IL'IN, V.A. (Moskva)

Principles for the designing of contactless remote-control systems equipped with exponential converters [with summary in English]. Avtom. i telem. 20 no.4:468-472 Ap '59.
(MIRA 12:5)

(Remote control)

report to be presented at the 1st Intl Congress of the Intl Federation of Automatic Control, 25 Jun-5 Jul 1960, Moscow, USSR.

BYKHOVETSKIY, M. L. - "Ultra stability in electronic calculating devices in the solution of nonlinear equations in indefinite form"

CHELYUSTKIN, A. B. - "Use of calculating devices in systems for the automatic control of rolling mills"

CHICHINADZE, V. K. - "Concerning some problems of the organization of self-adjusting and self-teaching systems of automatic control, based on principles of random search"

DAVYDOV, E. I. - "Development of automatic control systems for boiler units"

DUDNIKOV, Ye. G. - "Determination of optimum adjustments of industrial automatic regulation systems according to initial data obtained from experience"

DUB'YE, A. I., and SCHENVASSER, R. N. - "Methods of organizing Lyapunov functions in the theory of nonlinear regulating systems"

DRUZHININ, N. N. - "Balanced regulation and inter-communications of a multi-motor electric drive and technology in continuous rolling mills"

FEL'DBAUM, A. A. - "Problems of statistical theory of automatic optimization systems"

FETUIN, V. I. - "Automation of a reversible cold rolling mill for nonferrous metals"

FILIPPOV, A. F. - "Application of the theory of differential equations with a discontinuous right side to nonlinear problems of automatic regulation"

GAVRILOV, M.A. - "Structural surplus and operational reliability of relay devices"

GAIKIN, M. I. - "Automation of irrigation systems"

[illegible], G. R., [illegible], V. R., [illegible], M. P., [illegible], L. R., and KIMTI, M. M. - "Power regulation of disturbance and problems of the stability of electric power systems"

GINZBURG, S. A. - "Logical method of synthesis of functional converters"

[illegible] - "Methods of transmission of information and the structure of telemechanical systems for dispersed structures"

ILYASOV, V. L., and LUTSKIY (fnu) - "The code-impulse system of telemeasurement for dispatched operations of trunk-line gas pipe lines"

IVAKHNENKO, A.G. - "Concerning the application of the theory of combined regulation systems for cybernetic adaptation systems"

KARANDEYEV, K. B., and [illegible], G. A. - "A quasi-equilibrated bridge as an element in a system of automatic control"

KAZAKEVICH, V. V. - "Concerning the process of extra regulation of inert objects in the presence of disturbance"

KAZAKOV, I. E. - "Some problems of the theory of statistical linearization and its application"

KILIN, F. M. - "Some problems of the theory of impulse systems with time selectors"

[illegible], A. E., [illegible], S. V., VORKOBOYNIKOV, L.M., IOFFE, B. M., [illegible], B. P., [illegible], B. P., SHATUNSKIY, Ye. L., KYSIN, A. Ye., and YAKOBSON, Ye. S. - "The problem of bioelectric control"

[illegible] - "[illegible] types of [illegible] and their field of use"

[illegible], K. L., [illegible], B. G., and [illegible], K. A. - "System of automatic control and regulation of blast distribution in the tuyeres of blast furnace"

[illegible], B. L. - "Investigation of the dynamics of the hydraulic [illegible]"

[illegible], A. A. - "Dynamics of continuous systems of automatic regulation with extra self-adjustment of corrective devices"

KRASOVSKIY, N. N. - "Concerning the selection of parameters of optimum stability systems"

[illegible], A. I. - "The dynamics of devices imitating living organisms"

KULEBAKIN, V. S. - "The invariant theory of automatic regulation and control systems"

LANIN, L. B. - "Pneumatic calculating devices as a means of insuring the reliability of complex automation systems"

LAZAREV, V. [illegible] and PARKHOMENKO, P.P. - "[illegible] of analysis and synthesis of the [illegible] of relay devices"

IL'IN, V.A.

[Concerning the methodology for transmitting information and the structure of remote control systems of dispersed objects] O metodakh peredachi informatsii i strukture sistem telemekhaniki dlia rassredotochennykh ob"ektor. Moskva, 1960. 10 p. (International Federation of Automatic Control, 1st International Congress, Moscow, 1960. Doklady, no.46) (MIRA 14:8)

(Remote control)

PHASE I BOOK EXPLOITATION SOV/5080

Il'in, Viktor Aleksandrovich

Sistemy telemekhaniki dlya rassredotochennykh ob"yektov (Remote-Control Systems for Dispersed Objects) Moscow, Gosenergoizdat, 1960. 110 p. 13,000 copies printed. (Series: Biblioteka po avtomatike, vyp. 15)

Editorial Board: I.V. Antik, S.I. Veshenevskiy, V.S. Kulebakin, A.D. Smirnov, B.S. Sotskov, Ye.P. Stefani, and N.N. Shumilovskiy; Ed.: N.A. Kuznetsov; Tech. Ed.: G.Ye. Larionov.

PURPOSE: This book is intended for students in advanced courses and technical personnel concerned with the automation and remote control of manufacturing processes.

COVERAGE: The book examines the structure and the principles of design of remote-control systems in which the objects of remote control are dispersed over a given area or along lines and participate in a single manufacturing process (oil and gas industries, pipelines, quarries and mines, railroad and

Card 1/4

28 (1)

S/030/60/000/01/060/067
B015/B011

AUTHORS: Il'in, V. A., Doctor of Technical Sciences, Mamikonov, A. G., Candidate of Technical Sciences

TITLE: Position and Prospects in the Development of Telemechanics

PERIODICAL: Vestnik Akademii nauk SSSR, 1960, Nr 1, pp 110 - 113 (USSR)

ABSTRACT: The authors describe the course of the scientific-technical conference on telemechanics held in Moscow from November 16 to 21, 1959. The Conference had been convened by the Akademiya nauk SSSR (Academy of Sciences of the USSR) and the Gosudarstvennyy nauchno-tekhnicheskiy komitet Soveta Ministrov SSSR (State Scientific-technical Committee of the Council of Ministers of the USSR), and was attended by delegates of the industry, scientific research institutes, design offices, and universities. The numerous and miscellaneous lectures showed the important progress made by scientific research in the field of telemechanics and its practical application in the last years. Unlike former times, when power economy was regarded as the chief field of application, the facilities offered by telemechanics today are introduced to an ever greater extent in the petroleum and gas industry, the railroad transportation, large

Card 1/2

IL'IN, V.A. (Moskva)

Reliability of switching circuits in dispersed systems.
Avtom.i telem. 21 no.4:530-532 Ap '60.
(MIRA 13:6)
(Switching theory)

82769
S/103/60/021/008/009/014
B012/B063

AUTHOR: Il'in, V. A., (Moscow)

TITLE: Remote Control of Spread Objects

PERIODICAL: Avtomatika i telemekhanika, 1960, Vol. 21, No. 8, pp. 1173-1180

TEXT: The present paper describes new, very reliable circuits for the remote control of spread objects, using a code of two frequencies. These circuits were developed at the Institut avtomatiki i telemekhaniki AN SSSR (Institute of Automation and Telemechanics of the AS USSR). A disturbance of any element of these circuits cannot lead to an erroneous selection or command, but only to protective non-operation. Such a circuit diagram is shown in Fig. 1. It needs no local feeding sources. Two subsequent oscillations of two frequencies, f_1 and f_2, are sent from the dispatcher point. A dividing transformer lowers the influence of the line on the resonant circuits L_1C_1 and L_2C_2. The circuit diagram is briefly described. The same resonant circuits may also be used to select another object. In

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Remote Control of Spread Objects

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B012/B063

this case, the oscillations are transmitted in the inverse order of frequencies (first f_2, and then f_1). Such a circuit was used for a system developed by IAT AS USSR. The capacitor C in the circuit diagram shown in Fig. 1 is charged at the expense of the energy of the first circuit. In order to eliminate this drawback, an amplifier is connected to the output of the first circuit. Such a circuit diagram is reproduced in Fig. 2. It is shown that it is necessary for many telemechanic frequency systems to reach a reasonable compromise between a single circuit and complicated filters with many inductances and capacitances. Two-circuit filters used in radiotechnical circuits are offered as a suitable solution for telemechanic systems with spread objects. LC resonant circuits may be replaced by two-circuit filters without any appreciable change of the mode of operation of the circuit. Adjustment and calculation are uncomplicated (Ref. 7). Fig. 3 shows the circuit diagram of a two-circuit filter, by which resonant circuits may be replaced. The selective properties of resonant circuits are compared with those of two-circuit filters, and the advantages of the latter are diagrammatically illustrated in Fig. 6. It is finally noted that the efficiency of utilizing the channel of communication can be improved

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Remote Control of Spread Objects

S/103/60/021/008/009/014
B012/B063

by the use of two-circuit filters. There are 6 figures and 7 Soviet references.

SUBMITTED: March 11, 1960

Card 3/3

IL'IN, V.A.; SHISHMAREV, I.A.

Uniform evaluations in a closed domain for eigenfunctions of an elliptic operator and their derivatives. Izv. AN SSSR, Ser. mat. 24 no. 6:883-896 N-D '60. (MIRA 14:1)

1. Predstavleno akademikom S.L. Sobolevym.
(Eigenfunctions)

S/020/60/132/02/21/067
B014/B007

AUTHOR: Il'in, V.A.

TITLE: The Generating of Pulse Oscillations of Stable Frequency

PERIODICAL: Doklady Akademii nauk SSSR, 1960, Vol. 132, No. 2, pp. 323-325

TEXT: For the purpose of warranting a higher frequency stability of generators for sinusoidal voltages and pulse voltages, the use of bridge circuits is suggested. A diode is connected into the diagonal of the bridge. This kind of generator is a further development of the exponential converter (Refs. 1,2) suggested by the author in earlier papers. The circuit diagram of this generator with an electromagnetic relay is shown in Fig. 1. On the basis of the voltage- and current diagrams given, the mode of operation of the generator is discussed. Derivation of the formula for the calculation of the oscillation period from the circuit elements is carried out without taking account of the internal resistance of the current source and the inductivity of the relay. Fig. 2 shows the circuit diagram of such a generator which is composed of contactless elements (tubes, transistors etc.), and Fig. 3 shows two fully transistorized

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The Generating of Pulse Oscillations of Stable Frequency

S/020/60/132/02/21/067
B014/B007

circuits of this generator. In circuit A (Fig. 3) a frequency change of 0.002% occurs with a change of voltage of 1%. The author points out the general usability of these generators. There are 4 figures and 2 Soviet references.

PRESENTED: January 18, 1960, by A.I. Berg, Academician

SUBMITTED: January 16, 1960

Card 2/2

IL'IN, V.A.; SHISHMAREV, I.A.

Some problems for the Lu=div [p(x)grad u]--q(x)u operator with discontinuous coefficients. Dokl. AN SSSR 135 no.4:775-778 '60. (MIRA 13:11)

1. Moskovskiy gosudarstvennyy universitet im. M.V.Lomonosova. Predstavleno akademikom I.G.Petrovskim.

(Operators (Mathematics))

IL'IN, V.A., red.; KOLBANOVSKIY, V.N., red.; KOL'MAN, E., red.; VIKTOROVA, V., red.; CHEREMNYKH, I., mladshiy red.; MOSKVINA, R., tekhn. red.

[Philosophical problems on cybernetics] Filosofskie voprosy kibernetiki. Moskva, zd-vo sotsial'no-ekon. lit-ry, 1961. 391 p. (MIRA 14:6)

(Cybernetics)

S/044/62/000/004/087/099
C111/C222

AUTHOR: Il'in, V. A.

TITLE: Some questions on the science of control systems

PERIODICAL: Referativnyy zhurnal, Matematika, no. 4, 1962, 36, abstract 4V199. ("Filos. voprosy kibernetiki," M., Sotsekgiz, 1961, 213-226)

TEXT: The energetic structure of control systems is examined. A strong flow of energy is released in a control system by feeding small amounts of energy to the control elements. Systems with relay feed-back - automatic regulators - are described. Discussed are self-adapting machines, as well as the realization of processes that are analogous to a conditional reflex. The quantitative characteristics of the brain and of the modern machines are compared, such as the speed of signal transmission, the reaction time of a cell and the number of cells. Of these quantities, only the number of cells of the brain is larger then that of the modern machines. An analogy is drawn between the division of control functions of the head and spinal cord and the handling of some control functions of the machine. The industrial revolution, which replaced physical labor with machines, is compared to the tendency to

Card 1/2

S/044/62/000/004/087/099
Some questions on the science of ... C111/C222

assign the tiresome job of controlling the mechanism to the machine itself. The designation "thinking machine" is defended as the most convenient one.

[Abstracter's note: Complete translation.]

Card 2/2

S/044/62/000/007/054/100
C111/C333

AUTHOR: Il'in, V. A.

TITLE: Teleautomatics and cybernetic

PERIODICAL: Referativnyy zhurnal, Matematika, no. 7, 1962, 42, abstract 7V180. ("Kibernetiku-na sluzhbu kommunizmu. T.1". M.-L., Gosenergoizdat, 1961, 262-272)

TEXT: For the modern automatic control a qualitive leap is characteristic, this is the transition to complex automatic control and telemechanisation, to the union of the work-benches and the aggregates in only one industrial process. In connection with this there arises the necessity of solving new problems which are connected with the optimal improvement of the industrial processes with respect to numerous parameters; there arise specific problems of the transmission of informations by means of teleautomatics. According to the author teleautomatics investigates systems possessing as well characteristics of the telemechanical systems as characteristics of the control-systems. The author considers the characteristic properties of telemechanics and teleautomatics as well as specific characteristics of the trans-

Card 1/2

Teleautomatics and cybernetic

mission of informations in these systems. At the end the author discusses the next tasks of teleautomatics and the chances for the application of cybernetic to the solution of those questions which are connected with the degree of effect of the steering of teleautomatical systems.

[Abstracter's note: Complete translation.]

38884

S/103/62/023/006/007/012
D288/D308

6.9500

AUTHOR: Il'in, V.A. (Moscow)

TITLE: Determining the efficiency of transmission of telemechanical information

PERIODICAL: Avtomatika i telemekhanika, v. 23, no. 6, 1962, 778-735

TEXT: The author suggests a comparison of all signalling, remote control and telemetering systems based on the criterion of transmission speed in bandwidth F: $R_F = R/F = (\log_2 n)/TF$ where T - time interval required for a single message and $\log_2 n$ - number of messages (n = number of possible different combinations) all counted in binary units. 5 methods are considered: single-channel time method; single frequency method; two-frequency method with simultaneous transmission; two-frequency method with consecutive transmission; binary time code. Formulas are given for R_F in terms of relevant parameters. The results are compared in a table and plotted. They indicate the superiority of the binary code systems for large values

Card (1/2)

Determining the efficiency ...

of n, and of the simplest single frequency system for n = 2...8. Practical limitation of transmission speeds is due mainly to filter bandwidths. For telemetery applications the following methods are considered: AM, FM, pulse width modulation, pulse position modulation and pulse code modulation; expressions for R_p in terms of pulse and modulation characteristics are compared. For cases of short relative pulse duration PWM and PPM appear to be most efficient; in cases demanding the error factor $\delta = 1/2n$ to be under 5%, PCM is superior. For short distance hauls simple AM systems provide a satisfactory operation. A graphical representation of R_p vs δ in % is given. There are 3 figures and 1 table.

