L 21081-65
ACCESSION NR: AP5001505

matem. i mekh. v. 28, No. 5, 1964). A system of linear differential equations with random parametric excitation and with random driving force is formulated, and its solution shows that the dispersion of the gyrocompass increases with time. The growth of the dispersion can lead to considerable errors in the reading of the gyrocompass unless damping is provided. It is therefore concluded that the time interval during which the damping of the gyroscope is turned off should not be too short. This report was presented by A. Yu. Ishlinskiy. Orig. art. has: 28 formulas.

ASSOCIATION: Institut mekhanika Akademii nauk SSSR (Institute of Mechanics, Academy of Sciences SSSR)

SUBMITTED: 01Jun64 ENCL: 00

SUB CODE: NG NR REF SOV: 003 OTHER: 000

Card 2/2

34821

S/020/62/142/005/010/022
B104/B102

13.2520

AUTHOR: Roytenberg, L. Ya.

TITLE: Theory of a gyroscopic follow-up system in the case of random noise

PERIODICAL: Akademiya nauk SSSR. Doklady, v. 142, no. 5, 1962, 1050-1053

TEXT: The optimum reproduction of the useful signal of a gyroscopic follow-up system is studied by means of the least root-mean-square error.

$$f(D)\,z(t) = e(D)\,x(t) \quad (D = d/dt), \qquad (2)-(3)$$

$$f(D) = \begin{Vmatrix} D^2 + \frac{n_1}{A} D & -\left(\frac{H}{A} D + \frac{m_1}{A}\right) \\ \frac{H}{B} D + \frac{S}{B} & D^2 \end{Vmatrix}, \quad z = \begin{Vmatrix} \alpha \\ \beta \end{Vmatrix},$$

$$e(D) = \begin{Vmatrix} -\frac{m_1}{A} & 0 \\ 0 & \frac{S}{B} \end{Vmatrix}, \quad x(t) = \begin{Vmatrix} x_1(t) \\ x_2(t) \end{Vmatrix}.$$

Card 1/4

is the equation of motion for such a system. α is the angle of rotation of the outer gimbal, β is that of the case, H is the kinetic moment of the gyroscope, A is the moment of inertia of the gyroscope with case and outer gimbal, B is the moment of inertia of the gyroscope and case around the case axis, $n_1\alpha'$ is the moment of frictional forces in the bearings of the outer gimbal, $m_1\{\beta-x_1(t)\}$ is the moment around the axis of the outer gimbal to which a stabilizing motor is fixed, $S\{\alpha-x_2(t)\}$ is the moment around the case axis of the gyroscope with a correcting electromagnet attached to it. From (2) it follows that $z(t) = Y(D)x(t)$, $Y(D) = F(D)e(D)/\Delta(D)$, where F(D) is the adjoint of the matrix f(D) and $\Delta(D)$ is the determinant of the matrix f(D).

$$Y(D)=\frac{1}{\Delta(D)}\left\|\begin{matrix} -\frac{m_1}{A}D^2 & \frac{S}{B}\left(\frac{H}{A}D+\frac{m_1}{A}\right) \\ \frac{m_1}{A}\left(\frac{H}{B}D+\frac{S}{B}\right) & \frac{S}{B}\left(D^2+\frac{n_1}{A}D\right) \end{matrix}\right\|, \quad (5)$$

$$\Delta(D)=D^4+\frac{n_1}{A}D^3+q^2D^2+\frac{S+m_1}{H}q^2D+\frac{Sm_1}{H^2}q^2 \quad \left(q^2=\frac{H^2}{AB}\right).$$

holds for the transition matrix. The input signal consists of the useful signal m(t) and random noise n(t): $\theta(t) = m(t) + n(t)$. Useful signal

APPROVED FOR RELEASE: 07/19/2001 CIA-RDP86-00513R001445520009-1"

and noise are not correlated. It is shown that an optimum gyroscopic system must contain an optimum filter with the transmission function

$$\Phi(D) = k\frac{(D+\varkappa)(D+\rho)}{(D+\lambda_1)(D+\lambda_2)}, \quad k = \frac{2\mu\nu^2 L}{\varkappa N}\,\frac{a}{[(\mu+\mu_1+\varepsilon_1)^2+\varepsilon^2][(\mu+\mu_1-\varepsilon_1)^2+\varepsilon^2]},$$

$\varrho = b/a$, where $a = \mu^2 + \varepsilon^2 + 2\mu\varkappa + \varkappa(\lambda_1 + \lambda_2) - \lambda_1\lambda_2$,

