Automatic Control of Aircraft Engines (Cont.)

It was approved by the Main Board of Polytechnic and Mechanical Engineering Schools of the Ministry of Higher Education, USSR.

COVERAGE: The book presents the theoretical aspects, principles of construction, and special features of layouts and design of automatic devices for aircraft engines. The dynamics of transient processes are investigated and a method for selecting the characteristics of aircraft-engine control regulating systems is given. The book deals with automatic-control mechanisms for reciprocating and gas-turbine aircraft engines.

The book has been expanded from 336 pages (First Edition) to 400.

C[redacted]6

Bodner V.A

PHASE I BOOK EXPLOITATION 359

Zalmanzon, Lev Abramovich, and Cherkasov, Boris Aleksandrovich

Regulirovaniye gazoturbinnykh i pryamotochnykh vozdushno-reaktivnykh dvigateley (Control of Gas-turbine and Ramjet Engines) Moscow, Oborongiz, 1956. 374 p. 6,500 copies printed.

Reviewers: Petrov, B. N., Corresponding Member, USSR Academy of Sciences, and Bodner, V. A., Dr. of Technical Sciences, Prof.; Ed.: Sobolev, O. K.; Ed. of Publishing House: Belitskaya, A. M.; Tech. Ed.: Zudakin, I. M.; Managing Ed. (Oborongiz): Sokolov, A. I., Eng.

PURPOSE: This is a textbook approved by the Ministry of Higher Education for students of aviation vtuzes. It may also be useful to workers specializing in the field of aircraft engines.

COVERAGE: The book is mainly concerned with describing the physical bases of engine control processes and with setting forth methods for experimental research and design of control devices. The close connection in the operation of the

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elements of the control system and of the fuel supply system of the engine is revealed in a number of examples. Characteristics of the individual elements of the oil system are presented. The author thanks V. A. Bodner, B. N. Petrov, V. S. Zuyev, F. A. Korotkov, Yu. P. Portnov-Sokolov and N. V. Inozemtsev for their help in preparing the book. There are 148 references, of which 136 are Soviet (8 translations), 11 English and 1 French.

TABLE OF CONTENTS:

BODNER, V.A.

24-8-1/34

AUTHOR: Bodner, V. A. (Moscow).

TITLE: Auto-oscillations in a system containing a compressor and methods of eliminating such oscillations. (Avtokolebaniya v sisteme s kompressorom i metody ikh ustraneniya).

PERIODICAL: "Izvestiya Akademii Nauk, Otdeleniye Tekhnicheskikh Nauk" (Bulletin of the Ac.Sc., Technical Sciences Section), 1957, No.8, pp. 3-12 (U.S.S.R.)

ABSTRACT: Auto-oscillations, including pumping pulsations, occur in systems with internal positive back-coupling. However, the dynamic properties of the system can be changed in the desired direction, namely, from an auto-oscillatory into a non-auto-oscillatory one by connecting to the system an external negative back-coupling. In addition, it is shown that there is a possibility of eliminating auto-oscillations by means of high speed systems with a negative back-coupling and a method of selection of the parameters of such systems is described. The equations of motion are formulated for a system shown diagrammatically in Fig.4 which consists of a compressor, an inflow and an outflow piping, a storage space and a regulating flap. The stability of motion is investigated and formulae defining the conditions of stability are derived. Furthermore, the periodic movements of the air

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Auto-oscillations in a system containing a compressor and methods of eliminating such oscillations. (Cont.)

In the case of hard excitation, oscillations with the basic frequency and high amplitude will be generated immediately. The frequencies of the auto-oscillations approach the natural frequencies and the frequency correction in the first approximation is determined by the speed of movement of the air and by the hysteresis loop in the compressor characteristic. The amplitude of the auto-oscillations is determined by the type of the compressor characteristic and the parameters of the system connected to the compressor. The auto-oscillations in the system can be eliminated by connecting a closed "anti-pumping" regulator (system with back-coupling), the transfer function of which should be selected from the condition of disappearance of the real roots in the equations (3.4) and (4.21) and respectively (6.1) and (6.6). For a given case the method of selection of the transfer value of the regulator is illustrated. If an anti-hunting regulator is included, the system comprising a compressor will be stable in operation at any air consumption values, including the range of vortex formation. A closed anti-hunting regulator permits elimination not only of the auto-oscillations but also of

24-8-1/34

Auto-oscillations in a system containing a compressor and methods of eliminating such oscillations. (Cont.)

the discontinuous (non-periodic) movement.
There are 6 figures and 2 Slavic references.

SUBMITTED: March 7, 1957.

AVAILABLE: Library of Congress

Card 4/4

BODNER, V.A.

24-58-3-25/38

AUTHOR: Bodner, V. A. (Moscow)

TITLE: Automatic Stabilization of Potentially Unstable Systems. (Ob avtomaticheskoy stabilizatsii potentsial'no neustoychivykh sistem)

PERIODICAL: Izvestiya Akademii Nauk SSSR, Otdeleniye Tekhnicheskikh Nauk, 1958, Nr 3, pp 145-148 (USSR)

ABSTRACT: Numerous hydraulic and pneumatic systems applied for transforming energy and acting as amplifiers operate effectively only if the processes on the output side do not influence the processes on the input side, i.e. if they are unidirectional. Systems in which instability may occur as a result of disturbance of the unidirectional nature are potentially unstable. Examples of such systems are compressors, gas turbines, jet engines, etc. Disturbance of the unidirectional nature of such systems of energy transformation is due to internal parasitic back couplings. In this paper possible methods are considered of eliminating non-steady state regimes by means of closed correcting circuits possessing the requisite dynamic characteristics. It is thereby assumed that the systems under consideration possess a low degree of nonlinearity and that the methods

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Automatic Stabilization of Potentially Unstable Systems.

of the small parameter can be applied to them. The investigations are based on considering the system used for transforming the energy and for amplification as an active quadripole. The conclusion is arrived at that it is necessary to eliminate internal positive back coupling. For this purpose it is necessary to reduce to zero the elements Z_{12}, Y_{12}, H_{12} or G_{12} of the second diagonal of the matrix quadripole. In contrast to servo-stabilization systems, correction systems do not contain internal amplifiers or energy transducers and can be made of elements of the same type as the system to be corrected. It is shown on the example of a compressor how stability can be achieved at any operation regimes. For this purpose the parameters of the correcting quadripole should have a definite frequency dependence and should be functions of the operating conditions (flow rate through the compressor). For correcting a compressor, various correcting quadripoles can be used which have matrices with an equal element Y'_{12} or respectively Z'_{12}, h'_{12} or g'_{12}.

There are 6 figures and 4 Soviet references.

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28(1,2)

PHASE I BOOK EXPLOITATION SOV/2656

Avtomaticheskoye upravleniye i vychislitel'naya tekhnika, vyp. 2 (Automatic Control and Computation Technique, Nr 2) Moscow, Mashgiz, 1959. 316 p. Errata slip inserted. 8,000 copies printed.

Eds.: V.A. Bodner, Doctor of Technical Sciences, Professor, and A.M. Batkov, Candidate of Technical Sciences; Ed. of Publishing House: G.F. Polyakov; Tech. Ed.: B.I. Model'; Editorial Board: V.V. Solodovnikov, Doctor of Technical Sciences, Professor (Chairman); N.N. Bogolyubov, Academician; A. Yu. Ishlinskiy, Corresponding Member, Ukrainian SSR Academy of Sciences; V.V. Kazakevich, Doctor of Technical Sciences, Professor (Deputy Chairman); A.A. Lyapunov, Doctor of Physical and Mathematical Sciences, Professor; B.N. Petrov, Corresponding Member, USSR Academy of Sciences; Ye.P. Popov, Doctor of Technical Sciences, Professor; G.S. Pospelov, Doctor of Technical Sciences, Professor; B.A. Ryabov, Doctor of Technical Sciences, Professor; V.B. Ushakov, Doctor of Technical Sciences; B.V. Anisimov, Candidate of Technical Sciences; V.V. Petrov, Candidate of Technical Sciences; V.N. Plotnikov, Candidate of Technical Sciences, Docent (Scientific Secretary); Managing Ed. for Literature on Machine Building and Instrument Construction (Mashgiz): N.V. Pokrovskiy, Engineer.

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SOV/2636

Automatic Control and (Cont.)

PURPOSE: This book is intended for scientific workers and industrial engineers who are interested in problems of the design and testing of automatic control systems.

COVERAGE: This book is a collection of articles on automatic control. The first two articles pertain to the theory of sampled-data systems. The article by V.P. Perov is devoted to the problem of the synthesis of linear sampled-data systems. As a criterion for the determination of the optimum condition the minimum of the sum of the mean value of the square random error and square dynamic error during a time-restricted transient process is selected. The work of F.M. Kilin explains the methods of analysing transient and stable processes in sampled-data systems with jump-variable parameters, and also the problems of the statistical dynamics of such systems. In the work by Ye.P. Popov a study is made of the problem on diminishing the effect of a number of nonlinearities (relay type, dry friction, backlash, etc.) on the operation of an automatic control system by means of vibrational smoothing of the nonlinear characteristics; in addition an analysis is made of the methods of introducing vibrations by means of a self-oscillating regime. The article by A.D. Maksimov is devoted to the same problem However, here a study is made of vibrational smoothing by means of external periodic action on the

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system and not by means of self-oscillations. In the work by V.V. Kazakevich, the theory of trigger regulators is developed, taking into account the multivaluedness of the path characteristics. It is shown that such an analysis demands the introduction of a many sheeted phase surface. A study is made of setting processes, periodic motions, and their stability. In the article by Yu.A. Mitropol'skiy a study is made of systems described by nonlinear differential equations which are essentially different from linear differential equations and which have a small parameter in such form that when the parameter takes on the value zero, they can be exactly integrated. It is assumed that a number of parameters in the system slowly vary with time. The article by V.V. Petrov and V.Yu. Rutkovskiy is devoted to a study of the problem on the synthesis of optimum servomechanisms which guarantee the derivation of given transient processes and which satisfy given operating conditions; the problems of constructing circuits and the selection of the characteristics of servomechanisms are also studied. In the work by M.V. Starikova, a study is made of nonlinear systems of automatic control described by differential equations with delayed argument which have two or three nonlinear elements. An approximate solution of the problem under slowly varying external action is given. In the article by V.V. Kazakevich and G.M. Ostrovskiy a study is made of an automatic control system when there is dry friction with diminishing characteristics in the servomotor and when derivative feedback is introduced into the circuit. References are given at the end of each article.

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PHASE I BOOK EXPLOITATION SOV/4526

Soveshchaniye po teorii invariantnosti i yeye primeneniyu v avtomaticheskikh ustroystvakh. Kiyev, 1958

Teoriya invariantnosti i yeye primeneniye v avtomaticheskikh ustroystvakh; trudy soveshchaniya (Theory of Invariance and Its Applications to Automatic Devices; Transactions of the Conference Oct. 16-20, 1958) Moscow, 1959. 381 p. No. of copies printed not given.

