\frac{\partial}{\partial x^j}\frac{\partial \Lambda}{\partial \mu^k_j} - \frac{\partial \Lambda}{\partial \mu^k} = Q_k \quad (k = 5, 6, \ldots, n).$$

These are combined with the equalities

$$P_i^j = \mu^k_i \frac{\partial \Lambda}{\partial \mu^k_j} - x^j_i \frac{\partial \Lambda}{\partial x^i_i} - \Lambda\delta^j_i - Q_i^j,$$

$$P_k^j = -\frac{\partial \Lambda}{\partial \mu^k_j} - Q_k^j$$

to form a set of 5n equations which contains the classical equations of elasticity, hydrodynamics and Maxwell's electromagnetic theory. For Q_i and $Q_k = 0$ the above set represents a conservative system from which the various conservation laws are derived. In part five, the equations of energy conservation and heat flux are derived from the variational equations. For example,

L 22674-66
ACC NR: AP6004660

$$dU = \frac{p^{\alpha\beta}}{\varrho}\frac{\partial v_\alpha}{\partial x^\beta}d\hat{t} - \frac{1}{\varrho}\operatorname{div} Q d\hat{t} + \frac{1}{\varrho}Q_i^* d\hat{t}$$

represents the heat flux equation in the generalized thermodynamics form and $\frac{A}{\varrho} = -U - \frac{1}{\varrho}Q_i^*$ is the classical formula in the nonlinear theory of elasticity for $Q_i^* = 0$. In part six, the ponderomotive forces are derived in detail as they arise from the interaction of the electromagnetic fields with the continuum media. In an inertial system of coordinates, this yields

$$F^\alpha = \varrho_e E_\alpha + \frac{1}{c}[j, B]_\alpha + \frac{1}{2}\left[P\frac{\partial E}{\partial x^\alpha} - E\frac{\partial P}{\partial x^\alpha} + M\frac{\partial B}{\partial x^\alpha} - B\frac{\partial M}{\partial x^\alpha}\right].$$

An extensive bibliography is included on the various topics discussed above. Orig. art. has: 131 equations.

SUB CODE: 20/ SUBM DATE: 30Jan65/ ORIG REF: 055/ OTH REF: 219

12/

Card 4/4

L 3957-65 EWT(l)/EWP(m)/T/EPA(b)-2 IJP(c)

ACCESSION NR: AP5024204 UR/0020/65/164/003/0519/0522

AUTHOR: Sedov, L. I. (Academician) 44,55 34 B

TITLE: On the energy-momentum tensor and on macroscopic internal interactions in a gravitational field and in material media 21,44,55

SOURCE: AN SSSR. Doklady, v. 164, no. 3, 1965, 519-522

TOPIC TAGS: general relativity theory, special relativity theory, gravitation field

ABSTRACT: The equations defining the energy-momentum tensor for a continuous medium in the framework of general relativity are investigated, following earlier work by the author (Tr. XV Vsemiri kongressa po teoretich. i prikl. mekh., Munich, 1965). The general theory is required in order to describe the mechanics of a continuous medium in a gravitational field. The stress tensor is derived starting from a variational (least action) principle, and is found to differ from that of Einstein obtained in the special theory. Although the equations of a continuous medium can be written in terms of purely geometric properties, it is convenient and useful to retain internal stresses. The internal stress tensors in the general and special theories differ by a term depending on local gravitational