SUBMITTED: December 14, 1961

Card 2/2

BERG, A.I., glav. red.; TRALEYTNIKOV, V.A., glav. red.; BERKOVICH, B.K., zaml glav. red.; LERNER, A.Ya., doktor tekhn. nauk, prof., zam. glav. red.; AVILI, O.I., red.; AGEYKIN, D.I., red.; kand. tekhn. nauk, dots., red.; AYZENMAN, M.A., red.; VENIKOV, V.A., doktor tekhn. nauk, prof., red.; VORONOV, A.A., doktor tekhn. nauk, prof., red.; GAVRILOV, M.A., doktor tekhn. nauk, prof., red.; GERNOV, D.V., red.; IL'IN, V.A., doktor tekhn. nauk, prof., red.; KITOV, A.I., kand. tekhn. nauk, red.; KOGAN, B.Ya., doktor tekhn. nauk, red.; KOSTOUSOV, A.I., red.; KRUGLITSKIY, N.A., kand. fiz.-mat. nauk red.; LEVIN, G.A., prof. red.; LOZINSKIY, M.G., doktor tekhn. nauk, red.; [illegible]SIYEVSKIY, V.I., red.; MAKSAREV, Yu.Yo., red.; MASLOV, A.A., dots., red.; POPKOV, A.A., red.; RAKOVSKIY, M.Ye., red.; ROZENBERG, L.D., doktor tekhn. nauk, prof., red.; SOTSKOV, B.S., red.; TIMOFEYEV, P.V., red.; USHAKOV, V.B., doktor tekhn. nauk, red.; FEL'DBAUM, A.A., doktor tekhn. nauk, prof., red.; FROLOV, V.S., red.; KHARKEVICH, A.A., red.; KHRAMOY, A.V., kand. tekhn. nauk, red.; TSYPKIN, Ya.Z., doktor tekhn. nauk, prof., red.; CHERNUSTKIN, A.B., kand. tekhn. nauk, red.; SHREYDER, Yu.A., kand. fiz.-mat. nauk, dots., red.; BOCHAROVA, M.D., kand. tekhn. nauk, starshiy nauchnyy red.; DELONE, N.N., inzh., nauchnyy red.; BARANOV, V.I., nauchnyy red.; PAVLOVA, T.I., tekhn. red.

(Continued on next card)

BERG, A.I.—— (continued). Card 2.

[Industrial electronics and automation of production processes]Avtomatizatsiia proizvodstva i promyshlennaia elektronika. Glav. red. A.I.Berg i V.A.Trapeznikov. Moskva, Gos.nauchn. izd-vo "Sovetskaia Entsiklopediia." Vol.1. A - I. 1962. 524 p. (MIRA 15:10)

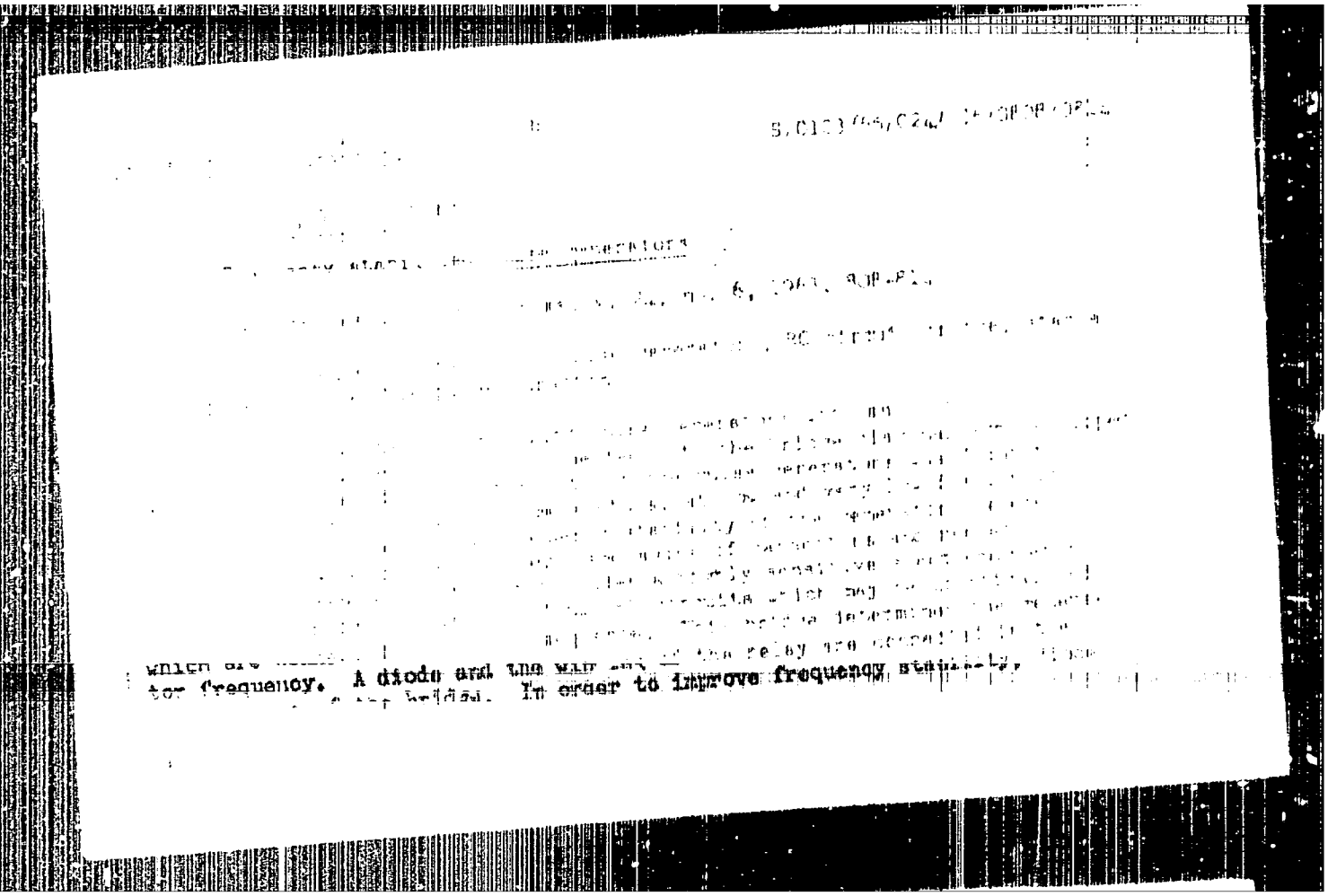
1. Chlen-korrespondent Akademii nauk SSSR (for Kotskov, Kharkevich, Zernov, Timofeyev, Popkov).
(Automatic control) (Electronic control)

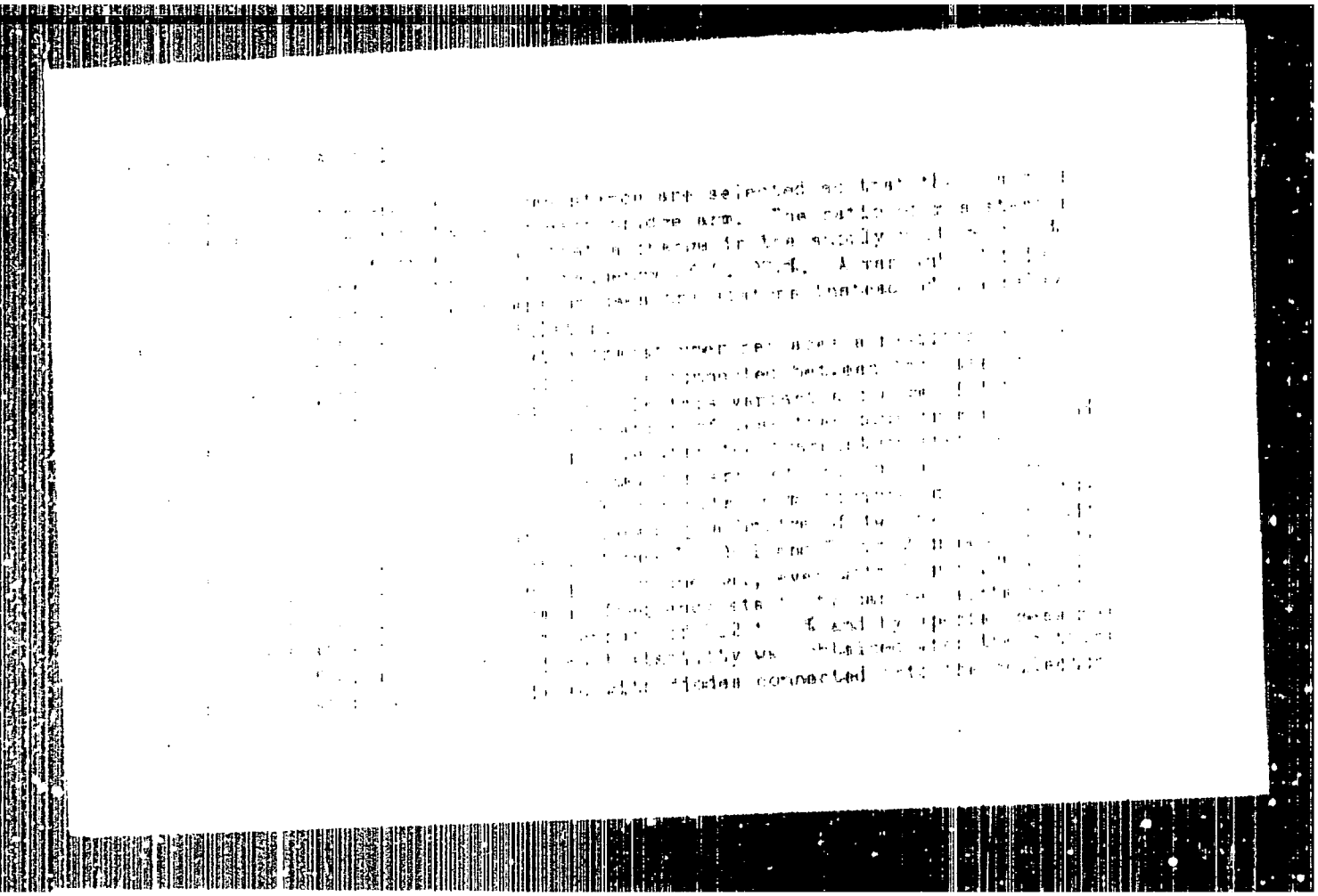
TITLE: Transfer of a space vehicle braking in the atmosphere ... the orbit of an artificial satellite

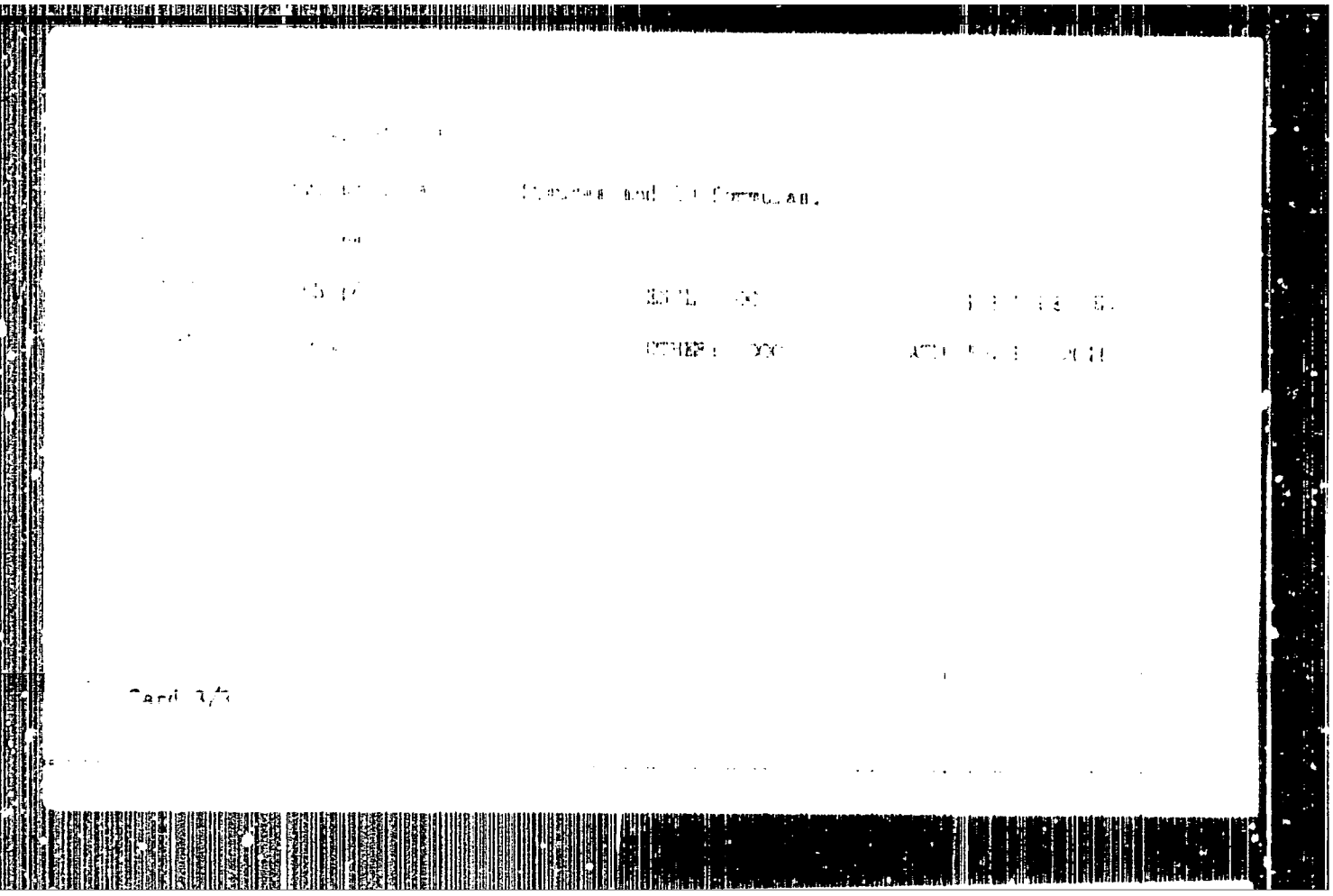
SOURCE: ...

... momentum integrals ... are established; it is ... derived, and conditions for its minimum ...

Card 1/2







L 19926-63 BDS

ACCESSION NR: AP3004826 S/0103/63/024/008/1147/1154

AUTHOR: Il'in, V. A.; El'darov, E. A. (Moscow)

TITLE: Signal transmission over power distribution networks (a review)

SOURCE: Avtomatika i telemekhanika, v. 24, no. 8, 1963, 1147-1154

TOPIC TAGS: remote control, telemetering, signal transmission, power-distribution network

ABSTRACT: Use of power distribution networks as connecting links for remote-control, telemetering, and supervisory-control equipment in various countries is briefly reviewed. Two transmission classes are distinguished: (1) circular remote control (house meter switching) at 175-3,000 cps; and (2) two-way signal transmissions at 10-100 kc. H-v transmission lines are used for signal transmission at 50-300 kc and sometimes up to 1,000 kc; they are equipped with wave-traps and coupling capacitors. Attenuation per km is tabulated for rr contact

Card 1/2

L 19926-63
ACCESSION NR: AP3004826

lines, mine networks, and cables, for 10-150 kc. Data measured on 380-v and 6-kv oilfield networks is reported, including the effects of a generator, a transformer, or a spur line connected to the signal-transmission link. French, German, and Swiss systems of frequency-division and pulse-time centralized remote control are described in some detail. Soviet supervisory-control systems (descriptions published elsewhere) for mining power networks, electrified rr's and industrial 0.4-6-kv networks are briefly described. Also, some USA supervisory systems are mentioned. Orig. art. has: 9 figures and 1 table.