Sponsoring Agency: Akademiya nauk Ukrainskoy SSR. Otdeleniye tekhnicheskikh nauk.

Resp. Ed.: V.S. Kulebakin, Academician; Editorial Commission: V.A. Bodner, Doctor of Technical Sciences, A.G. Ivakhnenko, Doctor of Technical Sciences, A.Yu. Ishlinskiy, Academician, Academy of Sciences UkrSSR, N.A. Kachanova, Candidate of Technical Sciences, P.I. Kuznetsov, Doctor of Physics and Mathematics, A.I. Kukhtenko, Doctor of Technical Sciences, B.N. Petrov, Corresponding Member, Academy of Sciences USSR, Ye.P. Popov, Doctor of Technical Sciences, G.M. Ulanov, Doctor of Technical Sciences, K.K. Khrenov, Academician, Academy of Sciences UkrSSR, P.I. Chinayev, Candidate of Technical Sciences, and N.M. Chumakov, Candidate of Technical Sciences; Tech. Ed.: G.V. Kruglov.

PURPOSE: This collection of papers is intended for engineers and other specialists working in various fields of automation.

COVERAGE: The collection includes reports and papers presented at the Conference on the Theory of Invariance and Its Applications to Automatic Devices, which was called by the Otdeleniye tekhnicheskikh nauk (Department of Technical Sciences) and the Institut elektrotekhniki (Institute of Electrical Engineering) of the Academy of Sciences of the Ukraine and convened in Kiyev October 16 - 20, 1958. The papers presented are concerned with high-quality automatic control systems designed on the basis of compensating for the effects of disturbances or maintaining the invariance of the quality to be regulated with respect to the disturbances acting on the system. The reports treat the physical and mathematical foundations of invariance in automatic control systems; they also consider methods for designing and calculating invariant systems and problems connected with specific cases of practical applications of compensation in various automatic systems. On the basis of these reports it was established by the Conference that, by utilization of the conditions of compensation and the principle of invariance, it is possible to produce automatic systems and various arrangements which are more perfect from the viewpoint of quality of the regulation and control process, stability, simplicity of construction, and reliability of operation. The following members of the Kiyev Seminar on Automatic Control are mentioned as organizers of the conference: A.I. Kukhtenko, A.G. Ivakhnenko, Yu.G. Kornilov, O.M. Kryzhanovskiy, N.M. Chumakov, N.A. Kachanova, and P.I. Chinayev. References accompany each article.

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BODNER, V.A.

KULEBAKIN, V.S., akademik, otv.red.; BODNER, V.A., doktor tekhn.nauk, red.; IVAKHNENKO, A.G., doktor tekhn.nauk, red.; ISHLINSKIY, A.Yu., akademik, red.; KACHANOVA, N.A., kand.tekhn.nauk, red.; KUZNETSOV, P.I., doktor fiz.-matem.nauk, red.; KUKHTENKO, A.I., doktor tekhn.nauk, red.; PETROV, B.N., red.; POPOV, Ye.P., doktor tekhn.nauk, red.; ULANOV, G.M., doktor tekhn.nauk, red.; KHRENOV, K.K., akademik, red.; CHINAYEV, P.I., kand.tekhn.nauk, red.; CHUMAKOV, N.M., kand.tekhn.nauk, red.; KRUGLOV, G.V., tekhn.red.

[Invariancy theory and its application to automatic devices] Teoriia invariantnosti i ee primenenie v avtomaticheskikh ustroistvakh; trudy soveshchaniia. Moskva, Akad.nauk USSR, Otd-nie tekhn.nauk, 1959. 381 p. (MIRA 13:7)

1. Soveshchaniye po teorii invariantnosti i eye primeneniyu v avtomaticheskikh ustroystvakh, Kiyev, 1958. 2. AN USSR (for Ishlinskiy, Khrenov). 3. Chlen-korresp.AN SSSR (for Petrov). (Automatic control)

SOV/24-59-1-30/35

AUTHOR: ~~Bedner, V.A.~~

TITLE: Conference on the Invariance Theory (Soveshchaniye po teorii invariantnosti)

PERIODICAL: Izvestiya Akademii Nauk SSSR, Otdeleniye Tekhnicheskikh Nauk, Energetika i Avtomatika, 1959, Nr 1, pp 139-141 (USSR)

ABSTRACT: A Conference on the Invariance Theory and its Application to Automation took place on October 16-20th 1958 in Kiyev, arranged by the Department of Technical Sciences of the Academy of Sciences, UkrSSR, in conjunction with the Automation Division of the Kiyev Mining Seminar. The importance of the invariance theory was described by Ishlinskiy in his opening speech. The papers submitted to the conference were divided into two groups. The first group consisted of: "The Invariance theory as a basic principle of efficient control and management", V.S.Kulebakin; "The full compensation of the disturbances caused by manoeuvering in gyroscopic systems" by A.Yu.Ishlinskiy; "Combined control in both general and quantity control" by A.G.Ivakhnenko; "Problem of the invariance theory in the control of deflection" by A.I.Kukhtenko; "Invariance theory to a

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Conference on the Invariance Theory

in the combined, nonlinear systems of control with the disturbance determined by the modulus" by G.M.Ulanov; "The fundamental principles of design and structural properties of the combined system of control" by B.N.Petrov. The second group consisted of: "The calculation of the servomechanism of the combined system of operation by the method of logarithmic frequency characteristics" by V.A.Besseksrskiy and S.M.Fedorov; "On the application of disturbances control in a highly controlled system" by V.M.Kuntsevich; "The stability of a symmetrically coupled system with combined control" by L.V.Tsukernik; "The independent and combined control of the parameters of aircraft motion" by G.S.Pospelov; "On problems of synthesis of linear systems of combined control" by P.I.Chinayev; "On the theory of uniform type of coupled systems of automatic control with a symmetric cross-coupling" by V.T.Morozovskiy; "A new method of application of the classical method of computation of power-compensating servomechanisms" by V.N.Yavorskiy; "On application of the principle of compensation for designing automatic stabilising systems"

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by V.A.Bodner. Others who submitted papers were: P.I.Dekhtyarenko; G.K.Nechayev; V.I.Nechiporenko; A.I.Sud-Zlochevskiy; Yu.G.Kornilov; A.N.Milyakh and B.Ye.Kubyshkin; O.M.Kryzhanovskiy; V.G.Vasil'yev; V.I.Kostyuk and others. The conference accepted the motion which emphasised the following points:
1) the invariance theory becomes generally accepted as a method of compensating the effect of external disturbances;
2) the compensation method of external disturbances was first elaborated in the USSR by Professor G.V.Shchipanov; further mathematical analysis in this field was carried out by N.N.Luzin, P.I. [illegible], A.G.Ivakhnenko, B.N.Petrov, V.S.Kulebakin and A.Yu.Ishlinskiy;
3) the Soviet scientists developed the invariance theory and related to it a non-linear system of automatic control;
4) the compensation method has been sufficiently developed so that its applications in the engineering fields became practicable;
5) the compensation method has been employed with great

success during the last 10 years in the navy, aviation, artillery, power stations, etc; therefore, it is advisable that:
1) the compensation method should be generally adopted;
2) the theoretical principles and the experimental data of automation and other dynamical systems affected by the deviation of control should be propagated;
3) the problems of compensation and the invariance theory should be discussed in schools and factories where automation is being introduced;
4) the papers submitted to this conference should be published;
5) preparation should be made for the International Convention on Automation in 1960;
6) research should be intensified in (a) the control and operation of linear systems with a time coefficient and delaying action, non-linear systems and systems with multi-controls, self-control and computing systems, (b) method of analysis and synthesis, (c) methods of measurements of disturbing factors, (d) determination of disturbances by the statistical method and (e)

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standardisation of the terminology in the field of control and operation;

7) in view of the slackness of the Commission on Automation, Academy of Sciences, USSR, formed April 1st, 1941 under Professor G.V. Shchipanov, the conference asks for a fresh move in this matter;

8) this report should be published in the scientific press.

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SOV/24-59-3-3/33

AUTHORS: Bodner, V. A., Seleznev, V. P., Ovcharov, V. Ye. (Moscow)

TITLE: The Theory of Inertial Damped Systems of Arbitrary Period that are Invariant with Respect to Changes in the Object.

PERIODICAL: Izvestiya Akademii nauk SSSR. Otdeleniye tekhnicheskikh nauk, Energetika i avtomatika, 1959, Nr 3, pp 11-18 (USSR)

ABSTRACT: The paper deals with inertial guidance systems containing more than one feedback loop. Fig 1 shows the general system the authors envisage as moving at a constant speed at a fixed distance from the surface of a spherical earth; Eqs (1.1) are the equations of motion, and Fig 2 shows the corresponding structural diagram. The platform is assumed to rotate about the vertical at a speed related to the latitude ϕ and longitude λ by $(\omega_3 + \dot{\lambda}) \sin \phi$, where ω_3 is the angular velocity of the earth. Eq (1.2) is found by differentiating the first equation in (1.1). Then (1.3) gives the compensation condition (the condition that the system is invariant with respect to a perturbation (acceleration)). The result system is at the boundary between

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SOV/24-59-3-3/33

The Theory of Inertial Damped Systems of Arbitrary Period that are Invariant with Respect to Changes in the Object

stability and instability; damping may be introduced via the dotted unit shown in Fig 3, or via the unit K_3 (full line). Eqs (1.6) and (1.5) relate respectively to these two cases. However, both forms of damping cause the condition (1.3) to be violated. The next paragraphs (Eqs (1.7) to 1.10)) illustrate the point that, if such a system is used as an indicator of location in a closed-loop control system, the damping introduced by these internal feedbacks is lost and the larger system becomes unstable. The second major division of the paper deals with systems in which the information about the position of the object in terrestrial co-ordinates is supplied by some non-inertial system not specified; this latter information is also assumed to be very much more accurate than the information supplied by the inertial system. This topic is treated very cursorily. The third major division is concerned with the errors introduced by errors in the information supplied to the inertial system; the errors are assumed random, and the usual result is reached. The last section deals with the effects of the

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The Theory of Inertial Damped Systems of Arbitrary Period that are Invariant with Respect to Changes in the Object

finite speed of the object on the working of the inertial system, and it is shown that the system ceases to function properly when the escape velocity is approached. The paper contains 6 figures and 4 references, 3 of which are Soviet and 1 English.

SUBMITTED: February 18, 1959.