$b = 2\mu^3 + (3\mu^3 - \varepsilon^2)\varkappa + 2\mu\varepsilon^2 + (\mu^2 + \varepsilon^2 + 2\mu\varkappa)(\lambda_1 + \lambda_2) + \varkappa\lambda_1\lambda_2$.

$$S_m(\omega) = \frac{4\mu\nu^2 L}{(\omega^2-\nu^2)^2+4\mu^2\omega^2}, \quad S_n(\omega) = \frac{2\varkappa N}{\omega^2+\varkappa^2} \quad (\nu^2 = \varepsilon^2+\mu^2). \qquad (10)$$

holds for the spectral densities of the random processes. The output signal y(t) of the optimum filter is fed into a computer which solves the integral equation

$$\sum_{l=1}^{2}\int_0^t W_{1l}(t-\tau)\,x_l(\tau)\,d\tau = y(t), \quad \sum_{l=1}^{2}\int_0^t W_{2l}(t-\tau)\,x_l(\tau)\,d\tau = 0. \qquad (22).$$

Card 3/4

W_{ki} are the elements of the weight matrix of the gyroscope. The solutions to these equations are the signals which are to be fed into the input of the gyroscope. The author thanks A. Yu. Ishlinskiy for valuable advice. There are 5 references: 4 Soviet and 1 non-Soviet. The reference to the English-language publication reads as follows: N. Wiener, Extrapolation, Interpolation and Smoothing of Stationary Time Series, N. Y., 1949.

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

PRESENTED: June 2, 1961, by A. Yu. Ishlinskiy, Academician

SUBMITTED: May 29, 1961

28 (2) SOV/115-59-10-25/29

AUTHOR: Roytenberg, M.N., Head [redacted]

TITLE: About the Organization and Activities of Testing Laboratories in Plants

PERIODICAL: Izmeritel'naya tekhnika, 1959, Nr 10, pp 59-60 (USSR)

ABSTRACT: The article contains comments on the article by K.N. Katsman entitled "About Some Problems of Organization and Activities of Measuring Laboratories in Plants" which appeared in "Izmeritel'naya tekhnika", 1959, Nr 2. The author is of the opinion that Katsman is not taking the problem seriously, since he suggests that all plant laboratories be united into one central laboratory. The activities of plant laboratories are varied and such a merger would only deteriorate their work. Let the laboratories do their work as they do today, only the quality of work should be improved and the laboratories should keep pace with the modern technical progress. The author agrees with the suggestion that all laboratories should be responsible to the chief

Card 1/2

SOV/115-59-10-25/29

About the Organization and Activities of Testing Laboratories in Plants

engineer of the plant.

ASSOCIATION: Izmeritel'naya Laboratoriya, Berdichev

Card 2/2

Roytenberg, N.L.

AL'TSHULER, Z.Ye., inzh.; BASTUNSKIY, M.A., inzh.; BERSTEL', V.N., inzh.; BIRENBERG, I.E., inzh.; BOGOPOLSKIY, B.Kh., inzh.; BUKHARIN, S.I., inzh.; GERSHTEYN, B.G., inzh.; GRINSHPUN, L.V., inzh.; DREYYER, G.I., inzh.; DINERSHTEYN, A.G., inzh.; ZLATOPOL'SKIY, D.S., iznh.; KLANYUK, A.V., inzh.; KOZIN, Yu.V., inzh.; LEVITIN, I.P., inzh.; MEL'NIKOV, L.F., inzh.; MEL'KUMOV, L.G., inzh.; NADEL', M.B., inzh.; PAVLOV, N.A., inzh.; PASLEN, D.A., inzh.; PESIN, B.Ya., inzh.; PYATKOVSKIY, P.I., inzh.; RAZNOSCHIKOV, D.V., inzh.; ROZENOYER, G.Ya., inzh.; ROZENBERG, R.L., inzh.; ROYTENBERG, N.L., inzh.; RYABINSKIY, Ya.I., inzh.; SYPCHENKO, I.I., inzh.; TABACHNIKOV, L.D., inzh.; FEL'DMAN, E.S., inzh.; SHTRAKHMAN, G.Ya., inzh.; SHTERENGAS, N.S., inzh.; LEVITIN, I.P., otvetstvennyy red.; STEL'MAKH, A.N., red.izd-va; BEKKER, O.G., tekhn.red.

[Overall mechanization and automatization of production processes in the coal industry] Kompleksnaia mekhanizatsiia i avtomatizatsiia proizvodstvennykh protsessov v ugol'noi promyshlennosti. Pod red. IU.V.Kozina i dr. Moskva, Ugletekhizdat, 1957. 82 p. (MIRA 11:3)

1. Gosudarstvennyy proyektno-konstruktorskiy institut. 2. Institut Giprougleavtomatizatsiya i Tekhnicheskogo Upravleniya Ministerstva ugol'noy promyshlennosti (for all except: Levitin, Stel'makh, Bekker)

(Automatic control) (Coal mining machinery)

S/020/62/146/006/004/016
B172/B186

AUTHORS: Roytberg, Ya. A., Sheftel', Z. G.