ASSOCIATION: none

SUBMITTED: 25Oct62 DATE ACQ: 26Aug63 ENCL: 00

SUB CODE: CO NO REF SOV: 009 OTHER: 006

Card 2/2

IL'IN, V.A. (Moskva)

Frequency stable pulse generators. Avtom. i telem. 24 no.6: 808-814 Je '63. (MIRA 16:7)

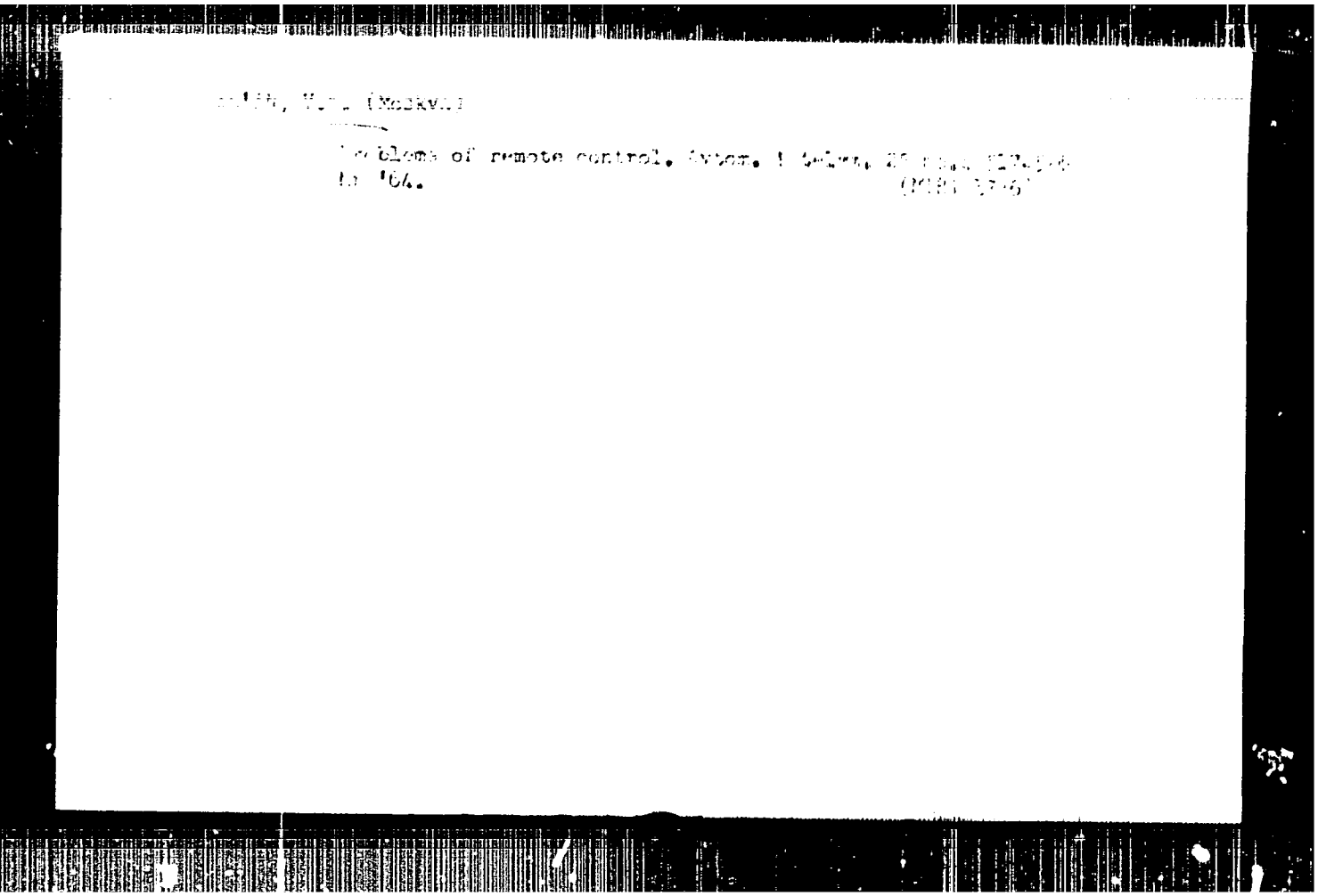
(Oscillators, Transistor)
(Pulse techniques (Electronics))

IL'IN, Viktor Aleksandrovich; YURASOV, A.N., red.; BUL'DYAYEV, N.A., tekhn. red.

[Telemetering and remote control of distributed objects] Telekontrol' i teleupravlenie rasseredotochennymi ob"ektami. Moskva, Gosenergoizdat, 1963. 311 p. (MIRA 17:3)

IL'IN, V.A., doktor tekhn.nauk

Modern trend of telemechanics; All-Union Conference in Moscow.
Vest. AN SSSR 34 no. 1:105-107 Ja '64. (MIRA 17:5)



'64.

AVEN, O.A.; DVORETSKIY, V.M.; DOMANITSKIY, S.M.; ZALMANZON, L.A.; KRASSOV, I.M.; KRUG, Ye.K.; TAL', A.A.; KHOKHLOV, V.A.; BULGAKOV, A.A.; DEMIDENKO, Ye.D.; BERNSHTEYN, S.I.; YEMEL'YANOV, S.V.; LERNER, A.Ya.; MEYEROV, M.V.; PEREL'MAN, I.I., FITSNER, L.N.; CHELYUSTKIN, A.B.; ZHOZHIKASHVILI, V.A.; IL'IN, V.A.; AGEYKIN, D.I.; GUSHCHIN, Yu.V.; KATYS, G.P.; MEL'TTSER, L.V.; PARKHOMENKO, P.P.; MIKHAYLOV, N.N.; FITSNER, L.N.; PANKHOMENKO, P.P.; ROZENBLAT, M.A.; SOTSKOV, B.S.; VASIL'YEVA, N.P.; PRANGISHVILI, I.V.; POLONNIKOV, D.Ye.; VOROB'YEVA, T.M.; DEKABRUN, I.Ye.

Work on the development of systems and principles of automatic control at the Institute of Automatic and Remote Control during 1939-1964. Avtom. i telem. 25 no. 6:807-851 Je '64. (MIRA 17:7)

KHRAMOY, A.V. [deceased]; MEYEROV, M.V.; AYZERMAN, M.A.; GLADKOV, G.M.; TSYPKIN, Ya.Z.; FEL'DBAUM, A.A.; LERNER, A.Ya.; PUGACHEV, V.S.; IL'IN, V.A.; GAVRILOV, M.A.

Work of the Institute of Automatic and Remote Control on the development of the theory of automatic control during 1939-1964. Avtom. i telem. 25 no. 6:763-807 Je '64. (MIRA 17:7)

IL'IN, V.A. (Moskva)

Stabilization of time parameters. Avtom. i telem. 25 no.6: 991-996 Je '64. (MIRA 17:7)

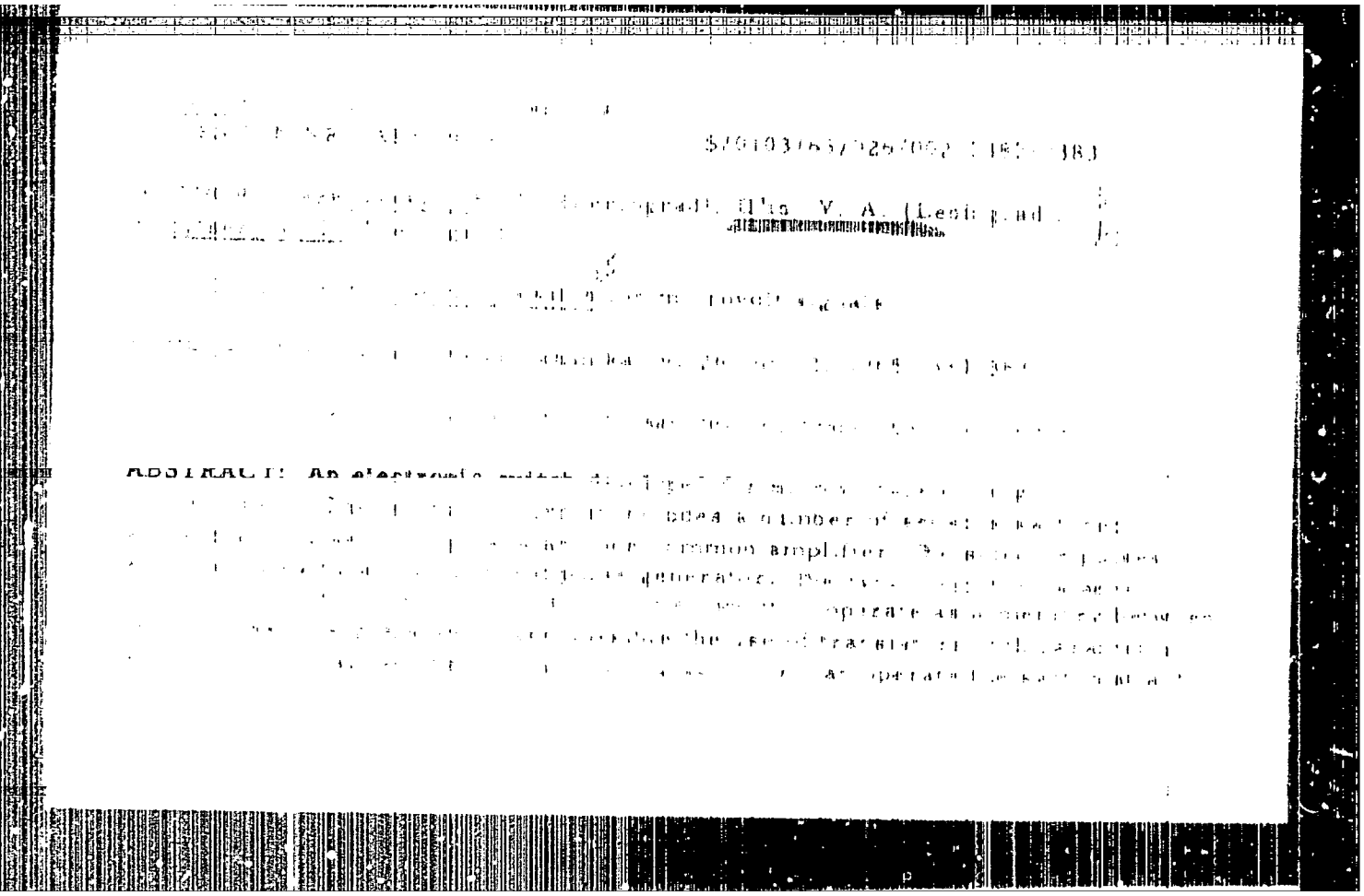
IL'IN, V.A., doktor tekhn.nauk

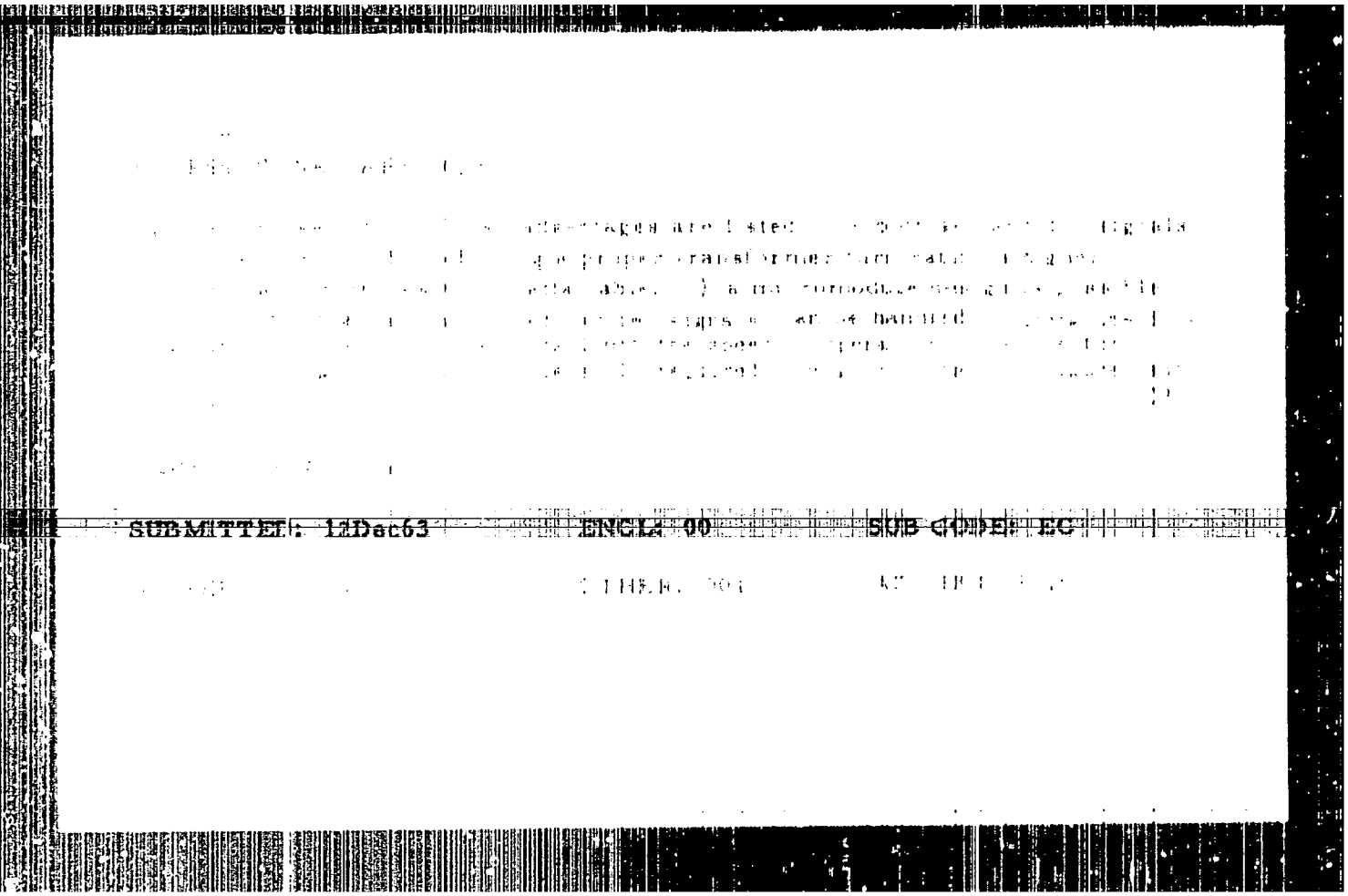
Improving the stability of pulse systems. Vest. AN SSSR 34 no.9:68-70 S '64. (MIRA 17:10)

1. Institut avtomatiki i telemekhaniki [tekhnicheskoy kibernetiki] Gosudarstvennogo komiteta po priborostroyeniyu, sredstvam avtomatizatsii i sistemam upravleniya pri Gosplane SSSR i Akademii nauk SSSR.