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SOV/24-59-4-15/33

AUTHORS: Bodner, V.A. and Kazakevich, V.V. (Moscow)

TITLE: Stability of Compressors as Non-linear Elements in Extended Systems

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh nauk, Energetika i avtomatika, 1959, Nr 4, pp 116-125 (USSR)

ABSTRACT: The compressor is one supplying compressed air to remote points through narrow pipes; the compressor is controlled by the pressure prevailing at a fairly distant point. The equations of motion (taken from Ref 1) are (1.1), where u, p and ρ are, respectively, the speed, pressure and density, d is the diameter of the pipe, α and m are coefficients representing viscous resistance and γ is the ratio of the specific heats. It is assumed that the pipe (Figure 1) is loaded at the ends by acoustic impedances Z_1 and Z_2; the boundary conditions are then (1.2), where p_1 and p_2 are the total pressures at the input and the output, respectively; p_{01} and p_{02} are the constant components of those

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pressures; Q_1 and Q_2 are flows (in volume terms) and q_1 and q_2 are excess flows (again in volume terms). The equations are linearized (Ref 1) as (1.3 and (1.4), with the symbols defined at the top of p 117; the boundary conditions are put as (1.5). It is assumed that h_{11} and h_{21} are constant for the purposes of examining the stability, though this is not so in unstable modes (variation in $\partial F/\partial Q_2$ is used as a test for instability).
In the second section, the equations are solved using the form given by Eqs (2.1) and (2.2), which with (1.3) and (1.4) give (2.3) for the input pipe and (2.4) for the output pipe; the corresponding solutions are (2.5) and (2.6), where Z_{11} and Z_{22} are the wave impedances of the pipes. Eq (2.7) gives the constants A and B ; this system has a solution only if (2.8) is complied with. The two equations derived from (2.8) are (2.9).

Then (2.8) is put as (2.10), with $E_{11} = -E_{12}$.
In section 3, the compressor is assumed to be connected to a pipe terminated by an impedance Z_2, with an impedance Z_1 at the input by the compressor (here $l_1 = 0$). The substitutions at the top of p 119 are then made, to give (3.1), which then splits up into Eqs (3.2) and (3.3); these equations show that the natural frequencies of the system depend only on the pipe and terminating impedance and that there are two series of frequencies given by Eq (3.4). First, the roots corresponding to the + sign are considered, with $|Z_2| \ll Z_{22}$; we then have Eq (3.5), which leads to a contradiction. Therefore, $|Z_2| \gg Z_{22}$ and we have Eq (3.6). Then the -sign is taken, again with $|Z_2| \ll Z_{22}$; this gives Eq (3.7). The case $|Z_2| \gg Z_{22}$ gives Eq (3.8). This argument shows that the minus sign must

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be taken and Eq (3.9) gives the frequencies. The subsequent analysis deals with the stability limits, which are given by Eq (3.13); the case $\psi = 0$ is considered in detail. Here, Eq (3.12) becomes (3.15), which implies Eqs (3.16) and (3.17); these define, respectively, the regions of dynamic and static stability. Figure 2 illustrates this. Figure 3 shows lines of constant decrement.

The next section deals with the effects of radiation from the open end of the pipe, assumed fitted with an infinite flange. Figure 4 illustrates the results in general terms. Eqs (3.19) onwards deal with the effects of an impedance Z_1 connected at the compressor end; at no point can the system then become absolutely unstable. The system is, respectively, least and most stable when the two equations for R_1 apply. The final two sections deal with other special cases, the significance of which

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Stability of Compressors as Non-linear Elements in Extended Systems

is clear from the conditions in the text immediately preceding the equations.

There are 3 figures and 3 Soviet references.

SUBMITTED: February 27, 1959

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AUTHORS: Bodner, V. A., and Kozlov, M. S. (Moscow)

TITLE: Response of a Control System Containing Slow Coordinate Sensons

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh nauk, Energetika i avtomatika, 1959, Nr 6, pp 99-107 (USSR)

ABSTRACT: Closed-loop systems of autopilot type are considered; Fig 1 shows the way in which the system is to be considered as regards deviation in a lateral direction from a specified path. Fig 2 relates similarly to deviation in a vertical plane and to control of the speed. Eq (1.2) is the control law applicable to Fig 1; Fig 3 shows the equivalent block diagram. Eq (1.3) relates to the lateral acceleration arising from wind forces. After this general introduction, section 2 deals with undamped systems; the equations are compiled on the basis of Fig 3. Up to (2.4) it is assumed that (1.1) is complied with; past that point it is assumed that $k_1k_2 - 1/R = n/R$ $(n \ll 1)$. Section 3 deals with damped systems, and is concerned very largely with stability. Section 4 deals with the same general

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Response of a Control System Containing Slow Coordinate Sensons

problem, except that the machine is not rigorously confined to a specified path, but rather has to pass between two specified points in space; in that case the damped system can be made adequately stable. There are 4 figures and 2 references, 1 of which is Soviet and 1 English.

SUBMITTED: June 10, 1959

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16(1) SOV/20-125-5-8/61

AUTHORS: Bodner, V. A., Ovcharov, V. Ye., Seleznev, V. P.

TITLE: On the Synthesis of the Invariant Damped Inertial Systems With Arbitrary Period (O sinteze invariantnykh dempfirovannykh inertsial'nykh sistem s proizvol'nym periodom)

PERIODICAL: Doklady Akademii nauk SSSR, 1959, Vol 125, Nr 5, pp 986-988 (USSR)

ABSTRACT: Reference is first made to several earlier papers dealing with this subject. The present paper describes a method for the synthesis of a damped inertial system with arbitrary period, which is invariant (with an accuracy up to ε) with respect to arbitrary external disturbances. On a platform which is free in the azimuth (and which moves within a constant distance from the center of the earth) two accelerometers, whose axes are perpendicular to each other, are assumed to be located. The axes are located in the plane that is perpendicular to the place vertical. First, the equations of the gyroplatform are written down, explained, and simplified. In this way

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On the Synthesis of the Invariant Damped Inertial Systems With Arbitrary Period

SOV/20-125-5-8/61

$\ddot{\alpha} + \Omega_0^2 \alpha = 0$, $\beta + \Omega_0^2 \ddot{\beta} = 0$ is obtained. Here α and β denote the small angles of the deviation of the gyrovertical from the place vertical in the direction of the x-axis, and y-axis respectively, T - the period of M. Shuler, and it holds that $\Omega_0^2 = (2\pi/T)^2 = g/R$. The gyroplatform is, under the above-mentioned conditions, invariant with respect to any external disturbances, with the exception of the variations of the initial conditions. The instrumental errors of the system (which are equivalent to the external disturbances) are in this case not taken into account. The first integrals of the acceleration components are apparently the components of the velocity of the object (in consideration of the peripheral velocity of the earth). The second integrals are the components of the path covered. Consequently, the velocity vector and the position coordinates of the object can be determined. In the case of initial conditions different from zero, undamped oscillations, however, occur in the system. When determining α and β, and, consequently also the position

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of the object, considerable errors are committed. Let an external discrete "information" concerning the velocity and the coordinates of the object be assumed to act upon the object. In this case the approximated values of the angles $\alpha \pm \Delta_1$ and $\beta \pm \Delta_2$ as well as of the angular velocities $\dot{\alpha} \pm \Delta_3$ and $\dot{\beta} \pm \Delta_4$ can be computed, where Δ_1, Δ_2, Δ_3 and Δ_4 denote the errors of angles and angular velocities due to the inaccuracy of the external information. These errors are limited with respect to the modulus and do not exceed small magnitudes of the order ε. In the general case, these errors Δ may be random functions of time. The equations of motion resulting from taking these errors into account are written down. For the construction of the invariant damped inertial systems with arbitrary period an external information is thus necessary, which may enter into the system discretely or continuously. In the case of a discrete entering of the information the pauses may be arbitrary. There are 2 figures and 3 Soviet references.

PRESENTED: November 13, 1958, by V. S. Kulebakin, Academician

REBROV, Mikhail Fedorovich, inzh.-kapitan; BODNER, V.A., prof., doktor tekhn.nauk, general-mayor inzh.-tekhn.sluzhby, red.; DRUZHININSKIY, M.V., red.; SOKOLOVA, G.F., tekhn.red.

[The role of automatic devices on an airplane] Chto delaiut avtomaty na samolete? Pod red. V.A.Bodnera. Moskva, Voen.izd-vo M-va obor.SSSR, 1960. 177 p. (MIRA 14:2)
(Airplanes--Controls)

PHASE I BOOK EXPLOITATION SOV/4275

Avtomaticheskoye upravleniye i vychislitel'naya tekhnika, vyp. 3 (Automatic Control and Computer Techniques, No. 3) Moscow, Mashgiz, 1960. 489 p. Errata slip inserted. 7,000 copies printed.

Ed. of Publishing House: G.P. Polyakov; Tech. Ed.: T.F. Sokolova; Managing Ed. for Literature on Machine Building and Instrument Making (Mashgiz): N.V. Pokrovskiy, Engineer; Editorial Board: V.V. Solodovnikov, Doctor of Technical Sciences, Professor (Chairman), N.N. Bogolyubov, Academician, A.Yu. Ishlinskiy, Academician, Ukrainian SSR, V.V. Kazakevich, Doctor of Technical Sciences, Professor (Deputy Chairman), A.A. Lyapunov, Doctor of Physics and Mathematics, Professor, B.N. Petrov, Corresponding Member, Academy of Sciences USSR, Ye.P. Popov, Doctor of Technical Sciences, Professor, G.S. Pospelov, Doctor of Technical Sciences, Professor, B.A. Ryabov, Doctor of Technical Sciences, Professor, B.V. Anisimov, Candidate of Technical Sciences, Docent, V.V. Petrov, Doctor of Technical Sciences, Docent, V.N. Plotnikov, Candidate of Technical Sciences, Docent (Scientific Secretary), V.B. Ushakov, Doctor of Technical Sciences.

PURPOSE: This book is intended for scientific workers, engineers, and aspirants working in the field of automatic control.

COVERAGE: The book is the third collection of reports read at the seminar on automatic control and computer engineering of the NTO priborostroyeniya (Scientific and Technical Society for Instrument Making), the MVTU im. Baumana (Moscow Higher Technical School imeni Bauman), and the MAI im. Ordzhonikidze (Moscow "Order of Lenin" Aviation Institute imeni Ordzhonikidze). It contains papers on current topics in automatic control and computer engineering which, according to the author, are significant for the solution of problems involved in the complex automation of industrial processes by means of control machines and includes discussion of the design of linear and nonlinear automatic control systems. The book covers some questions related to the dynamics of such systems, ways of increasing operational speed, and means of obtaining optimum transient processes. Automatic control systems involving discrete computers, systems with variable parameters, sampled-data control systems, the dynamic accuracy of these systems during random motions, and the theory of sampled-data systems are discussed. No personalities are mentioned. References are found at the end of each article.