TITLE: On equations of the elliptical type with non-continuous coefficient

PERIODICAL: Akademiya nauk SSSR. Doklady, v. 146, no. 6, 1962, 1275-1278

TEXT: Results which hold also for equations of higher order (uniqueness and existence of generalized solutions of the boundary value problems formulated below) are given by the author for an equation of second order. These results take the form $\mathcal{L}u = f$

$$\mathcal{L}u = \sum_{j,k=1}^{n} D_j(b_{jk}(x)D_k u) + \sum_{j=1}^{m} p_j(x)D_j u + b(x)u \quad (D_j = \frac{\partial}{\partial x_j};\ b_{jk} = b_{kj}).$$

The operator $\mathcal{L}$ is considered on determined Sobolev functional spaces. The complex-valued coefficients b_{jk}, P_j, b are defined in a domain G of the n-dimensional space. The boundary Γ of G is piecewise smooth. G is decomposed into two domains G_1 and G_2 by a (n-1)-dimensional continuously

Card 1/3

S/020/62/146/006/004/016
B172/B186

differentiable area, which is spherically homomorphic and has no common points with Γ, so that the coefficients of $\mathcal{L}$ are elements from $C^0(G_i)$ and $C^1(G_i)$ respectively, if considered as functions in G_i $(i = 1,2)$. The boundary conditions take the form

$$m\frac{\partial u}{\partial \mu} + Tu + Qu\big|_\Gamma = 0$$

$$a_1\frac{\partial u}{\partial \mu_1}\Big|_\gamma = a_2\frac{\partial u}{\partial \mu_2}\Big|_\gamma; \quad [u]_\gamma = 0$$

Here T designates a linear combination of the tangential derivative with real coefficient from $C^1(\Gamma)$; Q a limited linear operator in $L_2(\Gamma)$, m a constant being equal to 0 for T = 0, Q = 1, and otherwise being equal to 1; a_i $(i = 1,2)$ a positive function from $C^2(G_i)$; $\frac{\partial}{\partial \mu_i} = \sum b^i_{jk} \nu^i_k D_j u$. $(\nu^i_k$ are the components of the normal to the surface γ, pointing away from $G_i)$, $[u]_\gamma = u|_{\gamma - 0} - u|_{\gamma + 0}$. The question of smoothness of the generalized solutions is treated in a manner similar to that described in a study by

On equations of the elliptical... S/020/62/146/006/004/016
B172/B186

Nirenberg (Comm. Pure and Appl. Math., 8, no. 4 (1955)). The results obtained hold also for decompositions into more than two domains G_i.
Further, the corresponding eigenvalue problem is treated.

ASSOCIATION: Stanislavskiy pedagogicheskiy institut (Stanislav Pedagogical Institute). Drogobychskiy pedagogicheskiy institut (Drogobych Pedagogical Institute)

PRESENTED: May 21, 1962, by S. L. Sobolev, Academician

SUBMITTED: May 4, 1962

Card 3/3

ROYTBERG, Ya.A.

Eigenfunction expansion of self-conjugate elliptical systems.
Dop.AN URSR no.6:721-725 '60. (MIRA 13:7)

1. Stanislavskiy pedagogicheskiy institut. Predstavleno akademikom AN USSR B.V.Gnedenko [B.V.Hniedenko].
(Differential equations)
(Eigenfunctions)

ROYTENBERG, L.Ya. (Moskva)

Motion of a gyroscopic pendulum with radial correction during slight random shifts of its point of support. Izv. AN SSSR. Mekh. no.2:58-63 Mr-Ap '65. (MIRA 18:6)

L 61487-65 EEO-2/EWT(d)/FSS-2/EEC(k)-2/EWG(v)/EED-2/EWA(c) Pn-4/Po-4/Pe-5/
Pq-4/Pg-4/Pk-4/Pi-4 BC
ACCESSION NR: AP5013130 UR/0373/65/000/002/0058/0063

AUTHOR: Roytenberg, L. Ya. (Moscow)

TITLE: Motion of a gyroscopic pendulum with radial correction for random displacements of its pivot point