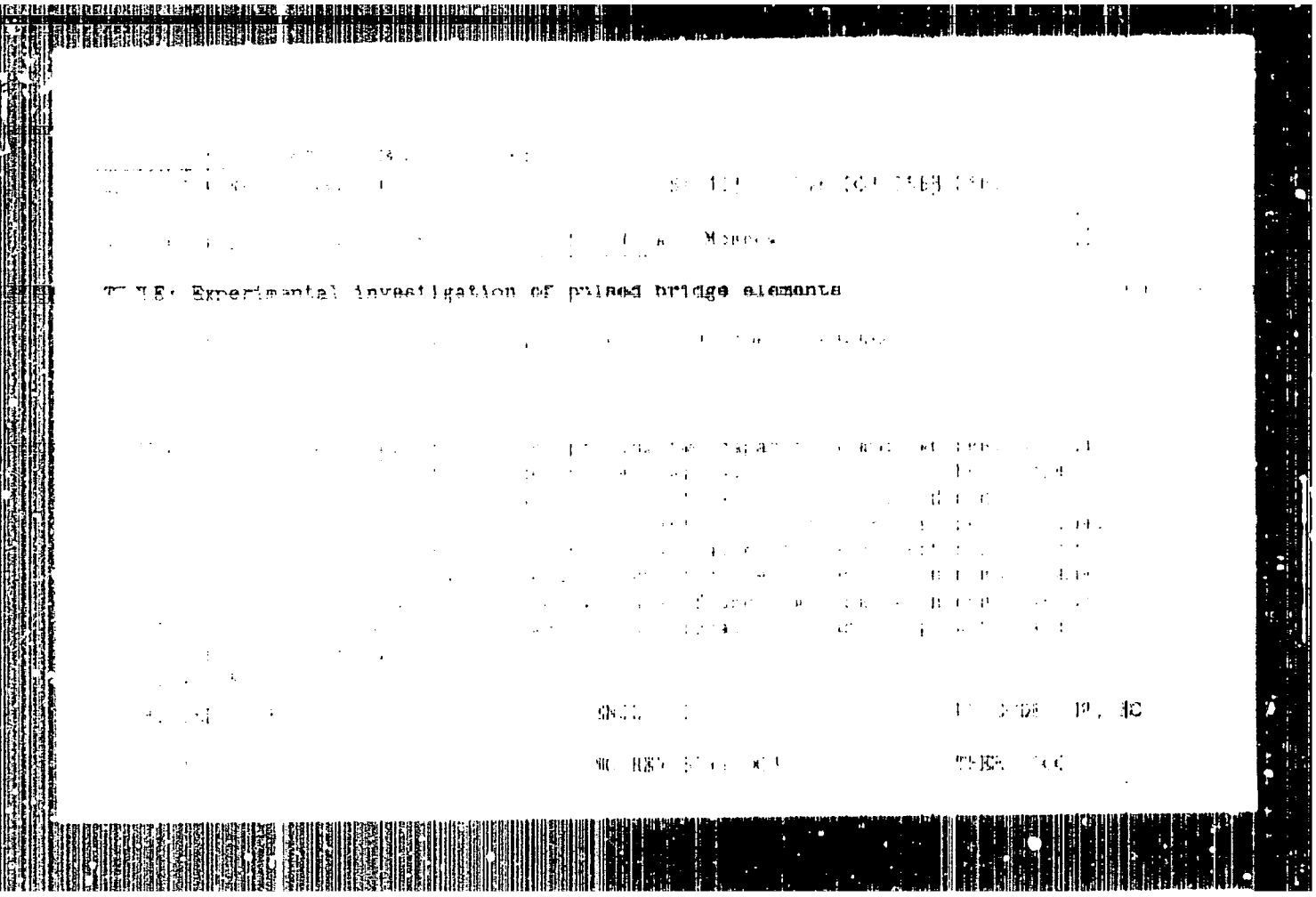
IL'IN, Viktor Aleksandrovich; KUPFERSHMIT, Ya.A., red.

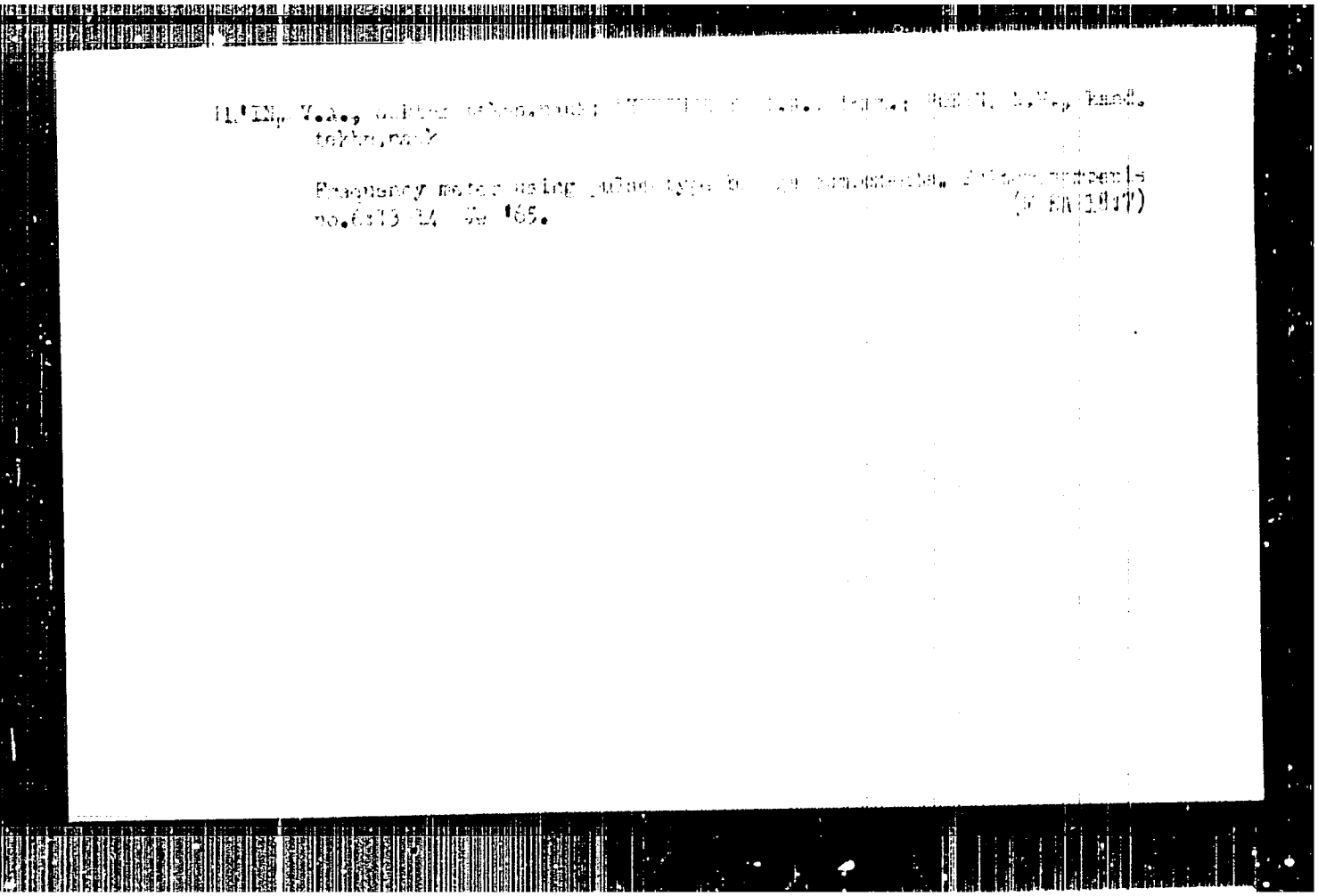
[Pulse devices with bridge circuit components] Impul'snye ustroistva s mostovymi elementami. Moskva, Energiia, 1965. 70 p. (Biblioteka po avtomatike, no.130)
(MIRA 18:5)





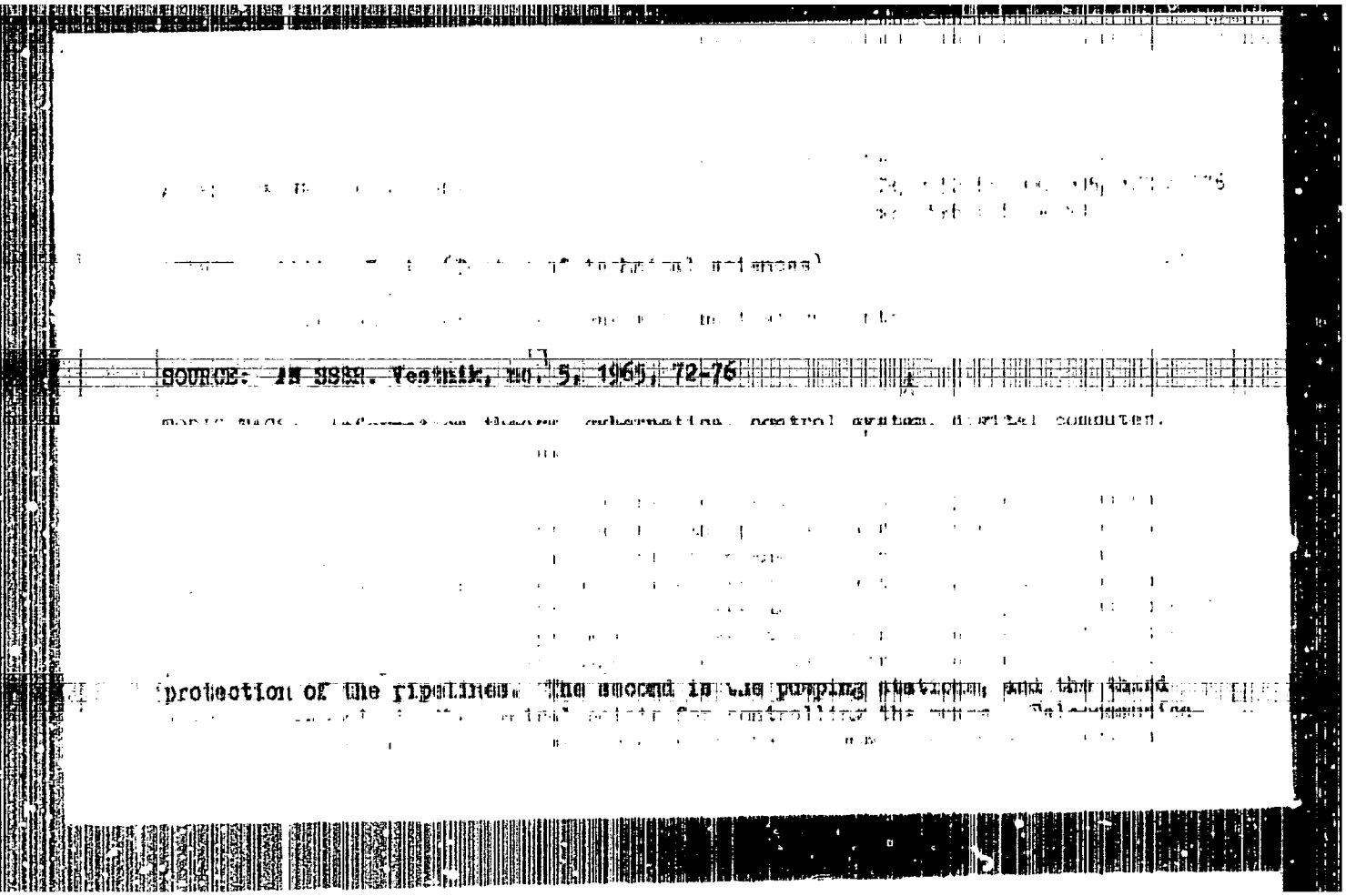
SUBMITTED: 12Dec63 ENCL: 00 SUB CODE: EC





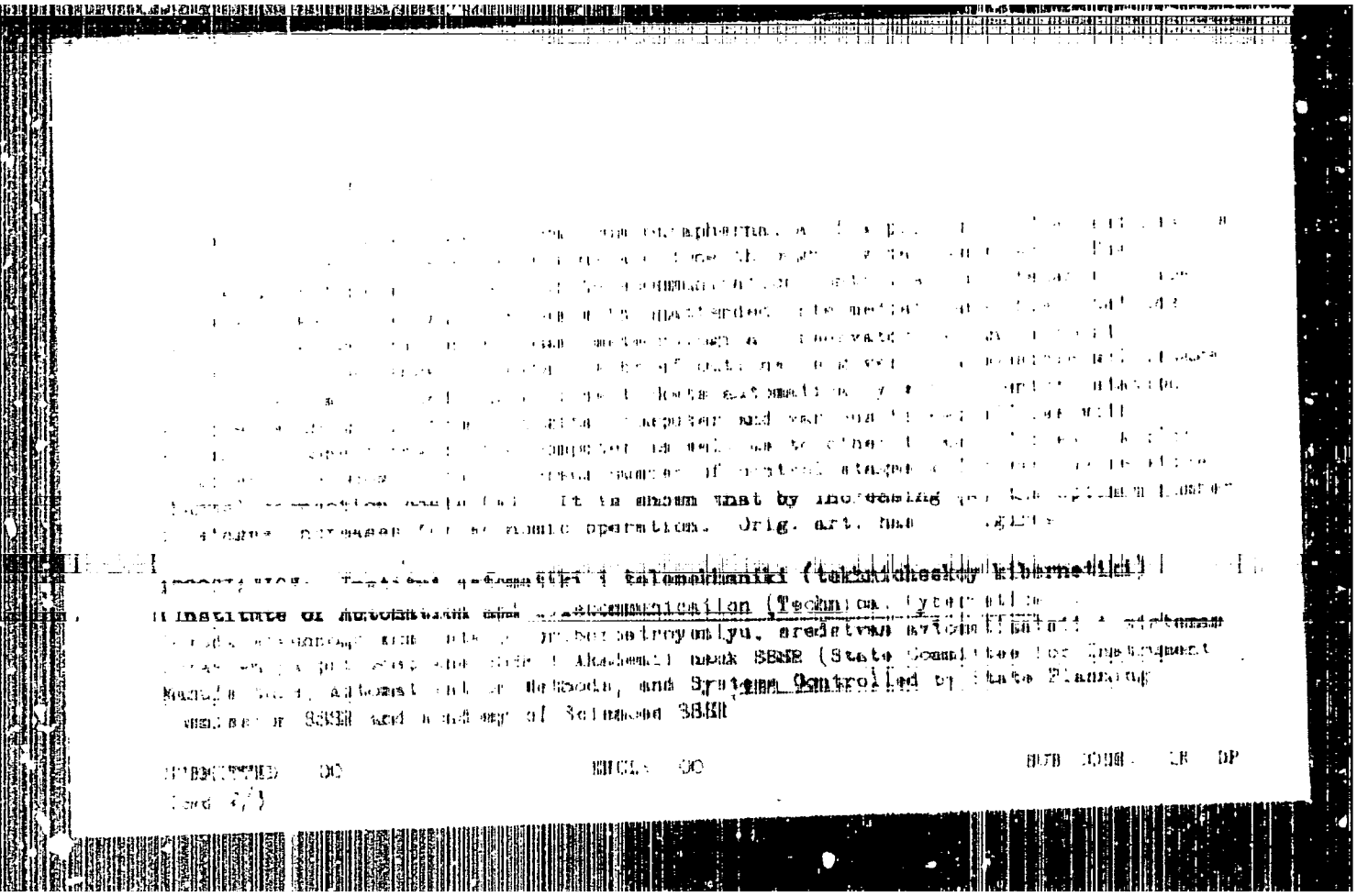
AKIMENKOV, S.F. (Moskva); [illegible] V.A. (Moskva)