AVAILABLE: Library of Congress

Card 4/4

AC/rb/efa
9/21/60

Bodner, V.A.

PHASE I BOOK EXPLOITATION SOV/4364

Bodner, Vasiliy Afanas'yevich, Gavriil Oskarovich Fridlender, and Nikolay Iosifovich Chistyakov

Aviatsionnyye pribory (Aircraft Instruments) Moscow, Oborongiz, 1960. 512 p. Errata slip inserted. 10,000 copies printed.

Reviewer: B.A. Ryabov, Doctor of Technical Sciences, Professor; Ed. (Title page): V.A. Bodner, Doctor of Technical Sciences, Professor; Ed. (Inside book): O.N. Burakova; Tech. Ed.: L.A. Garnukhina; Managing Ed.: S.D. Krasil'nikov, Engineer.

PURPOSE: This is a textbook for students of aviation institutions of higher education taking a course on aircraft instruments. It may also be useful to engineering and technical workers interested in instrument production.

COVERAGE: The book presents the theory, construction principles, special features, operating principles, and design elements of instruments controlling power plants and piloting and navigating instruments. Special attention is given to the theory of errors and methods of instrument compensation. The book also discusses measuring methods and diagrams of instruments which may be used in the future. The introduction and Chs. I, III, V, VI, VIII-XIV, sec. 1 and 2 of Ch. IV,

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and sec. 1, 2, 3, 5 of Ch. VII were written by V.A. Bodner; Ch. II, sec. 4 of Ch. VII, sec. 1-4 of Ch. XV, sec. 1-6 of Ch. XVI and Ch. XVII by G.O. Fridlender; sec. 3-5 of Ch. IV by N.I. Chistyakov; sec. 5 of Ch. XV, and sec. 7 of Ch. XVI, by M.S. Kozlov; parts of sec. 5 of Ch. XI, and sec. 5 of Ch. XII, by V.V. Olizarov. No personalities are mentioned. There are 31 references, all Soviet.

TABLE OF CONTENTS:

69807

S/024/60/000/01/009/028

3,3400 E081/E335

AUTHORS: Bodner, V.A. and Seleznev, V.P. (Moscow)

TITLE: Theory of an Imperturbable System Having Three-coordinate Gravitational Compensation

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh nauk, Energetika i avtomatika, 1960, Nr 1, pp 76-85 (USSR)

ABSTRACT: The paper deals with an inertial guidance system having a computer that inserts in each of the three accelerometer channels a signal corresponding to the gravitational acceleration that the accelerometer ought to register (but cannot). Much of the paper is concerned with transforming between coordinate systems (cartesian and spherical polar) and with the effects of errors in the initial settings of the gyroscopes (accelerometers) and in the gravity-compensation signals. It is assumed for this purpose that the vehicle is moving in the gravitational field of a single body (or equivalent single body). The characteristic equation is derived and it is shown that the system is unstable in all channels, even if the channels are not coupled; the calculated coordinates diverge steadily from the true ones and also

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oscillate about their mean values. The period of the oscillation is comparable with the period of a satellite describing a circular orbit about the gravitating body; the time-constant of the divergence is the time-constant of the motion of a vehicle moving with the escape velocity. Brief mention is made at various points of the need to correct such a system by means of external information, e.g. from sightings on fixed stars. There are 5 figures and 3 references, 2 of which are English and 1 Soviet.

SUBMITTED: August 27, 1950

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APPROVED FOR RELEASE: 06/09/2000 CIA-RDP86-00513R000205720019-5"

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E140/E135

3.3000

AUTHORS: Bodner, V.A., and Seleznev, V.P. (Moscow)

TITLE: The Theory of Errors in Space-Astronavigation 9

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh nauk, Energetika i avtomatika, 1960, Nr 2, pp 73-82 (USSR)

ABSTRACT: Statement of the problem. It has been shown previously (Refs 1-3) that the position of a space vehicle may be determined by photoelectric servosystems to a precision of 10^{-4}, fully satisfactory for interplanetary travel. To determine the velocity of the space vehicle, however, an inertial system (Ref 4) is necessary. The errors of position determination are due not only to measurement errors, but also the errors of the epheremides of the heavenly bodies, errors in the measurement of time, and to the geometrical properties of the method. The term heavenly bodies is applied to all bodies within the Solar system (sun, planets).

1. Principles of interplanetary astronavigation. The basis of astronomical methods of interplanetary navigation is the use of position surfaces - the loci of the probable locations of the vehicle. Three position surfaces are necessary to determine the coordinates of a vehicle.

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The Theory of Errors in Space-Astronavigation

A number of points may be obtained, one of which is the true position, and a knowledge of the approximate location permits selection of the true position. Photoelectric servosystems permit measurement of the following angular astronomical parameters: direction to the centres of heavenly bodies, the angles between these directions and the angles subtended by heavenly bodies. Measurement of the angle subtended by the apparent diameter of a heavenly body gives a surface of equal diameters (Eq 1.1). Measurement of the angle between the direction to a star and the centre of a heavenly body gives a surface of equal angles (Eq 1.2). The surface of equal angles between the centres of two heavenly bodies is a toroid (Eq 1.3).

2. Systematic errors of measurement of navigational elements. The absolute distances between heavenly bodies are known to within 10^{-4}. The photoelectric servosystem determines the centre of brightness, a function of the phase of the planet. This error increases with approach of the vehicle to the measured heavenly body. Measurement

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of the apparent diameter is connected with errors due to the surface characteristics of the heavenly body (atmosphere, deviations from spherical shape, corona, etc). In the measurement of stars errors are due to the aberration of light and the proper motion of the star. At a velocity of 100 km/sec the angular shift of the ray (Eq 2.1) may reach 1'. Using binary stars errors arise from the differing brightnesses. In the measurement of planets, the finite velocity of light is a cause of error. 3. Navigation method based on measurement of diameters of three heavenly bodies. In this method the error increases proportionally to the square of the distance from the heavenly body and decreases with use of bodies with larger diameters. There is a limiting distance from the measured heavenly body, dependent on the resolution of the photoelectric servosystem. The error increases without limit as the angles between the heavenly bodies tend to zero. The smallest error is obtained with the angles between the heavenly bodies mutually at 90°.

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4. Navigation method based on measurement of diameters of two heavenly bodies and the direction to a star. Again the errors increase without limit as the angles between the directions to the heavenly bodies tend to zero. These angles should be not less than 20 to 30°. The distances to the heavenly bodies should also not exceed the limiting values.

5. Navigation method based on measurement of the diameter of a heavenly body and the directions to two stars. Geometrically this method is identical with the well-known method of terrestrial navigation based on the measurement of the zenithal distances of two stars. This method is useful only in flight close to the heavenly body.

6. Navigation method based on measurement of the angles between the centres of three heavenly bodies. The minimum error is obtained with mutually perpendicular directions.

7. Comparison of the methods. In all navigation methods based on the measurement of heavenly bodies (planets) it is necessary to measure time and to know the epheremides

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The Theory of Errors in Space-Astronavigation

of the planets. This may be achieved by the use of special clocks or the measurement of a fourth heavenly body with known epheremides. Each navigation method gives best results under certain conditions. For remote navigation it is convenient to employ methods based on measurement of angles between centres of three heavenly bodies or two heavenly bodies and a star. For close navigation including landing on the surface of a heavenly body the method based on measurement of angles between centres of the heavenly body and two stars and the apparent diameter of the body may be used. Since the choice of stars is very wide, the limitations of the method are easily eliminated. An example of a system for astronavigation is given in block diagram (Fig 9). The apparent diameter of a heavenly body is found by scanning its surface through a telescope. There are 9 figures, 1 table and 4 references, of which 3 are Soviet and 1 is English.

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SUBMITTED: September 24, 1959

80949
S/024/60/000/03/011/028
E140/E463

3,3000

AUTHORS: Bodner, V.A. and Seleznev, V.P. (Moscow)

TITLE: On the Theory of Stable Systems with 3 Channels for Automatic Compensation of Gravitational Acceleration, Corrected by External Information

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh nauk, Energetika i avtomatika, 1960, Nr 3, pp 84-95 (USSR)

ABSTRACT: The position and velocity coordinates required for the navigation of an object in space may be measured either by a hyperinertial (Ref 1) or astronomical (Ref 2) navigational system. The information obtained from the hyperinertial navigational system is very reliable concerning velocities but is subject to high positional errors while the astronavigational system permits measuring the coordinates to high accuracy but the information on velocities is subject to large error. The present work considers a combined system termed astroinertial with three automatic compensation channels. The information from the astronomical system is used not only to reduce error in coordinate measurement but also to control the dynamic properties of the inertial system (eliminate instability, introduced damping and reduction

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of period of oscillation). The astroinertial system includes photo-servosystems for tracking heavenly bodies or stars, a gyroscopic platform, 3 accelerometers with axes directed along the adopted coordinate system, integrators for calculating velocities and coordinates, calculators for generating acceleration compensation signals, for processing the telescope control signals and for calculating corrections to the coordinates given by the inertial system. The improvement of the dynamic properties mentioned is obtained by summing the feedback signals with the output signals of the accelerometers and first integrators. The equations of the astroinertial system are given and the errors of the automatic system for compensating gravitational acceleration are analysed. The stability of the compensation system is analysed with the assumption that the telescopes are exactly aimed and that the space vehicle is in a gravitational field. A theorem is

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presented giving the characteristic equation of the automatic compensation system for gravitational acceleration and stating that by choice of transfer factors in the feedback networks arbitrary frequency and attenuation of error may be obtained. The accumulation of error during periods in which the astronomical objects are not visible so that correction for the inertial system measurements cannot be carried out is then analysed. Sources of error in the system are: errors of astronomical measurements, errors in the assumed masses, dimensions and ephemerides of heavenly bodies, errors of the automatic compensation system, instrumental errors of the accelerometers, integrators, calculators, photo-servomechanisms, astrodomes etc. It is found that the critical element of the system is the astronomical measurement system. Two methods of employing the astronomical information are proposed. In the first, three surfaces of position (Ref 2) are obtained. This method suffers from

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restrictions in the choice of stars suitable as points of reference and the computer is complicated. In the second method, the directions to the stars are used only to eliminate angular deviation of the gyroplatform with respect to the inertial coordinate system. Here the possible choice of stars is wider and the computer is simpler. Numerical examples of the error to be expected from the system under various conditions of space navigation are considered. During periods when accumulated errors in position measurement are being reduced, errors may arise in velocity measurement. There are three types of operation of the astroinertial system: "memory" in the absence of visible heavenly bodies, during which error is continuously accumulated; forced elimination of error of position; normal operation, where the natural frequency of the system is close to the frequency of rotation of the space vehicle

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On the Theory of Stable Systems with 3 Channels for Automatic Compensation of Gravitational Acceleration, Corrected by External Information

about the celestial body. There are 4 figures and 3 Soviet references.