SOURCE: AN SSSR. Izvestiya. Mekhanika, no. 2, 1965, 58-63

TOPIC TAGS: ship stabilization, gyroscopic pendulum

ABSTRACT: The moti^n of a gyroscopic pendulum with damping provided by the method of radial corrections (B. V. Bulgakov. Prikladnaya teoriya giroskopov. Gostekhizdat, 1955, str. 42) is theoretically investigated for random excitation of the support pivot. The equations of A. Yu. Ishlinskiy (K teorii giroskopicheskogo mayatnika. PMM, 1957, t. XXI, vyp. 1) are modified so as to include the radial correction torques and perturbation values W_1, W_2 and W_3 (0 average value) of pivot acceleration are added to the input accelerations. The condition for stability of self-excited oscillations is found as $g^{-1}W_3(t) > -1$, ($W_3(t)$ = random input along direction of earth radius). After introducing a

Card 1/3

L 61487-65
ACCESSION NR: AP5013130

small parameter $\lambda = g_0/g$ (where g_0 = some normalizing coefficient satisfying, for example, $/W_1//g_0 = 1$), the system equations are expressed in matrix and subsequently in matrix integral form. Using the method of successive substitutions, the solution is formulated as a series with powers higher than 2 neglected. The mathematical probability of the random processes $X_j(t)$ and the standard deviation are then derived, including the correlation function. The solutions of the equations is demonstrated by an example in which the $W_j(t)$ are stationary processes of the white noise variety, and the correlation functions are given by

$$K_{11}(t-\tau) = G_1\delta(t-\tau), \quad K_{12}(t-\tau) = 0$$
$$K_{22}(t-\tau) = G_2\delta(t-\tau), \quad K_{13}(t-\tau) = L\delta(t-\tau)$$
$$K_{33}(t-\tau) = G_3\delta(t-\tau), \quad K_{23}(t-\tau) = 0.$$

For this case it is found that even at no initial deviations ($X_1(0) = X_2(0) = 0$) the gyroscopic pendulum seeks a finite displacement due to the radial correction, i.e., $M[X(t)]$ (mathematical probability) approaches a constant value around which the pendulum performs decaying oscillations. Orig. art. has: 2 figures and 45 formulas.

ASSOCIATION: none

Card 2/3

L 61487-65
ACCESSION NR: AP5013130

SUBMITTED: 15Jul64 ENCL: 00 SUB CODE: NG

NO REF SOV: 005 OTHER: 000

Card 3/3

ROYTENBERG, I. Ya. (Moskva)

Motion of a gyrocompass due to arbitrary displacements of its fixed point. Prikl. mat. i mekh. 29 no.1:165-172 Ja-F '65. (MIRA 18:4)

ROYTENBERG, Ya. N.

Multigyroscopic Vertical (Gyrohorizon) (Mnogogiroskopnaia Vertikal'). IA. N. Roitenberg. *Prikladnaia Matematika i Mekhanika* (Moscow), Vol. 10, No. 1, 1946, pp. 101-124, figs. 6 references. (In Russian.)

A development of A. N. Krylov's application of gyroscopic theory to the stabilization of a platform on a ship. Following a brief description of gyrohorizon principles, various aspects of the application of the theory are treated analytically: differential equations of the motion of the instrument; motion of the instrument on an immovable support; the influence of rolling and acceleration of the moving ship; motion in relation to the period of free oscillations; accumulation of errors during protracted maneuvering of the ship; and ballistic deviations during transitory maneuvering of the ship and with a small period of free oscillations.

Aero Sci

ROYTENBERG, YA. N. Dr. Physicomath. Sci.

Dissertation: "Power Gyroscopic Stabilizers." Inst. of Mechanics, Acad. Sci., USSR
25, Feb. 1947

SO: Vechernyaya Moskva, Feb., 1947. (Project #17836)

ROYTENBERG, I.N.

Roitenberg, I. N. Auto-oscillations of gyroscopic stabilizers. Appl. Math. Mech. [Akad. Nauk SSSR. Prikl. Mat. Mech.] 11, 271-280 (1947). (Russian. English summary)

The equations of a gyroscopic ship stabilizer may be reduced to a system Σ of 5 linear equations of order one with constant coefficients in unknowns $\beta, x_1, \cdots, x_4$, where β is an angular variable. Four of the equations are homogeneous and the fifth has a right-hand side of the form $K \operatorname{sgn} \beta$. Two solutions for $0 \leqq \beta \leqq \pi$, $-\pi \leqq \beta \leqq 0$, are pieced together to form a unique continuous solution. Periodic solutions exist and are determined and their stability discussed. A numerical example is computed to show that such stable solutions may exist. *S. Lefschetz.*

Source: Mathematical Reviews, 1948, Vol 9, No. 1

ROYTENBERG, YA. N., and BULGAKOV, BV.