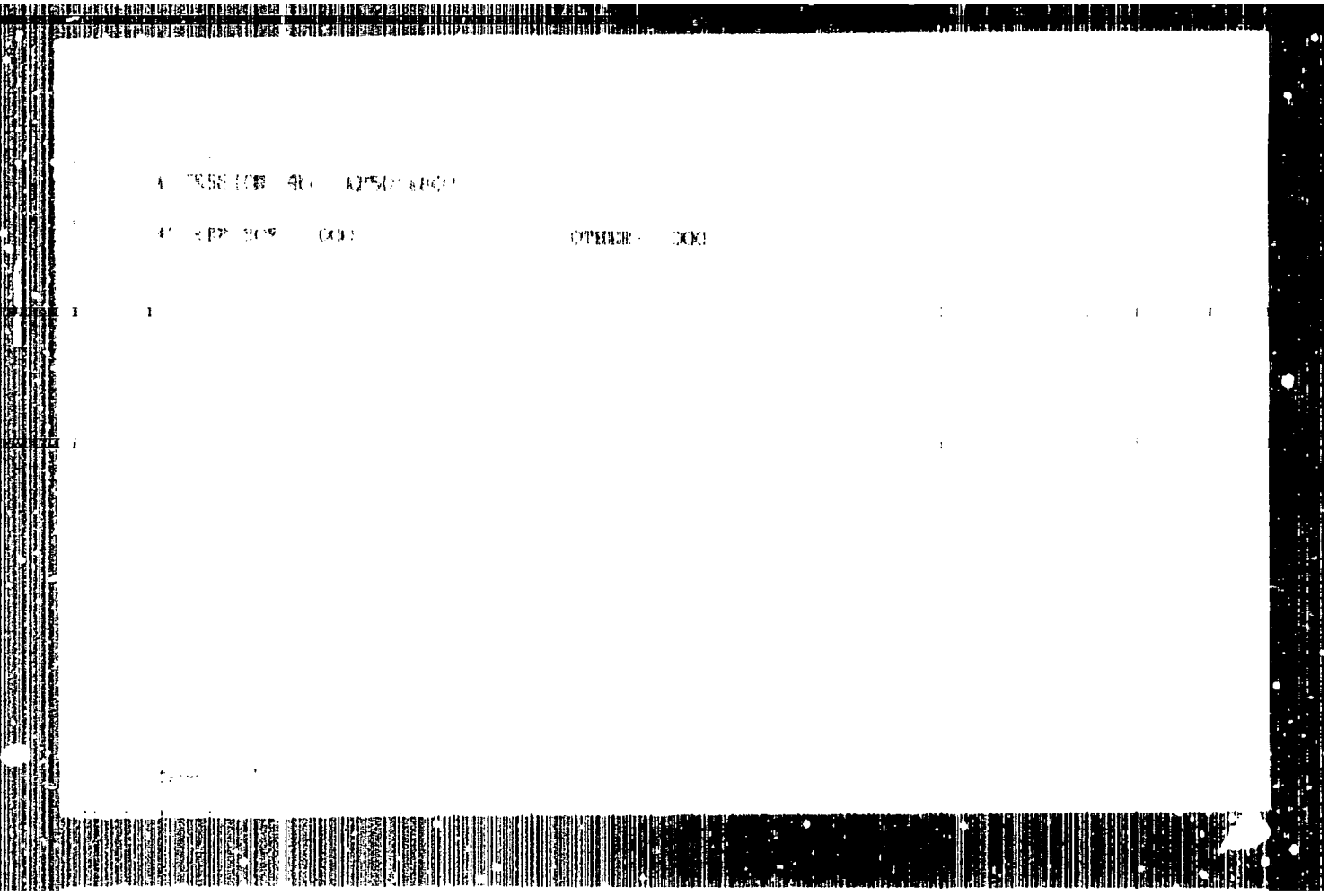
Experimental [illegible] of cable-type bridge [illegible]. Avtom. i telem. 26 no.3:503-506 Mr '65. (MIRA 18:6)



SOURCE: IN SSSR. Vestnik, no. 5, 1965, 72-76

protection of the pipelines. The second is the pumping station, and the third





ACC NR: AT6022311 SOURCE CODE: UR/0000/66/000/000/0065/0071

AUTHOR: Il'in, V. A. (Doctor of technical sciences, Professor)

ORG: none

TITLE: Selecting the structure of complex remote control systems

SOURCE: Vsesoyuznaya nauchnaya sessiya, posvyashchennaya Dnyu radio. 22d, 1966. Sektsiya telemekhaniki. Doklady. Moscow, 1966, 65-71

TOPIC TAGS: remote control system, automatic control theory, telemetry system, optimal automatic control

ABSTRACT: With an increase in the size of automatic control systems and the number of scattered objects it is practical, under certain conditions, to adopt control hierarchy which is one of the basic principles of cybernetics. In this case both the reliability and the high cost of transmission channels require a large autonomy of controlled objects at their locations. As a result of this the application of the control hierarchy becomes necessary for relatively simple telemetric systems. A hierarchic structure is defined quantitatively at each control step by hierarchy coefficients K_i and the number of control steps m. The quantity K_i is the number of men, units, or objects subordinate directly at each given control step. The choice of the structure of a hierarchy system is in effect reduced to the choice of coefficients Ki at each control

Card 1/2

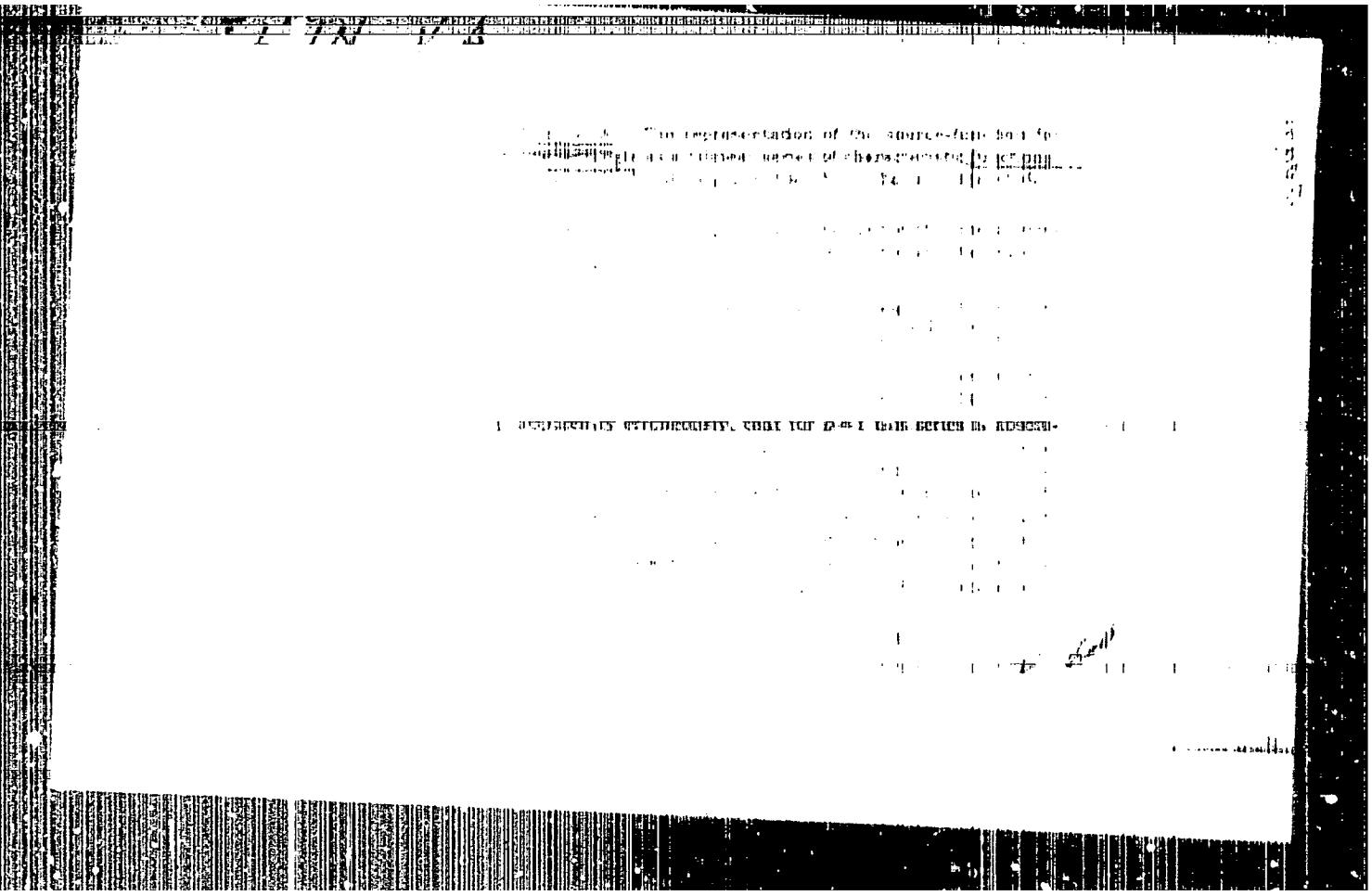
[illegible]IN, V.A.

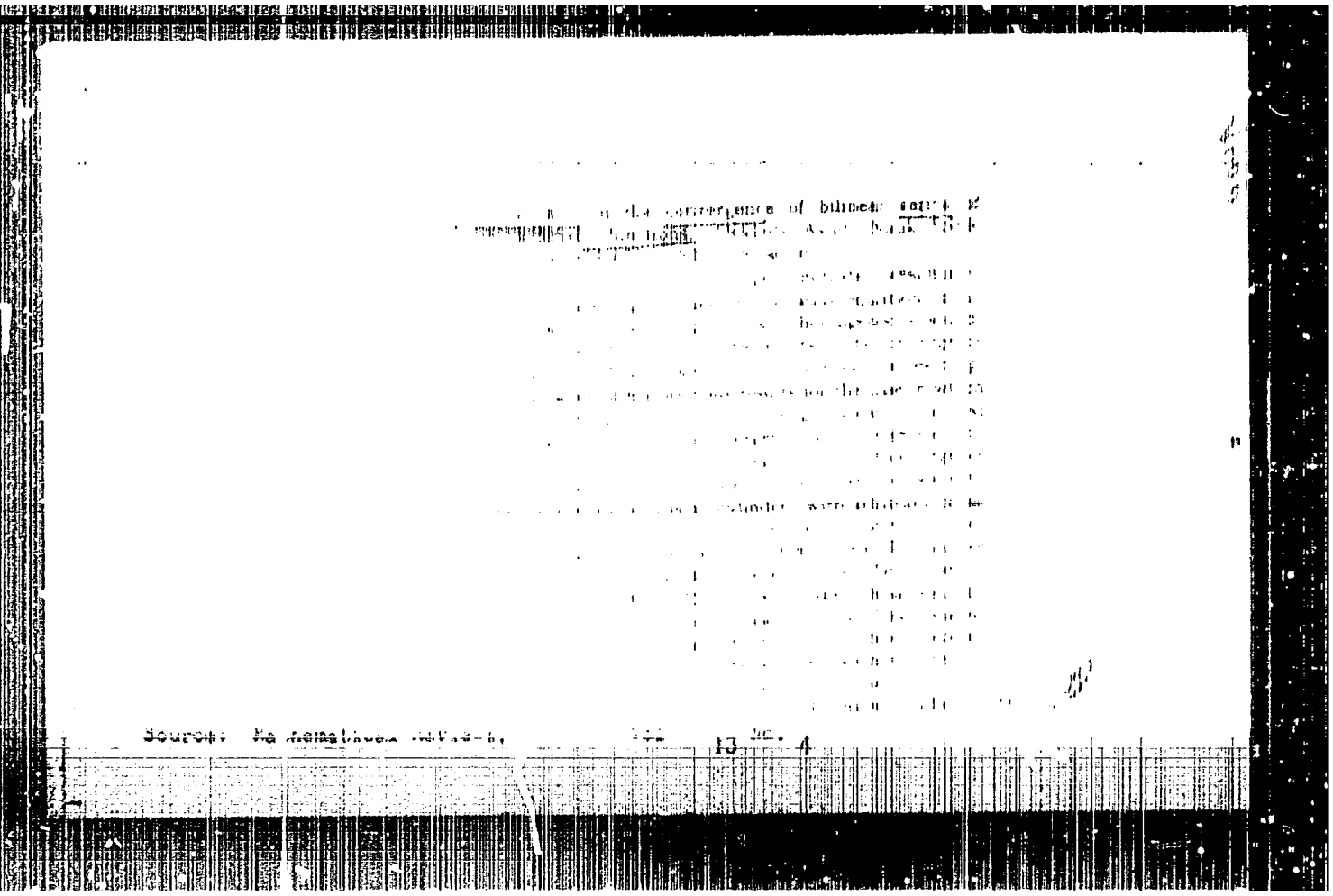
Calculating the trajectories of the flight of spaceships between coplanar circular orbits in a Newtonian gravitational field. Kosm.issl. 2 no.5:698-712 S-O '64. (MIRA 17:10)

IL'IN, V.A.

Summability of Fourier series in eigenfunctions of a Laplace operator by Cesaro, Riss, and Poisson-Abel averages. Dokl. AN SSSR 160 no.4:765-768 F '65. (MIRA 18:2)

1. Moskovskiy gosudarstvennyy universitet. Submitted July 9, 1964.





Il'in, V. A. -- "Diffraction of Electromagnetic Waves on Several Heterogeneities." Cand Phys-Math Sci, Moscow State U, Moscow 1953.
(Referativnyy Zhurnal--Fizika, January 54)

SO: SUM 163, 22 July 1954

ILJIN, V.A.

CARD 1/2 PG - 354

SUBJECT USSR/MATHEMATICS/Fourier series
AUTHOR ILJIN V.A.
TITLE The decomposition of the functions with one singularity into a series in terms of eigenfunctions. The kernels of broken order.
PERIODICAL Doklady Akad. Nauk 105, 18-21 (1955)
reviewed 10/1956

Let a function possess the singularity r^{ε} ($\varepsilon<0$ or $\varepsilon>0$). In the two-dimensional case for a special function of this kind the author gives a direct computation of the Fourier coefficients for the decomposition with respect to the system of eigenfunctions of the equation $\Delta u + \lambda u = 0$ in an arbitrary region G. A formula is derived which determines the Fourier coefficients of this function up to the terms of order $\frac{1}{\lambda_i^{n/2+5/4}}$ (n - arbitrary integer). A function is constructed which possesses the mentioned singularity and which at the same time everywhere else is sufficiently smooth. The results which have sketched proofs for the two-dimensional case, are extended to arbitrary dimensions (without proof) and are formulated in the following theorem: Every function of N variables which in one point possesses a singularity r^{ε} ($\varepsilon>0$) and which everywhere else satisfies the condition of decomposability, can be decomposed into an absolutely convergent series in terms of eigenfunctions inside of an arbitrary N-dimensional region. Here the convergence of every inner subregion G' of G is uniform.