SUBMITTED: October 1, 1959

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BODNER, V.A.; KAZAKEVICH, V.V.

Stability and self-oscillations of acoustical systems containing compressors and the use of negative feedback to suppress self-oscillations. Avtom. upr. i vych. tekh. no.3:445-489 '60. (MIRA 13:11)
(Compressors—Aerodynamics) (Oscillations)

FRIDLENDER, Gavriil Oskarovich, doktor tekhn. nauk, prof.; KOZLOV, Mikhail Stepanovich, kand. tekhn. nauk, dotsent; RYABOV, B.A., doktor tekhn. nauk, prof., retsenzent; BROMBERG, P.V., doktor tekhn.nauk, prof., retsenzent; BODNER, V.A., doktor tekhn. nauk prof., red.; SUVOROVA, I.A., red. izd-va; NOVIK, A.Ya., tekhn. red.

[Aeronautical gyroscopic instruments] Aviatsionnye giroskopicheskie pribory. Pod red. V.A.Bodnera. Moskva, Gos.nauchno-tekhn. izd-vo Oborongiz, 1961. 390 p. (MIRA 15:1)
(Artificial horizons (Aeronautical instruments))
(Gyroscopic instruments)

BK

PHASE I BOOK EXPLOITATION SOV/5894

Bodner, Vasiliy Afanas'yevich, and Mikhail Stepanovich Kozlov

Stabilizatsiya letatel'nykh apparatov i avtopiloty (Stabilization of Aircraft and Automatic Pilots) Moscow, Oborongiz, 1961. 508 p. Errata slip inserted. 10,000 copies printed

Ed. (Title page): V. A. Bodner, Doctor of Technical Sciences, Professor; Reviewers: B. N. Petrov, Academician; Ye. G. Isvol'skiy, Candidate of Technical Sciences, Docent; and I. A. Mikhalev, Candidate of Technical Sciences; Ed. of Publishing House: I. A. Suvorova; Tech. Ed.: N. A. Pukhlikova; Managing Ed.: S. D. Krasil'nikov, Engineer.

PURPOSE: This is a textbook for the course "Stabilization of Aircraft and Autopilots" given at aviation schools of higher education. It may also be useful to engineers and technicians interested in the theory and construction of automatic flight-control systems.

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COVERAGE: The book discusses the theory, construction principles, design characteristics, and use of automatic flight-control systems. It covers the theory of automatic control of angular motion, of motion of the center of mass, and of flight speed; semiautomatic control systems; and control systems for the various flight stages (in flight, landing, being guided to terrestrial and aerial targets). The discussion also includes the dynamic characteristics of aircraft and the dynamics of transient processes of closed-loop flight control systems, their transfer functions and frequency characteristics. Methods are presented for determining the transfer coefficients of such systems and their effect on control dynamics. The design characteristics of self-optimizing control systems are also considered. Chs. I, II, IV, V, VI, IX, and XII were written by V. A. Bodner; Chs. III, VII, VIII, X, and XI, by M. S. Kozlov; and Ch. XIII, by both authors. No personalities are mentioned. There are 15 references: 14 Soviet (including 2 translations) and 1 English.

TABLE OF CONTENTS [Abridged]:

APPROVED FOR RELEASE: 06/09/2000 CIA-RDP86-00513R000205720019-5"

SELEZNEV, Vasiliy Petrovich; OL'MAN, Ye.V., inzh., retsenzent; BODNER, V.A., doktor tekhn.nauk, red.; GOTESMAN, Ye.V., kand. tekhn. nauk, red.; BOGOMOLOV, M.F., red. izd-va; ROZHIN, V.P., tekhn. red.

[Navigational instruments] Navigatsionnye ustroistva. Pod red. V.A.Bodnera. Moskva, Gos.nauchno-tekhn.izd-vo Oborongiz, 1961. 615 p. (MIRA 14:12)

(Navigation (Aeronautics)) (Electronics in aeronautics) (Aeronautical instruments)

25753
S/024/61/000/001/007/014
E061/E128

13,2500

AUTHORS: Bodner, V.A., and Seleznev, V.P. (Moscow)

TITLE: A Contribution to the Theory of Inertial Systems Without a Gyroscopically Stabilized Platform

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh nauk, Energetika i avtomatika, 1961, No.1, pp. 143-152

TEXT: This is a continuation of previous work by the authors (Ref.1), "A contribution to the theory of undisturbable systems with three channels of self-compensation of accelerations for gravitational forces", this journal, 1960, No.1. In an inertial system with a stabilized platform accelerometers measure the accelerations of the system while the stabilized platform provides fixed axes of reference. In the inertial system without stabilized platform, which is considered, three accelerometers measure accelerations along the axes of the moving object. The measurements are affected by components due to gravity, and the rotation of the object. The effects of rotation are compensated by signals derived from instruments measuring rotational velocity. The effects of gravity are compensated by a feedback signal from a computer which

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calculates the necessary correction from the position of the object with respect to the celestial bodies affecting it. The position information is derived from the corrected accelerometer signals by double integration. The apparatus gives the position of the object in a moving system of coordinates. To obtain the position of the object in a fixed system of coordinates, information about the angular position of its axes is derived from the measured rotational velocities of the system. This is fed to a computer which transforms the outputs of the accelerometers into measurements along fixed axes. The transformed accelerations are corrected for gravitational effects as described above. Two methods of measuring angular velocities by means of linear accelerometers are described. In each, two accelerometers are placed on each axis of the moving object; in one method the accelerometer axes are perpendicular and in the other parallel to the object axes. The angular velocities are derived from the differences between the accelerometer signals and from the
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distances between them. The stability of the systems of compensation of gravitational effects described is examined. It is shown that the apparatus is unstable; errors in the measurement of acceleration grow without limit. The system can be used for short measurements only. However, if an additional measurement of the position of the moving object with respect to the celestial bodies, obtained say by radar, is used to compensate the signal correcting the gravitational effects, the system is stable. Errors in measurement result in harmonic oscillations of limited amplitude.
There are 7 figures and 3 references: 2 Soviet and 1 English.

SUBMITTED: November 30, 1959

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BODNER, V.A.; RYAZANOV, Yu.A.

Synthesis of structural diagrams of the self-adjusting control system for supercharger turbojet engines. Avtom.reg.aviadvig. no.3:33-50 '61. (MIRA 14:12)

(Airplanes—Turbojet engines)
(Automatic control)

27665

S/024/61/000/004/023/025
E140/E563

13.2000

AUTHORS: Bodner, V.A. and Seleznev, V.P. (Moscow)

TITLE: On the automatic control of the motion of a body in inertial space

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh nauk, Energetika i avtomatika, 1961, No.4, pp.197-207

TEXT: The motion of a body in a gravitational field on the scale of interplanetary distances will be realised over pre-calculated orbits which are optimised in some sense. The minimum expense of energy is obtained by maximum utilisation of inertial motion, but at the same time minimum time is desired. This requires the use of motors controlled by a given program. In this study it is assumed that the body contains a navigational system in the form of an inertial system with three channels for the automatic compensation of gravitational acceleration. Changes in the vector applied to the body for purposes of controlling its motion are obtained by varying the rate of fuel consumption and by variation of the angle of attack of the motor. The coordinate system is taken as heliocentric. The equations of motion are derived in terms of the tractive force P, the gravitational force

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On the automatic control of the ... S/024/61/000/004/023/025
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G and the resistive force Q (due to incidence of the object in an atmosphere, the effects of meteoritic particles and of electrical and magnetic fields). The conditions for motion over a ballistic trajectory are found. The equations of motion of the automatic control system are then derived from a separate consideration of the equations of the object, the navigational system, the control signal generator, the computer, the amplifier and the motor, all included in the closed loop of the complete control system. The cases of small and large deviations are considered separately. The dynamic error of the system is neglected, which is justified by the consideration that the time constants of the system elements are much smaller than the durations of the processes involved in the control of the motion of the centre of gravity of a large mass. Two systems are considered - static and astatic. In the integral system the error can be made smaller. In the special case of motion around a planet there will be random variations of the forces acting on the object due to the presence of an atmosphere, with its varying density with height, with exposure to the sun's heat radiation and to variations in the solar activity. The dispersions of the errors in the coordinates of the above two systems are found

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as functions of the ratio of the system natural frequency to the frequency of revolution. The analysis indicates the advantage of having as high a natural period as possible, which can only be obtained in practice by increasing the acceleration due to the tractive force. The processes in the control system in the presence of large deviations are studied by the approximate method of statistical linearisation, and using a process of successive approximations. The dispersion is found to sufficient precision after about three or four computational cycles. The analysis shows that the static control system should have regulation with respect to the deviations and the first derivatives of the deviations, with the latter predominating, and, in the astatic system, an integral signal in addition. To reduce the reaction of the system to random forces its frequency should be made as great as possible, by increasing the slope of the traction characteristic and by increasing the traction reserves. The frequency of the control system should in any case exceed substantially the frequency of revolution about a planet. There are 8 figures and 9 Soviet references.

SUBMITTED: February 11, 1961

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13,2500 (1080)

AUTHORS: Bodner, V.A., and Seleznev, V.P. (Moscow)

TITLE: On the theory of inertial reference systems

PERIODICAL: Akademiya nauk SSSR. Izvestiya. Otdeleniye tekhnicheskikh nauk. Energetika i avtomatika, no.5, 1961, 163-173

TEXT: The authors apply Kulebakin's absolute invariance principle to the nongyroscopic inertial reference system proposed by J.J. Klein (Ref.1: Nongyroscopic inertial reference. IRE Trans. Automat. Control, 1959, V.4, No.2). With reference to a single axis the basic system is shown in Fig.1 and consists of an inertial body 2, which may rotate about the axis x - x. An accelerometer 1 is fixed to this axis with its axis of sensitivity perpendicular to the plane of the figure (the y-axis). At the opposite end of the x-axis the rotor of a drive motor 3 is fixed. The motor torque is derived from the accelerometer signal through a loop with transfer function F(p). A double integration gives the velocity $\dot{s}_y$ and the distance s_y when the control circuit is adjusted so that the inertial reference

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On the theory of inertial reference.... S/024/61/000/005/008/009
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system models a Schuler pendulum and can be used to obtain the local vertical. Analysis of the system errors shows that the suspensions of the inertial bodies must be carefully designed, the moment of inertia must be large and external navigational information should be introduced. The system must also be damped. Technologically feasible methods should permit the construction of such systems with precisions two orders of magnitude greater than are presently attainable with gyroscopic systems. The authors proceed to an analysis of the effects of introducing external information under the assumption that the error of a Doppler velocity meter is small in comparison with the errors due to the perturbation moment and the accelerometer. The introduction of external information has the effect of reducing the Schuler period by factors of 10 to 30. The external information thus has the effect of improving the dynamic characteristics and the precision. It may be applied either continuously or discontinuously, depending on the required precision and the mode of operation of the information sources. An improved design of a [illegible] reference [illegible] given in Fig.6.