On the Theory of Energized Gyro Horizons

Izvest AN SSSR No. 3 (1948)

APPROVED FOR RELEASE: 07/19/2001 CIA-RDP86-00513R001445520009-1"

ROYTENBERG, YA. N.

36174 Avtokolebaniya silovyKh giroskopichesKiKh stabilizatorov. Priborostroeniye, vyp. 4, 1948, S. 3-25--Bibliogr: 5 nazv.--OKonchaniye. Nachalo: No. 3.

SO: Letopis' Zhrunal 'nykh Statey, No. 49, 1949

ROYTENBERG, Ya. N.

Roitenberg, Ya. N. The work of B. V. Bulgakov, corresponding member of the Academy of Sciences of the USSR, on the theory of automatic control. Trudy vtorogo vsesoyuznogo soveščaniya po teorii avtomatičeskogo regulirovaniya, Tom I [Transactions of the second all-union congress on the theory of automatic control, Vol. I], pp. 68-75 (1 plate). Izdat. Akad. Nauk SSSR, Moscow-Leningrad, 1955. (Russian)

AUTHOR: Roytenberg, Ya.N. (Moscow) 40-22-2-3/21

TITLE: On a Method for the Construction of a Lyapunov Function for Linear Systems With Variable Coefficients (Ob odnom metode postroyeniya funktsiy lyapunova dlya lineynykh sistem s peremennymi koeffitsiyentami)

PERIODICAL: Prikladnaya matematika i mekhanika, 1958, Vol 22, Nr 2, pp 167-172 (USSR)

ABSTRACT: For the construction of Lyapunov functions for systems of linear differential equations with constant coefficients Chetaev elaborated effective methods. The author now transfers these methods to systems of differential equations with variable coefficients. By consideration of the system of differential equations which is obtained from the initial system by setting the coefficients constant, it is possible to transform the initial system into a form so that a Lyapunov function can be given. The stability conditions can be found in well-known manner from the condition for the definiteness of the Lyapunov function. The Lyapunov function itself is set up in the usual way in the form :

Card 1/2

On a Method for the Construction of a Lyapunov Function for Linear Systems With Variable Coefficients

40-22-2-3/21

$$V = -\frac{1}{2}\left[\sum_{g=1}^{N'} \xi_g^2 + \sum_{h=N'+1}^{N'+N''} \left(\xi_h^2 + \eta_h^2\right)\right]$$

whereby the ξ, η represent the variables of state of the system. The obtained stability conditions are sufficient but not necessary.
The method is illustrated by an example.
There are 3 Soviet references.

SUBMITTED: September 16, 1957

1. Stability--Theory 2. Equations of state--Theory

Card 2/2

SOV/40-22-4-14/26

16(1)

AUTHOR: Roytenberg, Ya.N. (Moscow)

TITLE: On the Accumulation of Perturbations in Nonsteady Linear Impulse Systems (O nakoplenii vozmushcheniy v nestatsionarnykh lineynykh impul'snykh sistemakh)

PERIODICAL: Prikladnaya matematika i mekhanika, 1958, Vol 22, Nr 4, pp 534 - 536 (USSR)

ABSTRACT: In addition to investigations which have been carried out during the last years by different authors on disturbances in impulse systems the author considers in the present paper the problem of accumulation of disturbances in nonsteady linear impulse systems which are under the influence of external forces. The maximum amplitudes of the disturbing forces are to be bounded.

The author considers an impulse system, the equations of which can be written as difference equations in the following form :

$$(1) \quad y_k(t+\tau) + \sum_{l=1}^{n} a_{kl}(t) y_l(t) = x_k(t) \qquad (k=1,\dots,n)$$

The system of these equations is equivalent to a matrix equation of the form :

Card 1/3

$$(2) \qquad y(t+\tau) + a(t)y(t) = x(t)$$

Here y is the coordinate by which the behavior of the impulse system is described, x are the external disturbing forces. With a series set up for the coordinates y now a general, but very nontransparent expression is obtained which can be expressed as a double sum. Under the assumption that the forces are bounded in their absolute value :

$$(11) \qquad |x_k(t)| \leqslant L_k$$

this expression can be transformed as follows :

$$(12) \; |y_s(t_1)| \leqslant \left| \sum_{k=1}^{n} N_{sk}(t_1,0) y_k^*(t_1 - \vartheta_1 \tau) \right| + \sum_{k=1}^{n} L_k \sum_{j=1}^{\vartheta_1} |N_{sk}(t_1, j\tau)|$$

From this expression the maximum disturbance can be calculated which the impulse system can obtain as the result of the influence of external forces. Since also this estimation is still very nontransparent, the author considers the possibilities of calculation on electronic computers.