ILJIN, V. A.

SUBJECT USSR/MATHEMATICS/Theory of functions CARD 1/1 PG - 157

AUTHOR ILJIN V.A.

TITLE Sufficient conditions for a decomposition into an absolutely and uniformly convergent series in terms of eigenfunctions.

PERIODICAL Doklady Akad. Nauk 105, 210-213 (1955)
reviewed 7/1956

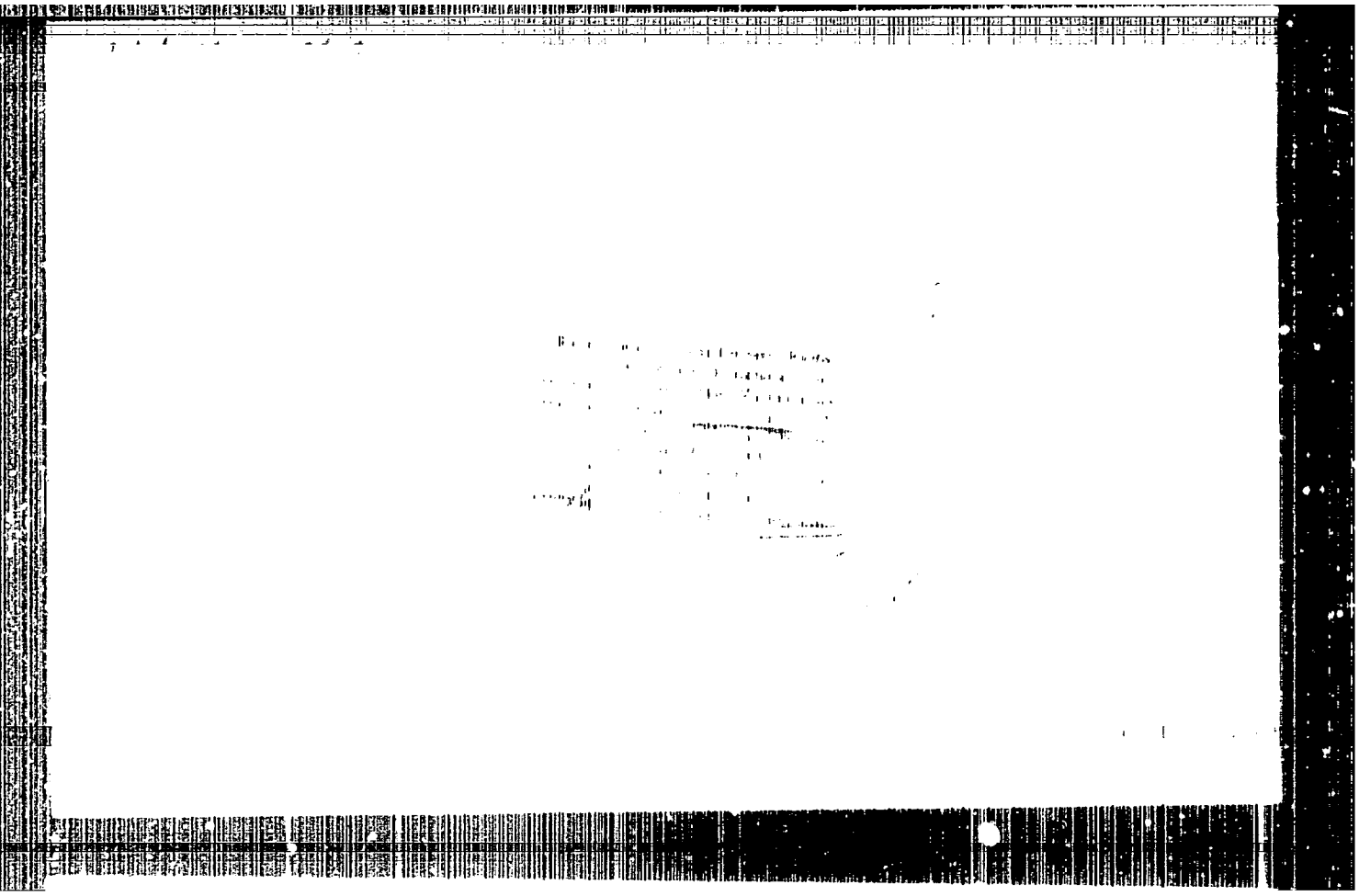
The author given an essentially weakening of the known sufficient conditions for the development of a function in an absolutely and uniformly convergent series in terms of eigenfunctions of the equation

$$\Delta u + \lambda u = 0$$

in an arbitrary region G with a homogeneous boundary condition of arbitrary kind. The strong continuity of the derivatives is superfluous. The first derivatives can have jumps of first kind on arbitrary objects not higher than of first dimension. Generally: The k-th derivatives can have jumps of first kind on arbitrary objects not higher than of (2k-1)-th dimension.

INSTITUTION: Lomonossov University Moscow.

IL'IN, V. A., Doc Phys-Mat Sci -- (diss) "Concerning the Convergence of Expansions in Eigen Functions of a Laplace Operator." Mos, 1957. 23 pp, (Mos State Univ im Lomonosov), 120 copies. Bibliogr: pp 22-23 (30 titles). (KL, 7-58, 108)



IL'IN, V.A.

The foundation of Fourier's method for the wave equation. Usp. mat.nauk 12 no.4:289-295 Jl-Ag '57. (MIRA 10:10)
(Calculus)

IL'IN, V.A. (Moskva)

The kernel of fractional order. Mat.sbor. 41(83) no.4:459-480 Ap '57. (MLRA 10:7)
(Fourier's series) (Eigenfunctions) (Integral equations)

20-114-4-6/63

AUTHOR: Il'in, V. A.

TITLE: On the Uniform Convergence of Expansions in Characteristic Increasing Numbers (O ravnomernoy skhodimosti razlozheniy po sobstvennym funktsiyam pri summirovanii v poryadke vozrastaniya sobstvennykh chisel)

PERIODICAL: Doklady Akademii Nauk SSSR, 1957, Vol. 114, Nr 4, pp. 698-701 (USSR)

ABSTRACT: The present paper studies the problem of the uniform convergence of developments according to the eigenfunctions of the equations $\Delta u + \lambda u = 0$ in any domain g with any number N of dimensions. A homogeneous boundary condition of the first, second or third kind is assumed here. The conditions for further development can be made easier if the demand for absolute convergence is dropped and only the uniform convergence of Fourier's series is studied when summarizing in the order of the increasing eigennumbers.
This expectation is also confirmed. The author found an adequate result for any domain with any amount of dimensions and, besides, was able to prove the following: Let be g assumed to be

Card 1/3

20-4-4/60

On the Uniform Convergence of the Expansion According to the Eigenfunctions of Domains with an Odd Number of Dimensions

ASSOCIATION: Moscow State University
(Moskovskiy gosudarstvennyy universitet)

PRESENTED: March 7, 1957, by S.L. Sobolev, Academician

SUBMITTED: February 19, 1957

AVAILABLE: Library of Congress

Card 3/3

AUTHOR: Il'in, V.A. (Moscow) SOV/39-46-1-1/6

TITLE: Sufficient Conditions for the Expansibility of a Function Into an Absolutely and Uniformly Convergent Series in Terms of Eigenfunctions (Dostatochnyye usloviya razlozhimosti funktsii v absolyutno i ravnomerno skhodyashchiyasya ryad po sobstvennym funktsiyam)

PERIODICAL: Matematicheskiy sbornik, 1958, Vol 46, Nr 1, pp 3-26 (USSR)

ABSTRACT: The paper consists of two chapters. In the first chapter the following theorem is proved.
Theorem: The function f(Q) of N variables is assumed to be defined in an N-dimensional domain g with Lyapunov boundary and to possess in the interior point P of g a singularity of the type r_{PQ}^{ε} ($\varepsilon > 0$) or $r_{PQ}^{2m} \ln r_{PQ}$ ($m=1,2,\ldots$), i.e. it is assumed to be representable in the form

$$f(Q) = r_{PQ}^{\varepsilon} + v(Q)$$

or

$$f(Q) = r_{PQ}^{2m} \cdot \ln r_{PQ} + v(Q)$$

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Sufficient Conditions for the Expansibility of a Function Into an Absolutely and Uniformly Convergent Series in Terms of Eigenfunctions

SOV/39-46-1-1/6

where: 1) $v \in W_2^{([N/2]+1)}(g)$ 2.) v is so that the functions $f, \Delta f, \Delta^2 f, \ldots, \Delta^k f$ ($k = [N/4]$ for the first and $k = \left[\frac{N-2}{4}\right]$ for the second and third boundary value problem) satisfy the corresponding homogeneous boundary condition in the generalized sense (see [Ref 2], Ch 2). Then f(Q) can be expanded in g into an absolutely and uniformly convergent series in terms of the eigenfunctions of $\Delta u + \lambda u = 0$.

By an example then it is shown that for functions with the singularities $\ln r_{PQ}$ or r_{PQ}^{ε} ($\varepsilon < 0$) at most conditionally convergent Fourier expansions are to be expected (in [Ref 3] where this conjecture is already proved). Besides it is directed to an error of Courant and Hilbert (Methods of Math.Physics Vol 1): The series

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$$\frac{4}{\pi^2 ab} \sum_{m=1}^{\infty} \sum_{n=1}^{\infty} \frac{\sin \frac{\pi}{a} mx \cdot \sin \frac{\pi}{b} ny \cdot \sin \frac{\pi}{a} m\xi \cdot \sin \frac{\pi}{b} n\eta}{\frac{m^2}{a^2} + \frac{n^2}{b^2}}$$

denoted there as absolutely and uniformly convergent in the rectangle in reality shows absolute divergence in the whole rectangle.

The second chapter gives a generalization of the classical theorem of Hilbert-Schmidt for kernels of fractional order which are connected with the eigenfunctions of the Laplace operator. Among others it is proved : If $f(q)$ is continuous in a closed two dimensional domain g, if it possesses piecewise continuous first derivatives and square-integrable second derivatives in g, and if it satisfies the corresponding boundary condition, then it can be expanded in g in terms of

Sufficient Conditions for the Expansibility of a Function Into an Absolutely and Uniformly Convergent Series in Terms of Eigenfunctions SOV/39-46-1-1/6

the eigenfunctions of this domain into an absolutely and uniformly convergent series. Here the piecewise continuity is understood in a somewhat restricted sense.
There are 7 references, 6 of which are Soviet, and 1 German.

SUBMITTED: December 22, 1956

Card 4/4

On the Expansion of Functions With Singularities into Conditionally Convergent Series in Terms of Eigenfunctions 38-22-1-3/6

fies the usual conditions for the series expansion, the Fourier series of this function uniformly converges in the interior of g (after separation of the singular point), if it is summed in the order of increasing eigen values. For the proof the author applies a well-known asymptotic formula (see [Ref 2,3,4]) which he newly proves and as it appears with an important method. There are 12 references, 9 of which are Soviet, 1 Jugoslav, 1 German, and 1 Polish.

PRESENTED: by S.L. Sobolev, Academician

AVAILABLE: Library of Congress

1. Functions-Analysis

Card 2/2

39-45-2-5/7

AUTHOR: Il'in, V.A. (Moscow)

TITLE: On the Uniform Convergence of the Expansions in Terms of Eigenfunctions in the Whole Closed Domain (O ravnomernoy skhodimosti razlozheniy po sobstvennym funktsiyam vo vsey zamknutoy oblasti)

PERIODICAL: Matematicheskiy sbornik, 1958, Vol 45, Nr 2, pp 195-232 (USSR)

ABSTRACT: Let g be an N-dimensional domain, Γ - boundary of g, ν - normal of Γ. In g the author considers expansions in terms of eigenfunctions of the equation $\Delta u + \lambda u = 0$ for boundary conditions (i.e. for $u|_\Gamma = 0$ or $\frac{\partial u}{\partial \nu}\Big|_\Gamma = 0$ or $\left[\frac{\partial u}{\partial \nu} + h(S)u\right]\Big|_\Gamma = 0$, where $h(S) \geq 0$). He investigates the convergence of these expansions in the closed domain g.

In the chapter I the convergence of the series

$$(1) \qquad \sum_{i=1}^{\infty} \frac{u_i^2(P)}{\lambda_i^{\alpha}}$$

is considered. In order to guarantee the uniform convergence in the closed domain, on Γ certain additional assumptions have to be satisfied. The author proves the interesting result: If Γ is a surface of the type of Lyapunov and if $u_i(P)$ are the eigenfunctions

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On the Uniform Convergence of the Expansions in Terms of Eigen- 39-45-2-5/7
functions in the Whole Closed Domain

series and for giving a uniform estimation of the remainder series. For arbitrary smooth functions f the author gives the order for the vanishing of the Fourier remainder. Numerous conclusions of these principal results are given.
There are 15 references, 13 of which are Soviet and 2 German.

SUBMITTED: December 22, 1956

1. Topology 2. Functions--Applications 3. Fourier series--Theory

Card 3/3

16(1)

AUTHORS: Il'in, V.A., Shishmarev, I.A. SOV/20-126-6-6/67

TITLE: On the Connection Between the Classical and the Generalized Solution of the Dirichlet Problem and of the Problem of Eigen Values

PERIODICAL: Doklady Akademii nauk SSSR, 1959, Vol 126, Nr 6, pp 1176 - 1179 (USSR)

ABSTRACT: It is proved that the classical and the generalized solutions of the Dirichlet problem

$$Lu = -f \text{ in } G \quad , \quad u|_{\Gamma} = 0 \quad ,$$

where Γ is the boundary of G, are almost everywhere identical in G, if certain conditions are satisfied guaranteeing the existence of the classical solution.
A similar result for the eigen value problem

$$Lv + \lambda v = 0 \text{ in } G \quad , \quad v|_{\Gamma} = 0 \quad ,$$

is obtained.
Five theorems and lemmata are given.

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On the Connection Between the Classical and the Generalized Solution of the Dirichlet Problem and of the Problem of Eigen Values

SOV/20-126-6-6/67

There are 8 references, 4 of which are Soviet, 2 German, 1 American, and 1 French.

ASSOCIATION: Moskovskiy gosudarstvennyy universitet imeni M.V.Lomonosova (Moscow State University imeni M.V. Lomonosov)

PRESENTED: March 17, 1959, by S.L. Sobolev, Academician

SUBMITTED: February 24, 1959

Card 2/2

16(1)

AUTHOR: Il'in, V.A.