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S/024/61/000/005/008/009
On the theory of inertial reference.... E140/E135

The inertial body is immersed in liquid enclosed in a container. The purpose of the liquid is to supply full compensation for the weight of the body and by this to eliminate the friction moment caused by the bearing reaction. A possible viscous friction of the body in the liquid is compensated. Elastic couplings are used to maintain the body in a definite position. Servosystems are employed to reduce the forces and moments acting on the body from the liquid and elastic couplings to negligibly small quantities. The body 1 is cylindrical for a single-axis system; in a three-system it is a sphere, with specific gravity equal to that of the liquid 2, in the container 3. The liquid viscosity should be low and its temperature maintained constant. The body is in a suspended state in the liquid and is fixed to the container by thin quartz filaments 8 which may twist. The container is connected to the object through ball bearings 9, whose axis of rotation corresponds to the axis of rotation of the inertial body. The difference angle between the body and the container is measured by a special frictionless detector 7 - either photoelectric or capacitive - from which signals are obtained for the compensation motor 6 serving to eliminate

Card 3/5

29566

On the theory of inertial reference S/024/61/000/005/008/009
E140/E135

moments acting on the body and a corrective motor 5 placed between the container and the body of the object. This results in the body, container and the object being decoupled from each other. A linear accelerometer 4 with axis of sensitivity perpendicular to the axis of the container is fixed to the container. Its output signal is also applied to the motors and is also integrated to determine the velocity and coordinates of the object. The accelerometer signals are also applied to an electromagnet 10 through an amplifier. The magnetic field of this element interacts with electric currents passed through the liquid from the electrodes 11 to establish a force on the liquid acting to correct viscous friction between the liquid and the body. The analysis of the system takes into account second-order effects neglected in Klein's original work, and develops conditions for compensation of the object acceleration, the unbalance, elastic support and viscous friction moments. The compensation conditions derived are valid for fixed altitude of flight. The effects of altitude variations on the compensation conditions must be corrected by means beyond the scope of the article.

X

Card 4/5

29566
S/024/61/000/005/008/009
On the theory of inertial reference ... E140/E135

There are 7 figures and 2 references: 1 Soviet-bloc and 1 non-Soviet-bloc. The English language reference reads:

Ref.1: J.J. Klein. Nongyroscopic inertial reference. IRE Trans. Automat. control. 1959, V.4, No.2.

SUBMITTED: March 21, 1961

X

Card 5/5

13.2500

25307

S/020/61/138/005/006/025
B104/B205

AUTHORS: Bodner, V. A., and Seleznev, V. P.

TITLE: Behavior of unperturbed systems in an inertial space

PERIODICAL: Akademiya nauk SSSR. Doklady, v. 138, no. 5, 1961
1043-1046

TEXT: Unperturbed systems in the three-dimensional space, which are used as navigation systems, are equipped with three accelerometers which are fastened to a gyroscopic stabilizer and are oriented alohg the three axes of the inertial system. The behavior of a navigation system of this kind in a three-dimensional inertial space is illustrated in Fig. 1. F and G are the vectors of the external forces and of the attractive force, respectively. The accelerometers measure the components of acceleration a_{xo}, a_{yo} and a_{zo}. On account of the deviation of the axes of the gyroscope from the sensitive axes of the accelerometer forming the orthogonal system, xyz, $x_o y_o z_o$ and xyz are not parallel. On the assumption that the angles α, β and γ (Fig. 2) are small, the following relations will hold for the

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signals of the three accelerometers: $a_x = a_{xo} + \Delta a_{xd}$, $a_y = a_{yo} + \Delta a_{yd}$, and $a_z = a_{zo} + \Delta a_{zd}$ (2), where $\Delta a_{xd} = a_{yo}\beta - a_{zo}\alpha$, $\Delta a_{yd} = a_{zo}\gamma - a_{xo}\beta$, and $\Delta a_{zd} = a_{xo}\alpha - a_{yo}\gamma$. In order to obtain an inertial system with three compensation channels for gravitational acceleration, it is necessary to form the compensation signals g_{xk}, g_{yk}, and g_{zk} whose amounts are equal to those of the components g_x, g_y and g_z of gravitational acceleration. Their signs, however, are reverse. Fig. 3 shows the block diagram of a system of this kind, from which the equation of motion

$$\left[(a_x - g_{xk})\frac{1}{p} + x_0'\right]\frac{1}{p} + x_0 = s_x, \quad \left[(a_y - g_{yk})\frac{1}{p} + y_0'\right]\frac{1}{p} + y_0 = s_y,$$
$$\left[(a_z - g_{zk})\frac{1}{p} + z_0'\right]\frac{1}{p} + z_0 = s_z, \qquad (3)$$

for the system is obtained. The symbols with the subscript o are the initial coordinates and velocities of the object; s_x, s_y, and s_z are the running coordinates of the object as given in the inertial system; p=d/dt. By means of (2) this equation can be represented in the form $\Delta x'' = \Delta g_x + \Delta a_{xd}$, ..., $\Delta z'' = \Delta g_z + \Delta a_{zd}$ (4), where $\Delta x = s_x - x$ denotes the error of the inertial system, which holds analogously for Δy and Δz, and $\Delta g_x = g_x - g_{xk}$, which holds analogously for Δg_y and Δg_z. Using the known expressions

$$g_x = \sum_{i=1}^{n} f m_i \frac{x - x_i}{R_i^3}, \quad g_y = \sum_{i=1}^{n} f m_i \frac{y - y_i}{R_i^3}, \quad g_z = \sum_{i=1}^{n} f m_i \frac{z - z_i}{R_i^3}, \qquad (6)$$

where

$$R_i = \sqrt{(x - x_i)^2 + (y - y_i)^2 + (z - z_i)^2}, \qquad (7)$$

the following relations are easily obtained for (4)

$$(p^2 + \eta_x^2)\,\Delta x - A\Delta y - B\Delta z = \Delta a_{xr}, \quad -A\Delta x + (p^2 + \eta_y^2)\,\Delta y - C\Delta z = \Delta a_{yr},$$
$$-B\Delta x - C\Delta y + (p^2 + \eta_z^2)\,\Delta z = \Delta a_{zr}, \qquad (9)$$

Card 3/7

where

$$\eta_x^2 = \sum_{i=1}^{n} \frac{fm_i}{R_i^3}\left[1 - 3\left(\frac{x - x_i}{R_i}\right)^2\right], \quad \eta_y^2 = \sum_{i=1}^{n} \frac{fm_i}{R_i^3}\left[1 - 3\left(\frac{y - y_i}{R_i}\right)^2\right];$$

$$\eta_z^2 = \sum_{i=1}^{n} \frac{fm_i}{R_i^3}\left[1 - 3\left(\frac{z - z_i}{R_i}\right)^2\right]; \qquad (10)$$

$$A = 3\sum_{i=1}^{n} \frac{fm_i}{R_i^3}\frac{(x - x_i)(y - y_i)}{R_i^2}, \quad B = 3\sum_{i=1}^{n} \frac{fm_i}{R_i^3}\frac{(x - x_i)(z - z_i)}{R_i^2},$$

$$C = 3\sum_{i=1}^{n} \frac{fm_i}{R_i^3}\frac{(y - y_i)(z - z_i)}{R_i^2}. \qquad (11)$$

($a_{xn}=a_{xd}$, $a_{yn}=a_{yd}$, $a_{zn}=a_{xd}$). The error of the inertial system, which is caused by an inaccurate compensation of acceleration, can thus be determined from a linear system of differential equations having variable

Card 4/7

coefficients. The stability of the compensation system is investigated on the assumption that $\Delta a_{xd} = \Delta a_{yd} = \Delta a_{zd} = 0$. It is shown that the compensation system for gravitational acceleration is unstable. The general motion of a system of this kind consists in (1) a harmonic oscillation with a period $T_1 = 2\pi\sqrt{R/g}$; (2) oscillations with the same period but with a growing amplitude; and 3) an aperiodic, exponentially increasing motion with a time constant $T_2 = T_1/2\sqrt{2}\pi$. From the results of the investigations, three theorems have been deduced: 1) The compensation of gravitational acceleration in all three channels of the inertial system leads to the characteristic equation $(p^2+\Omega^2)^2(p^2-2\Omega^2)=0$ for the error of each of these channels. 2) The oscillation period of the error of the inertial system is equal to the period of the satellite traveling on an orbit of radius R about an equivalent celestial body with the first cosmic velocity $V_1 = \sqrt{gR}$. 3) The time constant of the error increase of the inertial system is equal to the time constant of the motion of a satellite moving away from an equivalent celestial body with the second cosmic velocity $V_2 = \sqrt{2gR}$

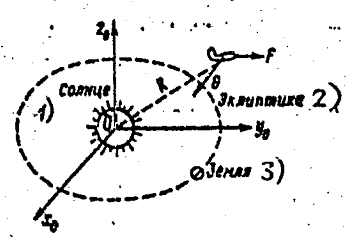
Behavior of unperturbed systems ... S/020/61/138/005/006/025
B104/B205

There are 3 figures and 1 Soviet-bloc reference.

PRESENTED: January 23, 1961, by V. S. Kulebakin, Academician

SUBMITTED: January 16, 1961

Fig. 1: System under consideration.
Legend: (1) Sun; (2) ecliptic;
(3) Earth.



Card 6/7

ALIMOV, I.D.[translator]; BODNER, V.A., prof., red.; DANILOV, N.A., red.; RYBKINA, V.P., tekhn. red.

[Automatic testing of the equipment of airplanes and rockets] Avtomaticheskaia proverka oborudovaniia samoletov i raket; sbornik statei. Moskva, Izd-vo inostr.lit-ry, 1962. 216 p. (MIRA 15:8)

(Airplanes—Testing) (Automatic control) (Rockets (Aeronautics)—Testing)

CHINAYEV, Petr Ivanovich, kand.tekhn.nauk; BODNER, V.A., doktor tekhn.nauk, retsenzent; NEMCHUNOVA, O.A., red.izd-va; BEREZOVYY, V.N., tekhn. red.

[Multidimensional automatic systems] Mnogomernye avtomaticheskie sistemy. Kiev, Gos.izd-vo tekhn.lit-ry, USSR, 1963. 278 p. (MIRA 16:12)

(Automatic control)

GLADKIKH, P.A.; KHACHATURYAN, S.A.; KAZAKEVICH, V.V., doktor tekhn. nauk, prof., retsenzent; BODNER, V.A., doktor tekhn. nauk, prof., retsenzent; DANILOV, L.N., inzh., red.; DANILIN, L.N., red.izd-va; TIMOFEYEVA, N.V., tekhn. red.