On the Accumulation of Perturbations in Nonsteady Linear Impulse Systems SOV/40-22-4-14/26

There are 4 references, 2 of which are Soviet, and 2 English.

SUBMITTED: May 9, 1958

Card 3/3

SOV/20-121-2-7/53

AUTHOR: Roytenberg, Ya. N.

TITLE: On the Accumulation of Perturbations in Non-stationary Linear Systems (O nakoplenii vozmushcheniy v nestatsionarnykh lineynykh sistemakh)

PERIODICAL: Doklady Akademii nauk SSSR, 1958, Vol 121, Nr 2, pp 221-224 (USSR)

ABSTRACT: Generalizing the instationary case treated by Bulgakov and Kuzovkov [Ref 4] the author considers the linear system of oscillation

(1) $$\sum_{k=1}^{n} f_{jk}(D)y_k = x_j(t) \qquad j=1,\ldots,n,$$

where $f_{jk}(D)$ are polynomials in $D \equiv \frac{d}{dt}$ with variable coefficients and the polynomial matrix of the coefficients is assumed to be not degenerated. After transformations and the introduction of new variables the system (1) is brought to the form

(2) $$\dot{z} + a(t)z = X(t),$$

where z, $a(t)$ and $X(t)$ are matrices. Under the assumption that the external forces $x_j(t)$ are bounded, the author gives an estimation for the utmost possible deviation of an arbitrary coordinate z_1 at the time t_1.

Card 1/2

SOV/20-121-2-7/53

On the Accumulation of Disturbances in Instationary Linear Systems

In a similar manner the system

$$\sum_{k=1}^{n} f_{jk}(D)y_k = \left[L_j(t)D + R_j(t)\right] x_j(t), \qquad j=1,\ldots,n$$

is investigated.

There are 6 references, 4 of which are Soviet and 2 American.

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

PRESENTED: March 10, 1958, by S.L.Sobolev, Academician

SUBMITTED: March 8, 1958

Card 2/2

ROYTENBERG, Ya.N.(Moskva)

Reducing a gyrocompass for meridian during the speeding up of gyrowheels. Prikl.mat.i mekh. 24 no.1:88-92 Ja-F '60. (MIRA 13:6)
(Gyrocompass)

APPROVED FOR RELEASE: 07/19/2001 CIA-RDP86-00513R001445520009-1"

ROYTENBERG, Ya.N. (Moskva)

Theory of pulse servosystems. Prikl. mat. i mekh. 24 no. 2:309-315 Mr-Ap '60. (MIRA 14:5)

(Servomechanisms)

80251
S/040/60/024/02/15/032
9

16.9500

AUTHOR: Roytenberg, Ya. N. (Moscow)

TITLE: On the Theory of the Impulse Servo-Systems

PERIODICAL: Prikladnaya matematika i mekhanika, 1960, Vol. 24, No. 2, pp. 309-315

TEXT: The author considers the servo-system

(1.1) $\dot{y}_1 - y_2 = 0, \quad \dot{y}_2 + 2\varepsilon y_2 = \mu k^2 [x(t) - y_1 + q(t)]$

where

(1.2) $\mu = \begin{cases} 1 \text{ for } & \vartheta\tau < t < \vartheta\tau + \tau_1 \\ 0 \text{ for } & \vartheta\tau + \tau_1 < t < (\vartheta+1)\tau \end{cases}$

Here y_1 is the generalized coordinate of the servo, $x(t)$ the set point, τ the period, τ_1 the working interval, $\tau_2 = \tau - \tau_1$ the pause, $q(t)$ an additional signal which acts at the input of the servo for the acceleration of the reproduction of $x(t)$, and $\vartheta = [\frac{t}{\tau}]$ the integer part of t/τ.

Let $q(t)$ be a step function which is constant on intervals which are

Card 1/3

80251
S/040/60/024/02/15/032

On the Theory of the Impulse Servo-Systems

and the operator T: $T^s y_k = y_k (t + s\tau)$ are introduced, then finally one obtains

(1.15) $f(t)y(t) = bq(t)$.

The solution of (1.15) is obtained with the aid of the Laplace transformation. From this there result the values of q(t), for which (1.3) occurs. At first the author treats the case k^2 = const. and then the case $k^2 = x(t)$. An example is given.

There are 2 figures, and 2 Soviet references.