SOV/20-127-1-5/65

TITLE: Solvability of the Mixed Problem for a Hyperbolic and a Parabolic Equation in an Arbitrary Normal Cylinder

PERIODICAL: Doklady Akademii nauk SSSR, 1959, Vol 127, Nr 1, pp 23-26 (USSR)

ABSTRACT: The author considers the mixed boundary value problem: 1. for the hyperbolic equation

$$Lu - u_{tt} = -f(x,t) \text{ in the cylinder } \Omega_1 = g \times [0 \leq t \leq 1]$$
$$u(x,0) = \varphi(x) \quad , \quad u_t(x,0) = \psi(x) \quad , \quad u|_\Gamma = 0 \tag{1}$$

2. for the parabolic equation

$$Lu - u_t = -f(x,t) \text{ in the cylinder } \Omega_1$$
$$u(x,0) = \varphi(x) \quad , \quad u|_\Gamma = 0 \, . \tag{2}$$

g is an arbitrary N-dimensional domain bounded by Γ; $x = (x_1, \ldots, x_N)$ is a point from g; $\varphi(x)$ and $\psi(x)$ are functions defined in g; L is a selfadjoint differential operator

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Solvability of the Mixed Problem for a Hyperbolic and a Parabolic Equation in an Arbitrary Normal Cylinder SOV/20-127-1-5/65

$$Lu = \sum_{i,j=1}^{N} \frac{\partial}{\partial x_i} \left[a_{ij}(x) \frac{\partial u}{\partial x_j} \right] - c(x)u$$

of elliptic type defined in $C \supset \overline{g}$; $a_{ij} = a_{ji}$,

$$\sum_{i,j=1}^{N} a_{ij} \xi_i \xi_j \geq \alpha \sum_{i=1}^{N} \xi_1^2 \quad , \quad \alpha = \text{const} > 0 \; ; \; c(x) \geq 0 \text{ in } C \; .$$

The author shows that the problems (1) and (2) are solvable in the classical sense, if Ω_1 is normal, i.e. if the Dirichlet problem for the Laplace equation is solvable in g for every continuous boundary function. Altogether there are given 4 longer theorems.
The author mentions O.A. Ladyzhenskaya, O.A. Oleynik, A.N. Tikhonov, I.A. Shishmarev and S.L. Sobolev.

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Solvability of the Mixed Problem for a Hyperbolic and a Parabolic Equation in an Arbitrary Normal Cylinder SOV/20-127-1-5/65

There are 17 references, 15 of which are Soviet, 1 German, and 1 American.

ASSOCIATION: Moskovskiy gosudarstvennyy universitet imeni M.V.Lomonosova (Moscow State University imeni M.V. Lomonosov)

PRESENTED: March 17,1959,by S.L. Sobolev, Academician

SUBMITTED: February 24, 1959

Card 3/3

163500

32452
S/044/61/000/010/016/051
C111/C222

AUTHOR: Il'in, V.A.

TITLE: On the question of the foundation of the Fourier method for hyperbolic equations

PERIODICAL: Referativnyy zhurnal. Matematika, no. 10, 1961, 42, abstract 10 B 183. ("Tr. Vses. soveshchaniya po differentsial'n. uravneniyam, 1958". Yerevan, AN Arm SSR, 1960, 88-97)

TEXT: In the N-dimensional region g which is bounded by the surface Γ the author considers the mixed problem for the linear hyperbolic equation

$$Lv - v_{tt} = -f(x,t),\ \Omega_1 = g \times [0 < t \leq 1] ,$$

$$v|_{t=0} = \varphi(x) ,\ \frac{\partial v}{\partial t}\Big|_{t=0} = \psi(x) ,\ v|_{\Gamma} = 0 , \qquad (1)$$

where L is the selfadjoint differential operator

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On the question of the foundation ...

$$Lv = \sum_{i,j}^{N} \frac{\partial}{\partial x_i} \left[a_{ij}(x) \frac{\partial v}{\partial x_j} \right] - c(x)v$$

of elliptic type, $c(x) \geq 0$. As a classical solution of the mixed problem (1) the author denotes a function $v(x,t)$ defined in the cylinder $\Omega_1 = g \times [0 \leq t \leq 1]$ which satisfies the conditions: 1) $v(x,t)$ is continuous in the closed cylinder Ω_1 and has continuous derivatives of first and second order in the interior of Ω_1; 2) $\partial v/\partial t$ is continuous in the closed cylinder Ω_1; 3) in every inner point of Ω_1, $v(x,t)$ satisfies the equation $L_v - v_{tt} = - f(x,t)$; 4) in every point x of the closed region g, $v(x,t)$ satisfies the initial conditions $v(x,0) = \varphi(x)$, $\frac{\partial v}{\partial t}(x,0) = \psi(x)$; 5) for every $t \in [0,1]$, $v(x,t)$ satisfies the boundary condition $v|_\Gamma = 0$; 6) the first derivatives of $v(x,t)$ are integrable in the square in Ω_1.

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32452
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On the question of the foundation ...

The author proves the theorem : The classical solution of the problem (1) is represented for an arbitrary N-dimensional region g bounded by a surface Γ of the Lyapunov type and for an arbitrary interval of time $0 \leq t \leq 1$ by the series

$$v(x,t) = \sum_{n=1}^{\infty} u_n(x)\left\{\varphi_n \cos\sqrt{\lambda}_n t + \frac{\psi_n}{\sqrt{\lambda_n}} \sin\sqrt{\lambda}_n t\right\} +$$

$$+ \sum_{n=1}^{\infty} u_n(x) \int_0^t f_n(\tau) \sin\sqrt{\lambda}_n (t-\tau) \frac{d\tau}{\sqrt{\lambda_n}}$$

($u_n(x)$ -- eigenfunctions, φ_n , ψ_n and $f_n(t)$ -- Fourier coefficients of $\varphi(x)$, $\psi(x)$ and $f(x,t)$ with respect to the system $u_n(t)$) if the following conditions are satisfied : 1) $\varphi \in W_2\left(\left[\frac{N}{2}\right]+3\right)(g)$ and besides φ, L , $L^2\varphi$, ... $L^{\left[\frac{N+4}{4}\right]}\varphi$ satisfy the boundary value conditions of first

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kind in the generalized sense ;

2) $\Psi \in W_2^{\left(\left[\frac{N}{2}\right]+2\right)}(g)$ and besides Ψ, $L\Psi$, $L^2\Psi$, ... $L^{\left[\frac{N+2}{4}\right]}\Psi$ satisfy the homogeneous boundary condition of first kind in the generalized sense;

3) $f \in W_2^{\left(\left[\frac{N}{2}\right]+2\right)}(\Omega_1)$ and besides f, Lf, $L^2 f$, ... $L^{\left[\frac{N+2}{4}\right]} f$ satisfy the homogeneous boundary condition of first kind in the generalized sense ;

4) in the closed region g the coefficients $a_{ij}(x)$ have continuous derivatives up to the order $\left(\left[\frac{N}{2}\right]+2\right)$, c(x) up to the order $\left(\left[\frac{N}{2}\right]+1\right)$.

[Abstracter's note : Complete translation.]

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69101

16.3500

S/042/60/015/02/01/~~002~~/18

AUTHOR: Il'in, V.A.

TITLE: On Solvability of Mixed Problems for Hyperbolic and Parabolic Equations

PERIODICAL: Uspekhi matematicheskikh nauk, 1960, Vol 15, No. 2, pp. 97-154.

TEXT: The author considers the classical solvability of the mixed problem for the hyperbolic equation

$$(1)\quad \begin{cases} Lu - u_{tt} = -f(x,t) & \text{in } \Omega_1 = g \times [0 \le t \le 1] \\ u(x,0) = \varphi(x), \quad u_t(x,0) = \psi(x), \quad u|_{x \in \Gamma} = 0 \end{cases}$$

and the solvability with the Fourier method of the mixed problem for the parabolic equation

$$(2)\quad \begin{cases} Lu - u_t = -f(x,t) & \text{in } \Omega_1 \\ u(x,0) = \varphi(x), \quad u|_{x \in \Gamma} = 0. \end{cases}$$

Here g is an N-dimensional domain with the boundary Γ, $x=(x_1,\ldots,x_N)$, $\varphi(x)$ and $\psi(x)$ are functions given in g, $f(x,t)$ is a function given in Ω_1,

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On Solvability of Mixed Problems for Hyperbolic and Parabolic Equations S/042/60/015/02/01/~~002~~/18

L is the selfadjoint operator

$$(3) \qquad Lu = \sum_{i,j=1}^{N} \frac{\partial}{\partial x_i} \left[a_{ij}(x) \frac{\partial u}{\partial x_j} \right] - c(x)u$$

of elliptic type; $c(x) \geqslant 0$.
The principal aim of the present paper is the determination of the minimal conditions which have to be satisfied by Γ in order that (1) has a classical solution or on (2) the Fourier method can be applied.
The principal result is the statement that (1) and (2) are solvable classically or with the Fourier method in an arbitrary normal cylinder Ω_1, if φ, ψ, f and the coefficients of L satisfy certain conditions of smoothness (Ω_1 is denoted to be normal if in g the Dirichlet problem is solvable for the Lapalace equation for every continuous limit function). These results are already announced by the author in a shortened form (Ref. 28, 32). Here they are founded in detail. The author gives a survey of the papers about the mixed problem. The paper contains 6 chapters with 19 paragraphs.

Card 2/3

69101

On Solvability of Mixed Problems for Hyperbolic and Parabolic Equations

S/042/60/015/02/01/002/18

The author mentions S.L.Sobolev, O.A.Oleynik, A.N.Tikhonov, M.V.Keldysh, S.G.Mikhlin, O.A.Ladyzhenskaya, I.A.Shishmarev, V.I.Smirnov, I.G.Petrovskiy, V.A.Steklov, A.I.Barabanov, N.M.Gyunter, D.M.Volkov, Kh.L.Smolitskiy, G.I.Petrashen', and B.M.Budak.
There are 37 references, 33 Soviet, 1 German, 2 American, and 1 French.

SUBMITTED: April 8, 1959

Card 3/3

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16.3500

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C111/C222

AUTHORS: Il'in, V.A., and Shishmarev, I.A.

TITLE: On the Connection Between the Generalized and Classical Solutions of the Dirichlet Problem 16

PERIODICAL: Izvestiya Akademii nauk SSSR, Seriya matematicheskaya, 1960, Vol 24, No. 4, pp. 521 - 530

TEXT: In the arbitrary N-dimensional domain g with the boundary Γ the authors consider the Dirichlet problem

(1) $$Lu = -f \text{ in } g \ , \ u|_{\Gamma} = 0 \ ,$$

where L is an elliptic selfadjoined differential operator

(2) $$Lu = \sum_{i,j=1}^{N} \frac{\partial}{\partial x_i} \left[a_{ij}(x) \frac{\partial u}{\partial x_j} \right] - c(x)u \ ,$$

where $c(x) \geqslant 0$. A function u(x) which is continuous in $(g + \Gamma)$, two times

Card 1/2

84746

S/038/60/024/005/004/004
C111/C222

16.3500

AUTHORS: Il'in, V.A. and Shishmarev, I.A.

TITLE: On the Equivalence of Systems of Generalized and Classical Eigenfunctions

PERIODICAL: Izvestiya Akademii nauk SSSR, Seriya matematicheskaya, 1960, Vol. 24, No. 5, pp. 757 - 774

TEXT: In the N - dimensional domain g with the boundary Γ the author considers the eigenvalue problem

$$(1) \qquad \begin{cases} Lu + \lambda u = 0 & (\text{in } g) \\ u|_{x \in \Gamma} = 0 \end{cases}$$

where

$$(2) \qquad Lu = \sum \frac{\partial}{\partial x_j} \left(a_{ij}(x) \frac{\partial u}{\partial x_j} \right) - c(x) \cdot u$$

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On the Equivalence of Systems of Generalized and Classical Eigenfunctions

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C111/C222

is a linear selfadjoint operator of elliptic type and $c(x) \geqslant 0$. Under these conditions theorem 1 asserts: Let g be a normal domain (i.e. let the Dirichlet problem for the Laplace equation for every continuous boundary function be solvable in g, cf. (Ref. 4)) and let it lie together with Γ in an open domain C. Let the coefficients of L belong to the classes

(5) $a_{ij}(x) \in C^{(1,\mu)}$, $c(x) \in C^{(0,\mu)}$ $(\mu > 0)$.

Then there exists a complete orthogonally normed system of the classical eigenfunction of (1).
As a generalized eigenfunction of (1) the author denotes a function $u(x)$ not equivalent to zero which belongs to the class $\overset{0}{D}(g)$ ($D(g)$ is the closure with respect to the norm of the $W_2^{(1)}(g)$ of the set of functions continuously differentiable in g which vanish in a certain boundary strip of the domain g) and which satisfies the identity

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$$(4) \qquad \int_g \left[\sum_{i,j=1}^{N} a_{ij} \frac{\partial u}{\partial x_i} \frac{\partial \psi}{\partial x_j} + c\,u\,\psi - \lambda\,u\,\psi \right] dx = 0$$

for each function $\psi(x) \in \overset{0}{D}(g)$.

Theorem 2: If the assumptions of theorem 1 are satisfied, then the orthogonally normed systems of the generalized and the classical eigenfunctions of the problem (1) as well as the corresponding systems of the eigenvalues are identical.

If g is not only normal but bounded by a surface Γ of the Lyapunov type, then it is sufficient when the $a_{ij}(x)$ and $c(x)$ satisfy the conditions in $(g + \Gamma)$ formulated in theorem 1 and 2.

The proof of the theorems bases on the investigation of the Green's function of the problem $Lu = -f$, $u|_{x \in \Gamma} = 0$. The existence of the Green's function $K(x,y)$ follows from (Ref. 6). Then the author proves that in g $K(x,y) = K(y,x)$, $K(x,y) > 0$, $K(x,y)$ is continuous everywhere in $g + \Gamma$ with the exception of $x = y$. Then the existence and continuity of the first and second derivatives of K as well as of the regular part of K are proved

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and these derivatives are estimated (lemmas 1 - 4). Then the theorems 1 and 2 are proved with the aid of the Green's function and its properties. The author mentions S.G. Mikhlin. There are 9 references: 6 Soviet, 1 German and 3 American.

PRESENTED: by S.L. Sobolev, Academician

SUBMITTED: April 9, 1959

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C111/C333

AUTHORS: Il'in, V.A., Shishmarev, I.A.