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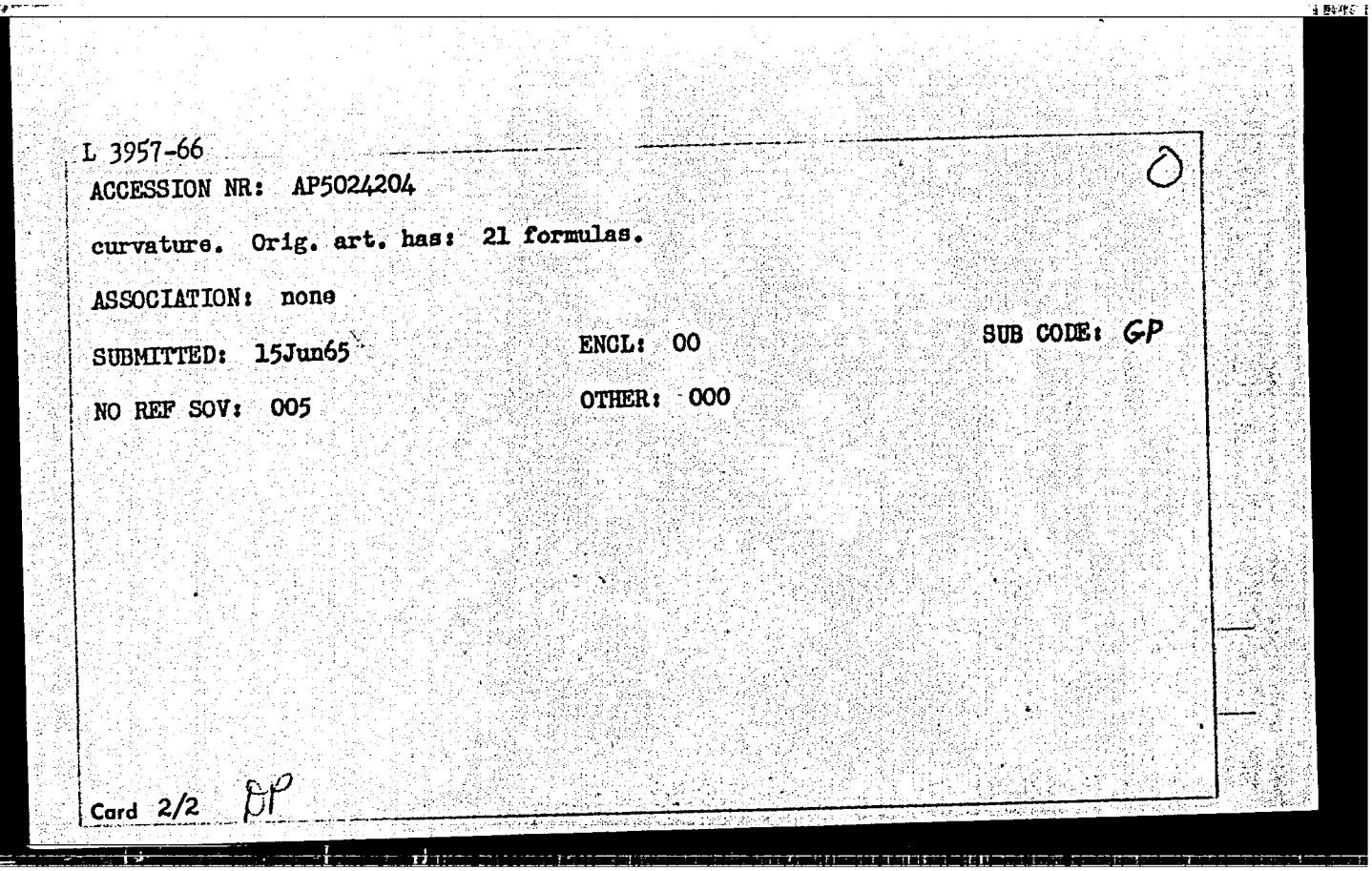

L 3957-66

ACCESSION NR: AP5024204

curvature. Orig. art. has: 21 formulas.

ASSOCIATION: none

SUBMITTED: 15Jun65 ENCL: 00 SUB CODE: GP

NO REF SOV: 005 OTHER: 000

Card 2/2 BP

L 35585-65 EWT(1)/EEC(t)

ACCESSION NR: AP5006251 S/0040/65/029/001/0004/0017

27
B

AUTHOR: Sedov, L. I. (Moscow) 21

TITLE: Concerning the pondermotive forces of interaction between an electromagnetic field and an accelerated moving material continuum taking into consideration the finite strains

SOURCE: Prikladnaya matematika i mekhanika, v. 29, no. 1, 1965, 4-17

TOPIC TAGS: tensor calculus, relativity, electromagnetism, electrodynamics, kinetics, aerodynamics, space research, plasma physics

ABSTRACT: The motion of a continuous medium that is interacting with an electromagnetic field is discussed. The conclusions set forth in this article do not specify in concrete detail the general nature of the medium's property. It takes into consideration, however, the possible interaction between a moving and strained medium and the electromagnetic field, namely in the case where the interaction is caused by the presence of electric currents in the medium and also by the appearance of electric polarization and the magnetization of the medium. The author's formula for the pondermotive forces differs in essence from similar formulas given by various authors, which are derived only for special, particular cases. The

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L 35585-65

ACCESSION NR: AP5006251 01

author's work makes possible a different determination of the tensors of energy and momentum of the electromagnetic field. Orig. art. has: 51 formulas.