SUBMITTED: January 7, 1960

Card 3/3

84760

S/040/60/024/003/021/021 XX
C111/C222

13.2520

AUTHOR: Roytenberg, Ya. N. (Moscow)

TITLE: On the Motion of Gyroscopic Apparata Under the Influence of Random Forces

PERIODICAL: Prikladnaya matematika i mekhanika, 1960, Vol. 24, No. 3, pp. 463 - 472

TEXT: The author investigates the motion of the gyroscope stabilizer, the plane gyroscope pendulum and the gyrocompass for a non-regular motion of the ship. The motion equations of the gyroscope stabilizer for an irregular motion of the sea are taken from (Ref. 3) and under neglect of the time constants of the control chains they are written in the matrix form

(1.6) $$f(D)y = e(D)\,\theta(t), \qquad D = \frac{d}{dt},$$

where f(D), e(D) are polynomials of the differential operator $D = \frac{d}{dt}$, $y = \begin{Vmatrix}\alpha \\ \beta\end{Vmatrix}$, α is the angle of rotation of the frame around its axis, β is the angle of rotation of the
$\theta(t)$ is the angle of the motion of the sea and

Card 1/5

84760

On the Motion of Gyroscopic Apparata Under the Influence of Random Forces

S/040/60/024/003/0 /01 XX
C111/C222

gyroscope around the axis of the case. The motion of the ship is assumed to be a stationary random process with the correlation function

$R_1(\tau) = L_1 e^{-\mu|\tau|} (\cos \varepsilon \tau + \frac{\mu}{\varepsilon} \sin \varepsilon |\tau|)$, L_1 - dispersion of θ, μ, ε - ship constants. The deviation of the gyroscope stabilizer caused by the motion of the sea is estimated by the dispersion α^2 of the angle of rotation of the frame. The author obtains

$$(1.22) \quad \overline{\alpha^2} = \frac{2\mu\nu^2 L_1 M_5}{N_5},$$

where $\nu^2 = \varepsilon^2 + \mu^2$,

$$(1.20) \quad M_5 = a_0 b_1 (a_3 a_4 - a_2 a_5) + a_0 b_2 (\varepsilon_0 a_5 - a_1 a_4),$$

Card 2/5

84760
S/040/60/024/003/021/021 XX
C111/C222

On the Motion of Gyroscopic Apparata Under the Influence of Random Forces

$$(1.21)\qquad N = - \begin{vmatrix} a_1 & a_0 & 0 & 0 \\ a_3 & a_2 & a_1 & a_0 \\ a_5 & a_4 & a_3 & a_2 \\ 0 & 0 & a_5 & a_4 \end{vmatrix} ,$$

$$(1.18)\quad b_1 = -\left(\frac{a}{A}\right)^2 , \quad b_2 = \left(\frac{n}{A}\right)^2 , \quad a_0 = 1 , \quad a_1 = 2\mu + \frac{n}{A} , \quad a_2 =$$

$$= 2\mu\frac{n}{A} + q^2 + \nu^2 , \quad a_3 = (2\mu + \frac{m}{H})q^2 + \frac{n}{A}\nu^2 , \quad a_4 =$$

$$= \left(2\mu\frac{m}{H} + \nu^2\right) q^2 , \quad a_5 = \frac{m}{H} q^2 \nu^2 .$$

Here $A = A_1 + j^2 I$, A_1 - moment of inertia of the frame + object + gyroscope with respect to the collimating axis. I - moment of inertia of the un-

Card 3/5

84760

On the Motion of Gyroscopic Apparata Under the Influence of Random Forces

S/040/60/024/003/0 /0 XX
C111/C222

loading motor, j - tranrmission gear ratio from the motor shaft to the collimating axis, $a = j(j-1)I$, $n = \zeta + \frac{Kc}{r_2}$ (ζ - friction coefficient for frame supportings, $K = jk_1 \phi$, $c = j k_2 \phi$, ϕ - magnetic flux caused by the exciter coils of the unloading motor), $m = \frac{s \varkappa K}{r_1 r_2}$, $q^2 = \frac{H^2}{AB}$, H - kinetic moment of the gyroscope, B - equatorial moment of inertia of the gyroscope.

For the gyroscope pendulum the dispersion of the stabilizing angle is also determined. With the aid of the obtained formulas it is stated that for a motion of the sea the oscillations around the axis of the box are very large and oscillations around the axis of suspension are very small.

Under restriction to the precession motion the intercardinal deviation

$$x_1^{*} = aI_4 \sin 2\psi \qquad (3.24)$$

is determined for the gyrocompass; it vanishes for cardinal azimuths of

Card 4/5

84760

On the Motion of Gyroscopic Apparata Under the Influence of Random Forces

S/040/60/024/003/021/021 XX
C111/C222

course $\psi = 0^{o}$, 90^{o} , 180^{o} , 270^{o} and reaches its maximum for the intercardinal angles $\psi = 45^{o}$, 135^{o} , 225^{o} , 315^{o} . Explicit expressions are given for I_4 and a . By a numerical example it is shown that the intercardinal deviation is sufficiently small if the gyrocompass e.g. is of two-rotoric type.
The author mentions A.A. Sveshnikov and S.S. Rivkin.
There are 1 table and 5 references: 3 Soviet, 1 English and 1 American.