TITLE: Uniform Estimations in the Closed Domain of the Eigenfunctions of an Elliptic Operator and of Their Derivatives

PERIODICAL: Izvestiya Akademii nauk SSSR, Seriya matematicheskaya, 1960, Vol. 24, No. 6, pp. 883 - 896

TEXT: Let the linear self-adjoint differential operator

$$(1) \quad Lu = \sum_{i,j=1}^{N} \frac{\partial}{\partial x_i} \left[a_{ij}(x) \frac{\partial u}{\partial x_j} \right] - c(x)u$$

be given in the open N-dimensional domain C; assume that it is elliptic, i.e. let

$$(2) \quad a_{ij}(x) = a_{ji}(x) \quad \text{and} \quad \sum_{i,j=1}^{N} a_{ij} \xi_i \xi_j \geq \alpha \sum_{i=1}^{N} \xi_i^2 \quad (\alpha = \text{const} > 0)$$

for all $x = (x_1, x_2, \ldots, x_N) \in C$ for arbitrary real $\xi_1, \ldots, \xi_N$. Let

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(3) $a_{ij}(x) \in C^{(1,\mu)}$, $c(x) \in C^{(0,\mu)}$, $\mu > 0$, $c(x) \geq 0$

be in C. Assume that g is an arbitrary open normal domain which lies in C together with its boundary Γ (g is normal, if in g the Dirichlet problem for the Laplace equation is solvable for every continuous boundary function). The authors consider the eigenvalue problem

(4) $$\begin{cases} Lu + \lambda u = 0 & (\text{in } g) \\ u|_{\Gamma} = 0 \end{cases}$$

in g. As it is well-known (4) possesses complete orthogonally normed systems of classical and generalized eigenfunctions, where these systems are identical according to (Ref. 3). All the eigenfunctions correspond to positive eigenvalues.
At first the authors prove the following formula for the eigenfunctions of problem (4) :

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$$(16)\quad u_n^2(y) = \int_G H(x,y)\left\{2\lambda_n u_n^2(x) - \left[2\sum_{i,j=1}^{N} a_{ij}\frac{\partial u_n}{\partial x_i}\frac{\partial u_n}{\partial x_j} + a u_m^2(x)\right]\right\} dx + \int_G u_n^2(x) LH\, dx \quad ,$$

where y is an arbitrary fixed interior point of G ,

$$(12)\quad H(x,y) = \frac{1}{(N-2)\omega_N \sqrt{A(y)}}\left[\sum_{r,s=1}^{N} A_{rs}(y)(x_r - y_r)(x_s - y_s)\right]^{\frac{2-N}{2}} ,$$

$A(y) = \det \| a_{rs}(y) \|$, $A_{rs}(y)$ the ratio of the algebraic complement of the element $a_{rs}(y)$ to the determinant $A(y)$,

$$\omega_N = \frac{2(\sqrt{\pi})^N}{\Gamma\left(\frac{N}{2}\right)} .$$

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Then the authors show : The estimation

(7) $$|u_n(x)| \leq c_2 \lambda_n^{\frac{1}{4}N}$$

holds uniformly in an arbitrary closed domain $(g + \Gamma)$.
A closed domain is said to belong to the class $A^{(k,\mu)}$, if the equation of the boundary surface in local coordinates belongs to the class $C^{(k,\mu)}$ (i.e. if its k-th derivatives satisfy the Hölder condition with the exponent μ). Theorem 2 : If the domain $(g + \Gamma)$ belongs to $A^{k,\mu)}$ and if the $\frac{\partial a_{ij}(x)}{\partial x_k}$, $c(x)$ belong to the class $C^{(k-2,\mu)}$ $(k \geq 2)$ in the closed domain $(g + \Gamma)$, then the eigenfunctions of (4) belong to $C^{(k,\mu)}$ in the closed domain $(g + \Gamma)$.

Theorem 3 : For all $u(x) \in C^{(k,\mu)}$ in $(g + \Gamma)$ there hold uniformly the estimations

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$$(37)\quad u_1 = O\left(u_{k,\mu}^{\frac{1}{k+\mu}} u_o^{\frac{k+\mu-1}{k+\mu}} + u_o R^{-1} \right), \quad 1 \leq k$$

$$(38)\quad u_{1,\mu} = O\left(u_{k,\mu}^{\frac{1+\mu}{k+\mu}} u_o^{\frac{k-1}{k+\mu}} + u_o R^{-(1+\mu)} \right), \quad 1 < k$$

where R is the diameter of g, u_1 the sum of the maxima of the absolute values of all 1-th derivatives of u(x) in $(g + \Gamma)$, $u_{1,\mu}$ the sum of the Hölder coefficients of these derivatives for the exponent μ, where u_o and $u_{o,\mu}$ are the maxima of the absolute value and the Hölder coefficient of the function u(x) in $(g + \Gamma)$.
Theorem 2 is deduced from theorem 1 (theorem of Schauder and Caccioppoli). Theorem 3 and a further theorem 4 contain well-known apriori-estimations

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of Schauder and Caccioppoli (theorem 1 and the estimations of theorem 3 and 4 are contained in (Ref. 4)).
From the estimations of the theorems 1-4 the authors obtain the following results :
1. For the derivatives of the eigenfunctions of (4) it holds uniformly in $(g + \Gamma)$:

$$(9) \quad |u_n^{(k)}(x)| \leq c_4 \lambda_n^{N/4 + k/2}$$

2. for the Hölder coefficient $u_{k,\mu}$ of the k-th derivative of the eigenfunction it holds :

$$(10) \quad u_{k,\mu} \leq c_5 \lambda^{N/4 + k/2 + \mu/2} ;$$

c_4 , c_5 depend on κ, μ is the Hölder exponent.
Kh.L. Smolitskiy, D.M. Eydus and L.N. Slobodetskiy are mentioned.
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Uniform Estimations in the Closed Domain of the Eigenfunctions of an Elliptic Operator and of Their Derivatives

There are 10 references : 7 Soviet, 2 American and 1 French.

[Abstracter's note : (Ref. 3) is a paper of the authors in Izvestiya Akademii nauk SSSR, Seriya matematicheskaya, 1960, 24, 757-774 ; (Ref.4) is the book of Miranda : Partial Differential Equations of Elliptic Type]

PRESENTED: by S.L. Sobolev, Academician

SUBMITTED: April 9, 1959

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C111/C222

11.3500

AUTHORS: Il'in, V.A., and Shishmarev, I.A.

TITLE: Some Problems for the Lu = div[p(x)grad u]-q(x)u Operator With Discontinuous Coefficients

PERIODICAL: Doklady Akademii nauk SSSR, 1960, Vol.135, No.4, pp.775-778

TEXT: Let g be an N-dimensional open region with the boundary Γ; let C be an (N-1)-dimensional region in g being homeomorphic to the sphere and dividing g into g_1 and g_2. Let T be an open region containing $(g+\Gamma)$. In $(g+\Gamma)$ the author considers the following Dirichlet problem:

$$(1)\qquad \begin{cases} L_1u = \operatorname{div}[p_1(x)\operatorname{grad} u]-q_1(x)u = f_1(x) \text{ in } g_1 \\ L_2u = \operatorname{div}[p_2(x)\operatorname{grad} u]-q_2(x)u = f_2(x) \text{ in } g_2 \\ u|_\Gamma = \varphi(x),\ [u]|_C = \psi(x),\ \left[p\frac{\partial u}{\partial n}\right]|_C = \chi(x) \end{cases}$$

where

$[u]|_C \equiv u|_{C-0}-u|_{C+0}$, $\left[p\frac{\partial u}{\partial n}\right]|_C = p_1\frac{\partial u}{\partial n}|_{C-0}-p_2\frac{\partial u}{\partial n}|_{C+0}$, n is the outer normal of g_1 and the symbols C-0 and C+0 mean that the boundary values are taken from the inner and outer side, respectively, of C (with

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respect to g_1).

Definition 1: A function u(x) which satisfies the following conditions is called a classical solution of the problem (1): 1) u(x) belongs to the class $C^{(0)}$ in (g_1+C) and $(g_2+C+\Gamma)$; u(x) belongs to $C^{(1)}$ in (g_1+C) and (g_2+C); u(x) belongs to $C^{(2)}$ in g_1 and g_2; 2) u(x) satisfies the problem (1) in the classical sense. ($C^{(n)}$ and $C^{(n,n)}$ are defined as in (Ref.1)).
The following five conditions (A) are formulated:
1) C belongs to the Lyapunov class, Γ is regular.
2) $p_1(x) \in C^{(1,\mu)}$ in (g_1+C); $p_2(x) \in C^{(1,\mu)}$ in $(T-g_1)$;

$q_1(x) \in C^{(0,\mu)}$ in (g_1+C); $q_2(x) \in C^{(0,\mu)}$ in $(T-g_1)$;

$f_1(x) \in C^{(0,\mu)}$ in g_1; $f_2(x) \in C^{(0,\mu)}$ in g_2; besides:

$f_1(x) \in C^{(0)}$ in (g_1+C); $f_2(x) \in C^{(0)}$ in $(g_2+C+\Gamma)$

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3) $p_i(x) > 0$, $q_i(x) \geq 0$ (i=1,2) everywhere in the regions of definition of them.

4) $\varphi(x)$ is defined and continuous on Γ.

5) $\psi(x)$, χ are defined on C; $\psi \in C^{(1,\mu)}$, $\chi \in C^{(0,\mu)}$.

Theorem 1: If the first and third condition A is satisfied then it exists only one classical solution of (1).

Theorem 2: If all conditions A are satisfied then there exists a unique solution of (1), where it belongs to the class $C^{(1,\mu)}$ in each of the regions (g_1+C) and (g_2+C).

If $\varphi = \psi = \chi = 0$ then the classical solution is simultaneously the generalized solution in the sense of (Ref.4,5).

The Green's function K(x,y) of (1) is symmetrical, continuous in (x,y) everywhere in $(g+\Gamma)$ (inclusively C!) for $x \neq y$, and in $(g+\Gamma)$ it satisfies the estimations

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$$(2)\qquad \begin{cases} |K(x,y)| \leq c_1 + c_2 \ln \dfrac{1}{r_{xy}} & \text{for } N = 2 \\ |K(x,y)| \leq c_3 r_{xy}^{2-N} & \text{for } N > 2 . \end{cases}$$

Then the authors consider

$$(3)\qquad \begin{cases} L_1 u + \lambda u = 0 \quad \text{in} \quad g_1 \\ L_2 u + \lambda u = 0 \quad \text{in} \quad g_2 \\ u|_\Gamma = 0,\ [u]|_c = 0,\ \left[p\dfrac{\partial u}{\partial n}\right]\Big|_c = 0, \end{cases}$$

where L_1 and L_2 are the same as in (Ref.1).

Definition 2: The classical eigenfunction of (3) is a function $u(x) \not\equiv 0$ which 1) satisfies the condition 1) of the definition 1, and 2) for a certain λ satisfies (3) in the classical sense.

Theorem 3: If the first three conditions of A are satisfied then there exists a complete system of classical eigenfunctions of (3) orthogonally

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normed in the $L_2(g)$, where besides each of these eigenfunctions belongs to the class $C^{(1,\mu)}$ in each of the regions (g_1+C), (g_2+C).

Theorem 4: The complete system of classical eigenfunctions of (3) is identical with the complete system of generalized eigenfunctions of (3).

Theorem 5: Under the assumptions of theorem 4 there exists a constant c_0 so that uniformly in $(g+\Gamma)$ it holds

(5) $$|u_n(x)| \leq c_0 \lambda_n^{N/4}$$

(here $u_n(x)$ is an arbitrary eigenfunction of (3) corresponding to the eigenvalue λ_n).

The authors mention D.M.Eydus and O.A.Oleynik; they thank A.N.Tikhonov

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Some Problems for the Lu - div[p(x)grad u]-q(x)u Operator With Discontinuous Coefficients

for advices. There are 8 references: 6 Soviet, 1 German and 1 American.

[Abstracter's note: (Ref.1) concerns Miranda, Partial Differential Equations of Elliptic Type. (Ref.4) concerns Courant and Hilbert, Methods of Mathematical Physics, 2, Chapter 7.]

ASSOCIATION: Moskovskiy gosudarstvennyy universitet imeni M.V.Lomonosova (Moscow State University imeni M.V.Lomonosov)

PRESENTED: June 20, 1960, by I.G.Petrovskiy, Academician

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16.3500

AUTHORS: Il'in, V. A., Shishmarev, I. A.

TITLE: Method of potentials of the Dirichlet-Neumann problem in the case of equations with discontinuous coefficients

PERIODICAL: Sibirskiy matematicheskiy zhurnal, v. 2, no. 1, 1961, 46-58

TEXT: The authors' study is based on an N-dimensional open domain g with a boundary manifold Γ. The domain g divides an (N-1)-dimensional surface C which is homeomorphic to the sphere, into two subdomains g_1 and g_2. The authors deal with the following Dirichlet problem:

$$L_k u = \operatorname{div}\left[p_k(x) \operatorname{grad} u\right] - q_k(x)\, u =$$

$$\sum_{i=1}^{N}\left[p_k(x)\frac{\partial^2 u}{\partial x_i^2} + \frac{\partial p_k}{\partial x_i}\frac{\partial u}{\partial x_i}\right] - q_k(x)\, u = f_k(x) \quad (\text{in } g_k)$$

$$u|_\Gamma = \varphi, [u]|_C = \psi, \left[p\frac{\partial u}{\partial n}\right]\Big|_C = \chi.$$

They assume that C belongs to Lyapunov class of surfaces, that Γ is regular,

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and that the functions $p_i(x)$, $q_i(x)$, $f_i(x)$, φ, ψ, χ belong to certain classes of functions which are more general than the classes of functions corresponding to the classical Dirichlet problem. O. A. Oleynik has proved existence theorems for a similar but more special Dirichlet problem. The authors of the present paper prove the existence and uniqueness of a classical solution of the Dirichlet problem formulated above. Their existence is proved by the method of potentials; explicit solutions are not given. Following this, they discuss the Neumann problem:
$L_1 u = f_1(x)$ in g_1, $L_2 u = f_2(x)$ in g_2,

$\left(p_2 \frac{\partial u}{\partial n_2} + hu\right)\Big|_\Gamma = \varphi$, $[u]\big|_C = \psi$, $\left[p \frac{\partial u}{\partial n}\right]\Big|_C = \chi$, where h is a function given on Γ.

Also for this boundary problem, the authors prove the existence and uniqueness of a classical solution. Finally, they solve the Dirichlet problem in a general way and study its relation to the classical solution. An appendix gives the explicit form of some theorems that were implicitly used or derived in the paper. The authors thank A. N. Tikhonov for discussions of the results obtained. There are 6 Soviet-bloc references.

SUBMITTED: July 2, 1960

YE'IN, V.A.; SHISHMAREV, I.A.

Eigenfunction problem for the operator $Lu=\operatorname{div}[p(x)\operatorname{grad} u]-g(x)u$ having discontinuous coefficients. Sib. mat. zhur. 2 no.4:520-536 Jl '61. (MIRA 14:9)

(Eigenfunctions)

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16.3500

AUTHOR: Il'in, V.A.

TITLE: The solvability of the problems of Dirichlet and Neumann for a linear elliptic operator with discontinuous coefficients

PERIODICAL: Akademii nauk SSSR. Doklady, v. 137, no. 1, 1961, 28-30

TEXT: Let the (N-1)-dimensional surface C homeomorphic to the sphere lie in the open N-dimensional region g with the boundary Γ, and let it divide g into the subregions g_1 (in C) and g_2. Let the open region T contain $g + \Gamma$ in the interior. In $g + \Gamma$ the author considers the Dirichlet problem

$$L_1 u = \sum_{i,k=1}^{N} a_{ik}^{(1)}(x) \frac{\partial^2 u}{\partial x_i \partial x_k} + \sum_{i=1}^{N} b_i^{(1)}(x) \frac{\partial u}{\partial x_i} - c^{(1)}(x)u = f^{(1)}(x) \text{ in } g_1$$

$$L_2 u = \sum_{i,k=1}^{N} a_{ik}^{(2)}(x) \frac{\partial^2 u}{\partial x_i \partial x_k} + \sum_{i=1}^{N} b_i^{(2)}(x) \frac{\partial u}{\partial x_i} - c^{(2)}(x)u = f^{(2)}(x) \text{ in } g_2 \quad (1)$$

$$u|_\Gamma = \varphi , \quad [u]|_C = \psi , \quad \left[\frac{\partial u}{\partial \nu}\right]\Big|_C = \chi ,$$