SUBMITTED: 19Nov64 ENCL: 00 SUB CODE: EM, ME

NO REF SOV: 007 OTHER: 002

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SEDOV, L.I., akademik

Lomonosov and the principles of natural science. Vest. AN SSSR 35 no.5: 116-125 My '65. (MIRA 18:6)

L 15950-66 EWT(l)/EWP(m)/EWT(m)/EWA(d)/T/FCS(k) WW/JW/WE
ACC NR: AP6002415 SOURCE CODE: UR/0020/65/165/005/1019/1022

AUTHOR: Korobeynikov, V.P.; Sedov, L.I. (Academician)

ORG: Mathematical Institute im. V. A. Steklov, Academy of Sciences of the SSSR (Matematicheskiy institut AN SSSR)

TITLE: Calculation of one dimensional flow in cylindrical and plane explosions in an ideally conducting gas, taking into account the back pressure and the magnetic field

SOURCE: AN SSSR. Doklady, v. 165, no. 5, 1965, 1019-1022

TOPIC TAGS: chemical explosion, external magnetic field, shock wave propagation

ABSTRACT: Let there be assumed a cylindrical or a plane point explosion in a stationary electrically conducting gas in the presence of a magnetic field. It is further assumed that the conductivity of the gas is infinite, and that the gas is an ideal one with a constant ratio of the specific heat capacities, γ. E_0 is the energy evolved in the explosion, calculated for unit length in the cylindrical case ($\nu = 2$) and for unit area in the plane case ($\nu = 1$). Let the magnetic field be parallel to the axis of symmetry (the axis of the explosion) and parallel to the plane of symmetry (the plane of the explosion) for the

UDC: 534.222.2

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plane explosion. In these cases, the flow will be one dimensional and will depend only on the time, t, and on one spatial coordinate, r--the distance from the axis or the plane of symmetry. As a result of the explosion, a magnetohydrodynamic shock wave starts to propagate through the gas. For the motion of the gas behind the front of the shock wave, the following magnetohydrodynamic equations are assumed:

$$\frac{1}{\nu}\frac{\partial \rho}{\partial t}+\frac{\partial}{\partial \zeta}(\zeta \rho u)=0,\quad \frac{1}{\nu}\frac{\partial \mathscr{E}}{\partial t}+\frac{\partial}{\partial \zeta}[\zeta u(\mathscr{E}+p^*)]=0,$$
$$\frac{1}{\nu}\frac{\partial p^{1/\gamma}}{\partial t}+\frac{\partial}{\partial \zeta}(\zeta u p^{1/\gamma})=0,\quad \frac{1}{\nu}\frac{\partial H}{\partial t}+\frac{\partial}{\partial \zeta}(\zeta u H)=0, \qquad (1)$$
$$\frac{1}{\nu}\frac{\partial}{\partial t}\frac{\rho u}{r^{\nu-2}}+\frac{\partial}{\partial \zeta}(\rho v^2+p^*)+\frac{\nu-1}{\nu}\frac{\rho v^2}{\zeta}=0,$$

where $\zeta=r^\nu$, $u=\frac{v}{r}$, $\mathscr{E}=\frac{1}{2}\rho v^2+\frac{p}{(\gamma-1)}+\frac{1}{8\pi}H^2$,

v is the velocity; ρ is the density; $p^*=p+\frac{1}{8\pi}H^2$; ; and, p is the pressure. Results of the following mathematical development are exhibited graphically. "The author expresses his sincere thanks to Ye. Bishimov for his aid in programming, and to L. G. Straut and R. P. Agafonova for programming the problem on the BESM-2 machine and for carrying out the calculation." Orig. art. has: 10 formulas and 2 figures.

SUB CODE: 20/ SUBM DATE: 07Apr65/ ORIG REF:009/ SOV REF:000/ OTH REF:001

ACC NR: AM6034409 Monograph UR/

Sedov, Leonid Ivanovich

Plane problems in hydrodynamics and aerodynamics (Ploskiye zadachi gidrodinamiki i aerodinamiki) 2d ed., rev. Moscow, Izd-vo "Nauka", 66. 448 p. illus., biblio., index. 5,500 copies printed.

TOPIC TAGS: fluid mechanics, plane parallel flow, incompressible fluid flow, ship hydrodynamics, propeller hydrodynamics, aerospace vehicle aerodynamics, computer data processing

PURPOSE AND COVERAGE: This book, the second, revised edition of L. I. Sedov's work under this title, is also based on his monograph Teoriya ploskikh dvizheniy ideal'noy zhidkosti (Theory of plane motions of an ideal fluid). It discusses the advances in modern hydromechanics and aerodynamics closely connected with the theory of plane-parallel motion of incompressible gases and the broadened possibilities of approximate solutions of practical problems made possible now by high-speed computers. The author discusses a large number of problems from such fields of the flight aerodynamics of various aerospace vehicles, the theory of hydraulic and gas-operated machinery, the hydrodynamics of ships and propellers, motion of bodies at high speeds in water, rapid submersion in water, etc.