[Preventing and eliminating vibrations in pumping units] Preduprezhdenie i ustranenie kolebanii nagnetatel'nykh ustanovok. Moskva, Izd-vo "Mashinostroenie," 1964. 274 p. (MIRA 17:4)

ALEKSEYEV, Kir Borisovich; BEBENIN, Gennadiy Georgiyevich. Prinimal uchastiye KASHIN, G.N., kand. tekhn. nauk; BODNER, V.A., doktor tekhn. nauk, prof., red.; LOSEVA, G.F., red.

[Control of a space vehicle] Upravlenie kosmicheskim letatel'nym apparatom. Moskva, Mashinostroenie, 1964. 401 p. (MIRA 17:6)

KULEBAKIN, V.S., akademik, otv. red.; PETROV, B.N., akademik, otv. red.; BODNER, V.A., doktor tekhn. nauk, red.; VORONOV, A.A., doktor tekhn. nauk, red.; IVAKHNENKO, A.G., red.; ISHLINSKIY, A.Yu., akademik, red.; KOSTYUK, O.M., kand. tekhn. nauk, red.; KRASSOV, I.M., kand. tekhn. nauk, red.; KUNTSEVICH, V.M., kand. tekhn. nauk, red.; KUKHTENKO, A.I., red.; RYABOV, B.A., doktor tekhn. nauk, red.; SIMONOV, N.I., doktor fiz.-mat. nauk, red.; ULANOV, G.M., doktor tekhn. nauk, red.; FEDOROV, S.M., kand. tekhn. nauk, red.; TSYPKIN, Ya.Z., doktor tekhn. nauk, red.; CHINAYEV, P.I., kand. tekhn. nauk, red.; KRUTOVA, I.N., kand. tekhn. nauk, red.; RUTKOVSKIY, V.Yu., kand. tekhn. nauk, red.

[Invariancy theory in automatic control systems; transactions] Teoriia invariantnosti v sistemakh avtomaticheskogo upravleniia; trudy. Moskva, Nauka, 1964. 503 p. (MIRA 18:2)

1. Vsesoyuznoye soveshchaniye po teorii invariantnosti i yeye primeneniyu v avtomaticheskikh ustroystvakh. 2d, Kiev, 1962. 2. Chlen-korrespondent AN Ukr.SSR (for Ivakhnenko, Kukhtenko).

BODNER, Vasiliy Afanas'yevich; GUREVICH, Yu.G., red.

[Theory of automatic flight control] Teoriia avtomaticheskogo upravleniia poletom. Moskva, Izd-vo "Nauka," 1964. 698 p. (MIRA 17:5)

L 16029-65 EWT(1)/EEC(a)/EWP(m)/FS(v)-3/EEC(j)/EEC(r)/EWG(v)/EWA(d) Po-4/Pd-1/ Pe-5/Pq-4/Pg-4 ASD(a)-5/SSD/AFWL/AFMD(t)/RAEM(c)/ESD(si)/ESD(t) GW

ACCESSION NR: AP4049570 S/0258/64/004/004/0626/0638

AUTHOR: Bodner, V. A. (Moscow); Alekseyev, K. B. (Moscow); Bebenin, G. G. (Moscow)

TITLE: Use of magnetic torque for the spatial orientation of satellites

SOURCE: Inzhenerny*y zhurnal, v. 4, no. 4, 1964, 626-638

TOPIC TAGS: magnetic torque, satellite orientation, magnetic torquing, satellite stabilization, Earth magnetic field, yaw angle control, tilt angle control

ABSTRACT: The problem of the spatial orientation of satellites by means of magnetic torque is considered. The dynamics of two-axis and three-axis stabilization is investigated, and the means of accomplishing the desired control of yaw and tilt angles is described. To control the pitch angle, reaction nozzles or a wheel-control system is used. An analysis of the above is presented geometrically in Figs. 1 and 2 of the Enclosure. In Fig. 3 is shown a block diagram of a control system using a magnetorquer which makes closed-loop and open-loop control systems possible. Differential equations for angular

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ACCESSION NR: AP4049570

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satellite motions are derived under certain assumptions. The applicability of the selected static-and nonstatic-control laws is substantiated, and they are compared with respect to control accuracy and current consumption. Closed-loop and open-loop control systems are analyzed. The advantages of various systems are discussed. Orig. art. has: 5 figures and 34 formulas.

ASSOCIATION: none

SUBMITTED: 26Nov63 ENCL: 02 SUB CODE: SV

NO REF SOV: 003 OTHER: 003 ATD PRESS: 3142

Card 2/4

L 16029-65
ACCESSION NR: AP4049570

ENCLOSURE: 01

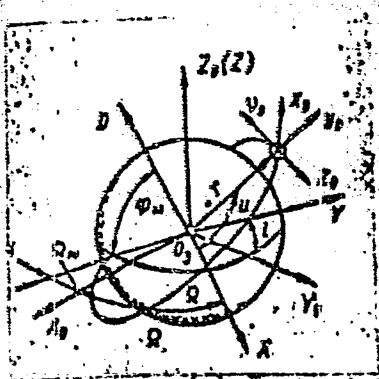


Fig. 1. Orbital geometry

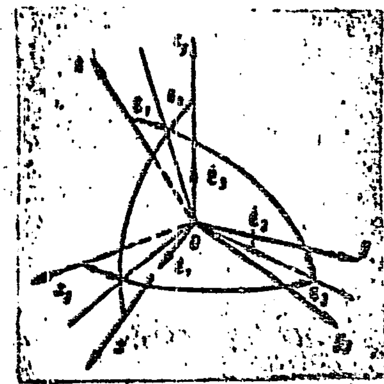
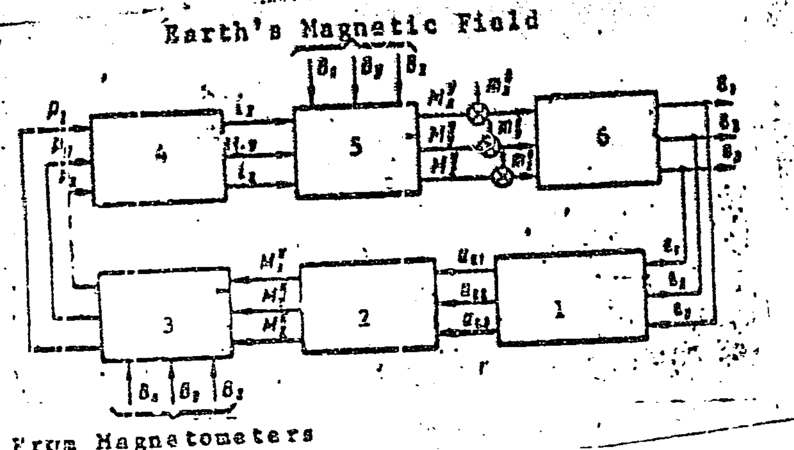


Fig. 2. Coordinate system

Card 3/4

L 16029-65
ACCESSION NR: AP4049570

ENCLOSURE: 02



1 - Measuring device; 2 - computer; 3 - computer; 4 - current commutator; 5 - magnetic coils; 6 - controlled variable.

Fig. 3. Block diagram of a control system using a magnetorquer

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L 30101-65 EEO-2/EWT(d)/EEC-4 Pn-4/Po-4/Pq-4/Pg-4/Pk-4/Pl-4 IJP(c) GS/BC

S/0000/64/000/000/0403/0411

ACCESSION NR: AT5004131

AUTHOR: Bodner, V. A. (Doctor of technical sciences); Ryazanov, Yu. A.

TITLE: Application of the theory of invariance to the selection of the parameters of a flight control system

SOURCE: Vsesoyuznoye soveshchaniye po teorii invariantnosti i yeye primeneniyu v avtomaticheskikh sistemakh. 2d, Kiev, 1962. Teoriya invariantnosti v sistemakh avtomaticheskogo upravleniya (Theory of invariance in automatic control systems); trudy soveshchaniya. Moscow. Izd-vo Nauka, 1964, 403-411

TOPIC TAGS: flight control system, invariance theory, automatic pilot, damping contour

ABSTRACT: The application of the theory of invariance to the selection of the parameters of a flight control system is investigated. First, the selection of the parameters of the damping contour is determined. This is done by obtaining expressions for the dynamic properties of an aircraft in yawing motion. Then the authors obtain equations for the selection of the parameters of a flight control system. This is done by determining the equation describing the autopilot. From this, the authors obtain the equation of a closed system from which the transfer functions for an aircraft in yawing motion are obtained. The article concludes with a determination of the pecularities of accomplishing a self-tuning

L 30101-65

ACCESSION NR: AT5004131

flight control system and a description of its components. The authors conclude that the conditions of invariance can be maintained, when the parameters of the object change, by means of changing the ratio of the damping contour by self-tuning devices. Orig. art. has: 5 figures and 17 formulas.

ASSOCIATION: none

SUBMITTED: 24Sep64 ENCL: 00 SUB CODE: NG, IE, AC

NO REF SOV: 001 OTHER: 000

Card 2/2

L 45822-65 EEO-2/EWT(d)/EEC(k)-2/EEC(t)/EWP(k)/EWP(h)/EED-2/EWA(c)/EWP(l)/EWP(v)
Pn-4/Po-4/Pq-4/Pf-4/Pg-4/Pae-2/Pk-4/Pl-4 BC 67
S/ B+1

AM4045247

BOOK EXPLOITATION

Bodner, Vasiliy Afanas'yevich

The theory of automatic flight control (Teoriya avtomaticheskogo upravleniya poletom) Moscow, Izd-vo "Nauka", 1964. 698 p. illus., biblio. 11,000 copies printed. Editor: Yu. G. Gurevich; Technical editor: L. Yu. Plakshe; Proofreader: O. A. Sigal

TOPIC TAGS: automatic flight control, extra atmospheric flight, guidance system, inertial guidance, landing, nonautonomic flight control, reentry, semiautomatic flight control

PURPOSE AND COVERAGE: This book presents the theory of automatic control of the flight of flying apparatuses. Basic attention is paid to the dynamic properties of flying apparatus as objects of control, to the principles of design, to the synthesis of characteristics, and to the selection of optimum parameters of control systems. The book is based largely on lectures presented by the author over a number of years in higher educational institutions. The author expresses his gratitude to M. S. Koslov, I. Fedorchenko, C. N. Kasrin, [illegible]

Card 1/3

L 45822-65

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TABLE OF CONTENTS:

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L 45822-65

AM4045247

SUB CODE: NG SUBMITTED: 20Mar64 NR REF SOV: 098

OTHER: 051

Card 3/3

L 40025-66 EWT(d)/EWT(1)/T-2/EWP(1) IJP(c) WW/BC/GD

ACC NR: AT6017619 (N) SOURCE CODE: UR/0000/65/000/000/0296/0308

AUTHOR: Belkin, Yu. S.; Bodner, V. A.; Getsov, L. N.; Mart'yanova, T. S.; Ryazanov, Yu. A.