UDC: NONE

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ACC NR: AM6034409

TABLE OF CONTENTS [abridged]:

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L 45141-66 EWT(d)/EWT(m)/EWP(w)/EWP(v)/EWP(k) IJP(c) WW/EM

ACC NR: AP6024406 SOURCE CODE: UR/0020/66/169/001/0055/0057

55
B

AUTHOR: Mikhaylova, M. ; Sedov, L. I. (Academician)

ORG: Moscow Institute of Railroad Engineers (Moskovskiy institut inzhenerov zheleznodorozhnogo transporta)

TITLE: Motion of a piston in a heat conducting and viscous medium

SOURCE: AN SSSR. Doklady, v. 169, no. 1, 1966, 55-57

TOPIC TAGS: heat conductivity, fluid viscosity, motion equation

ABSTRACT: The article considers the one dimensional motion of a gas in front of a piston which is moving at a constant velocity U in a heat conducting and viscous medium. The basic equations for one dimensional unsteady state motion of a viscous and heat conducting medium have the form:

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$$\frac{\partial \rho}{\partial t} + \frac{\partial (\rho u)}{\partial r} + (\nu - 1)\frac{\rho u}{r} = 0,$$

$$\frac{\partial (r^{\nu-1}\rho u)}{\partial r} + \frac{\partial}{\partial r}[r^{\nu-1}(\rho u^2 - p_{rr})] + (\nu - 1) r^{\nu-2} p_{nn} = 0,$$

$$\frac{\partial}{\partial t}\left[\rho r^{\nu-1}\left(\frac{u^2}{2} + \varepsilon\right)\right] + \frac{\partial}{\partial r} r^{\nu-1}\left[\rho u\left(\frac{u^2}{2} + \varepsilon\right) - p_{rr} u - \varkappa \frac{\partial T}{\partial r}\right] = 0, \quad (1)$$

$$p_{rr} = -p + \lambda\left[\frac{\partial u}{\partial r} + (\nu - 1)\frac{u}{r}\right] + 2\mu \frac{\partial u}{\partial r},$$

$$p_{nn} = -p + \lambda\left[\frac{\partial u}{\partial r} + (\nu - 1)\frac{u}{r}\right] + 2\mu \frac{u}{r},$$

where t is time; r is a coordinate; ρ is the density; u is a component of the velocity; ε is the internal energy; T is the temperature; λ is the coefficient of thermal conductivity; p is the pressure; p_{rr}, p_{nn} are stress coordinates; λ, μ are viscosity coefficients; $\nu = 1,2,3$, respectively, for flat, cylindrical, and spherical pistons. It is assumed that $p = R\rho T$ and $\varepsilon = C_v T$, where R is the gas constant, C_v is the specific thermal conductivity. The problem is solved mathematically after transformation to dimensionless variables. The article presents calculations for V, P, and R at a Prandtl number Pr = 1, for $\nu = 1,2,3$. Orig. art. has: 1 formulas and 3 figures.

SUB CODE: 20/ SUBM DATE: 05Oct65/ ORIG REF: 002

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L 00827-67 EWT(1)/EWP(m) WW

ACC NR: AP6024388 SOURCE CODE: UR/0020/66/169/002/0303/0305

AUTHOR: Aslanov, S. K.; Sodov, L. I. (Academician)

ORG: Odessa State University im. I. I. Mechnikov (Odesskiy gosudarstvennyy universitet)

TITLE: Investigation of the stability of shock waves in arbitrary media

SOURCE: AN SSSR. Doklady, v. 169, no. 2, 1966, 303-305

TOPIC TAGS: shock wave propagation, perturbation

ABSTRACT: As a result of the fulfillment of the linear boundary conditions for turbulent breakaway, and of the momentum and energy components, incorporated in the law of continuity of the mass flows, the following characteristic equation has been obtained

$$2\frac{\omega v}{v_0}\left(k^2+\frac{\omega^2}{v^2}\right)=\left(\frac{\omega^2}{vv_0}+k^2\right)(\omega-l_1 v)(\mu+1), \qquad (2)$$

where $\mu=\rho_0^2 v_0^2(\partial V/\partial p)_H$, $V=1/\rho$, and the subscript H denotes differentiation along the adiabatic curve of the shock wave. In further previously published work, Equation (2) was transformed by the introduction of the new variables

$$l_1=\frac{\Omega}{c}\cos\vartheta, \quad k=\frac{\Omega}{c}\sin\vartheta, \quad \Omega^2=c^2(k^2+l_1^2) \qquad (3)$$

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L 09421-67

ACC NR: AF6024388

where Ω is the frequency of sound in a system of coordinates connected with the substance behind the shock wave. The remainder of the article consists of an extended mathematical treatment of the problem, starting from the above bases. It is demonstrated that the presence of dissipative factors of viscosity and heat conductivity in a real gas leads to damping of the perturbations, as a result of which, in practice there is always stability of the shock waves in a gaseous medium. Orig. art. has: 11 formulas.

SUB CODE: 20/ SUBM DATE: 28Oct65/ ORIG REF: 003

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