ORG: none

73
B+1

TITLE: Adaptive systems for the optimization work regimes and transient processes in a turbojet engine

SOURCE: Vsesoyuznaya konferentsiya po teorii i praktike samonastraivayushchikhsya sistem. 1st, 1963. Samonastraivayushchiyesya sistemy (Adaptive control systems); trudy konferentsii. Moscow, Izd-vo Nauka, 1965, 296-308

TOPIC TAGS: optimal automatic control, turbojet engine, thrust optimization, SELF ADAPTIVE CONTROL

ABSTRACT: Synthesis and analysis of an adaptive system to optimize and control various parameters of a turbojet engine is presented. The equations of the system are written out in detail and numerical data are tabulated. The analysis was performed using analog simulation and the graphical results are presented. The control parameters considered were the rpm of the turbo-compressor, the inlet and afterburner temperatures and the turbine pressure gradient. The control inputs considered were the main fuel consumption, the afterburner fuel consumption, and the nozzle cross section. Orig. art. has: 16 formulas, 7 figures, 1 table.

SUB CODE: 12,13,21/ SUBM DATE: 22Nov65

Cord 1/1 af

BODNEVA, F.S.

Determination of the minimum requirment of nitrogenous substances by salmonella typhi. Zdravookhr. Kazakh. 23 no. 1: 68-69 '63. (MIRA 17:2)

1. Iz Vostochno-Kazakhstanskoy oblastnoy sanitarno-epidemiclogicheskoy stantsii.

BODNEV, M.N.

Inclined ship-lifting device of the Krasnoyarsk Hydroelectric Power Station. Trudy Lengidroproekta no.1:39-44 '64.

(MIRA 18:10)

BODINEVA, Ye.I.; KATSNEL'SON, A.A.

Width of a microphotometer slit during the photometric recording of the light intensity of roentgenograms. Zav.lab. 26 no.8:1014-1015 '60. (MIRA 13:10)

1. Moskovskiy gosudarstvennyy universitet im. M.V.Lomonosova. (Photometry) (X rays)

APPROVED FOR RELEASE: 06/09/2000 CIA-RDP86-00513R000205720019-5"

USSR

Rules for the change in the cathode polarization in the deposition of metals under the influence of surface-active additions. Yu. Yu. Matulis and A. I. Bodnevas. *Bull. Acad. Sci. U.S.S.R., Div. Chem. Sci.* 1955, [illegible] (Engl. translation).--See C.A. 49, 7425d. H. L. H.

BODNEVAS, A. I.

USSR/ Chemistry Physical chemistry

Card : 1/1 Pub. 40 - 1/27

Authors : Matulis, Yu. Yu., and Bodnevas, A. I.

Title : Certain laws governing the change in cathode polarization during separation of metals under the effect of surface-active additions

Periodical : Izv. AN SSSR, Otd. khim. nauk 4, 577 - 586, July - August 1954

Abstract : The rate and magnitude of change in cathode polarization, under the effect of surface-active substances, were determined in relation to the chemical composition and molecular structure of these substances. A compensation-oscillographic method, which measures these polarization changes during the introduction of various admixtures into the electrolyte during electrolysis, is described. The effect of surface-active admixtures was established through cathode polarization of Cu, Ag, Ni and Zn. Sixteen references: 14 USSR and 2 German (1905 - 1952). Table; graphs; diagram.

Institution : Acad. of Sc. Lith-SSR, Institute of Chemistry and Chemical Technology

Submitted : September 16, 1953

Dist: 4E2c

[illegible] for insulating [illegible] Mitin and [illegible]

[illegible] added [illegible]
[illegible] used for insulating

SOV/137-58-11-23142

Translation from: Referativnyy zhurnal. Metallurgiya, 1958, Nr 11, p 187 (USSR)

AUTHORS: Matulis, Yu. Yu., Bodnevas, A. I.

TITLE: On the Processes Caused by Changes in the Acidity of the Medium and Additions of Furfural During the Electrolytic Deposition of Cadmium From Sulfate Solutions (O protsessakh, vyzyvayemykh izmeneniyem kislotnosti sredy i dobavkami furfurola pri elektroosazhdenii kadmiya iz sernokislykh rastvorov)

PERIODICAL: Tr. AN LitSSR, 1958, Vol B1(13), pp 21-37

ABSTRACT: A study was made of the character of the changes in the cathodic polarization (P) and the mechanics of the electrode reactions caused by an increase in the acidity of the electrolyte and additions of furfural. The experiments were performed in 0.25 and 0.5N $CdSO_4$ solutions acidulated with H_2SO_4. The measurements of the cathodic P were achieved by the compensation-potentiometric and oscillographic methods. In a series of experiments the rate of H_2 evolution on the cathode was measured. The structure and the properties of the Cd deposits were also studied. The authors found that with the increase of the acidity of the solution the volume of the saturation current

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SOV/137-58-11-23142

On the Processes Caused by Changes in the Acidity of the Medium (cont)

decreases appreciably and the P potential assumes a more constant value. The leveling off of the potential results in an improved quality of the deposits with a decrease in the pH of the electrolyte. The authors submit that the stabilizing action of the H^+ ions on the potential of the cathode P in the electrolytic deposition of Cd is related to complex colloidal chemical processes occurring in the layer near the cathode and on the surface of the cathode. During the electrolytic deposition of Cd partial evolution of H_2 takes place which reduces the furfural (added to the electrolyte) in the cathode layer to products that possess inhibiting properties. A study was made of the character and the conditions leading to the origination of periodic variations of the P potential in the presence of furfural.

A. P.

Card 2/2

BODNEVAS, A.

SCIENCE

PERIODICAL: DARBAI. SERIJA B. TRUDY. SERIIA B. No. 2, 1958

Bodnevas, A. The question of periodic oscillations of the cathode potential of cadmium in its electrolytic separation from sulfatic solutions, containing some collodial admixtures. In Russian.p. 85.

Monthly list of East European Accessions (EEAI) LC. Vol. 8, No. 2, February 1959, Unclass.

BODNEVAS A. I.

S[redacted] 7

5(4) PHASE I BOOK EXPLOITATION SOV/2216

Soveshchaniye po elektrokhimii. 4th, Moscow, 1956.

Trudy...; [sbornik] (Transactions of the Fourth Conference on Electrochemistry; Collection of Articles) Moscow, Izd-vo AN SSSR, 1959. 868 p. Errata slip inserted. 2,500 copies printed.

Sponsoring Agency: Akademiya nauk SSSR. Otdeleniye khimicheskikh nauk.

Editorial Board: A.N. Frumkin (Resp. Ed.) Academician, O.A. Yesin, Professor; S.I. Zhdanov (Resp. Secretary), B.N. Kabanov, Professor, S.I. Zhdanov (Resp. Secretary); B.N. Kabanov, Professor, Ya. M. Kolotyrkin, Doctor of Chemical Sciences; V.V. Losev, P.D. Lukovtsev, Professor; Z.A. Solov'yeva; V.V. Stender, Professor; and G.N. Florianovich; Ed. of Publishing House: N.G. Yegorov; Tech. Ed.: T.A. Prusakova.

PURPOSE: This book is intended for chemical and electrical engineers, physicists, metallurgists and researchers interested in various aspects of electrochemistry.

COVERAGE: The book contains 127 of the 138 reports presented at the Fourth Conference on Electrochemistry sponsored by the Department of Chemical Sciences and the Institute of Physical Chemistry, Academy of Sciences, USSR. The collection pertains to different branches of electrochemical kinetics, double layer theories and galvanic processes in metal electrodepositon and industrial electrolysis. Abridged discussions are given at the end of each division. The majority of reports not included here have been published in periodical literature. No personalities are mentioned. References are given at the end of most of the articles.

SOV/2216

Stender, V.V., G.Z. Kir'yakov, G.N. Znamenskiy, S.A. Alekseyev, S.A. Shpigel', and A.P. Solyarskiy. High Current Densities During the Electrolytic Preparation of Zinc 461

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Bodnevas, A.I., and Yu. Yu. Matulis (Institute of Chemistry and Chemical Technology, Academy of Sciences, Lithuanian SSR). New Electrolyte for Bright Tinplating 477

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BODNEVAS, A.I. [Bodnevas, A.]

The effect of some lyophilic colloids on the cathodic process of zinc plating. Liet ak darbai B no.4:111-119 '59 (EEAI 9:3)

1. Institut khimii i khimicheskoy tekhnologii AN Litovskoy SSR.
(Zinc) (Plating) (Colloids)
(Cathodes)

RODNEVAS, A.I., kand. khim. nauk, red.; MATULIS, Yu.Yu., doktor khim. nauk, red.; YANITSKIY, I.V.[Janicki, I.], red.; FABIONAVICHYU,I. [Fabijonavicius, I.], inzh., otv. za vypusk; KANOVICH, N.,red.; PILKAUSKAS, K., tekhn. red.

[Improvement of electroplated coatings; materials] Voprosy usovershenstvovaniia gal'vanopokrytii; materialy. Vil'nius, In-t khimii i khimicheskoi tekhnologii Akad. nauk Litovskoi SSR, 1961. 122 p. (MIRA 15:4)

1. Respublikanskaya konferentsiya khimikov-gal'vanikov, rabotnikov nauki i promyshlennosti. 2d, Vilnius, 1960. (Electroplating)

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AUTHORS: Bodnevas, A. I., Matulis, Yu. Yu.

TITLE: Cathodic processes occurring in the electrodeposition of cobalt, and the action mechanism of lyophilic colloids

PERIODICAL: Referativnyy zhurnal, Metallurgiya, no. 2, 1962, 92, abstract 2I265 ("Tr. AN LitSSR", 1961, B 2(25), 119 - 136, Lithuanian summary)

TEXT: A study was made of polarization phenomena at relatively low D and acidified $CoSO_4$ solutions, and the action of admixtures of certain lyophilic colloids upon the cathodic polarization of Co was investigated in the course of Co electrodeposition from $CoSO_4$ solutions having different pH values and, in some cases, containing H_3BO_3. In acid solutions of $CoSO_4$ at low D there occurs only discharge of H^+ ions. The priority of this process is retained from the moment of switching on even at higher values of D. In the latter case the concentration of H^+ ions in the layer closest to the cathode is quickly depleted, the more active centers of the cathode become coated with Co hydroxide and the polarization potential momentarily prompts a rise in the equilibrium potential of the metal, whose electrodeposition occurs with a considerable overvoltage. The greatest rise

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