SUBMITTED: February 29, 1960

Card 5/5

S/040/60/024/04/22/023
C 111/ C 333

AUTHOR: Roytenberg, Ya, N, (Moscow)

TITLE: On the Theory of the Direct Gyroscope Stabilizers

PERIODICAL: Prikladnaya matematika i mekhanika, 1960, Vol. 24, No. 4, pp. 766-770

TEXT: Under the assumption that the undulations of a ship be a stationary random process, the author estimates the accuracy of active and passive gyroscopic stabilizers. For the mean quadratic deviation of the stabilization angle the author gives approximation formulas. A comparison of these formulas shows that the active gyroscopic stabilizers guarantee a higher stabilization velocity.

There are 4 references: 2 Soviet, 1 American and 1 German.

SUBMITTED: May 3, 1960

Card 1/1

ROYTENBERG, Ya.N. (Moskva)

Theory of direct gyrostabilizers. Prikl. mat. i mekh. 24 no.4:766-770 Jl-Ag '60. (MIRA 13:9)

(Gyroscope)

S/020/60/133/005/003/019
B019/B054

AUTHOR: Roytenberg, Ya. N.

TITLE: On the Motions of a Gyroscopic Compass Under the Action of Random Forces

PERIODICAL: Doklady Akademii nauk SSSR, 1960, Vol. 133, No. 5, pp. 1045 - 1048

TEXT: The author investigates the motion of a gyroscopic compass on the premise that the rolling of the ship is a steady random process which has a "fractional-rational" spectral density. Proceeding from the equation of motion (1) for a gyroscopic compass in a ballistic mercury container during the rolling of the ship, the author obtains - after substituting (3) in (1) - the system of differential equations (4) on the premise of a straight-lined steered course. The equations obtained from (4) in first approximation can be written down in the form of a matrix equation (5). The differential equation system (13) is obtained from this matrix equation for determining the expected values of the random processes; the solutions (15) are obtained from system (13) in first approximation. A

Card 1/2

On the Motions of a Gyroscopic Compass Under the Action of Random Forces

S/020/60/133/005/003/019
B019/B054

thorough discussion of (15) shows that in the rolling of the ship a gyroscopic compass has an azimuthal deviation. This deviation can be determined by formula (25). The determination of this deviation is explained by an example. There are 1 figure and 3 references: 2 Soviet and 1 British.

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

PRESENTED: April 12, 1960, by A. N. Kolmogorov, Academician

SUBMITTED: April 6, 1960

Card 2/2

ROYTENBERG, Ya. N.

"On the motion of a nonlinear gyroscopic system under the influence of random forces."

paper presented at the Intl. Symposium on Nonlinear Vibrations, Kiev USSR, 9-19 Sep 61

Moscow State University, Moscow, USSR

26730
S/040/61/025/003/007/026
D208/D304

16.8000 (1132, 1344)

AUTHOR: Roytenberg, Ya.N. (Moscow)

TITLE: On certain indirect methods of obtaining information about the state of a controlled system in a phase space

PERIODICAL: Akademiya nauk SSSR. Otdeleniye tekhnicheskikh nauk. Prikladnaya matematika i mekhanika, v. 25, no. 3, 1961, 440 - 444

TEXT: For an optimum system of automatic control, the control algorithm (obtained by the method of dynamic programming, or by the maximum principle of L.S. Pontryagin (Ref. 2: Optimal'nyye protsessy regulirovaniya, Usp. matem. nauk, 1959, t. XIV, vyp. I, str. 3)) is expressed in basic information concerning the state of the control system in a phase space. In many cases it is difficult to obtain this information, as it is not always possible to measure all the phase coordinates. The article deals with one of the possible

Card 1/7

26730
S/040/61/025/003/007/026
D203/D304

On certain indirect methods ...

methods of obtaining information indirectly in the case of stationary and non-stationary systems. Stationary systems: The motion of a stationary controlled system may be written

$$\sum_{k=1}^{n} f_{jk}(D) y_k = x_j(t) \qquad (j = 1, \ldots, n) \tag{1.1}$$

where y_k are the generalized coordinates of the system, $x_j(t)$ are the external forces acting on the system, $f_{jk}(D)$ is a polynomial in D, and $D = d/dt$. (1.1) is transformed into

$$y_j^{(m_j)} = F_j(y_1^{(m_1-1)}, \ldots, y_1, \ldots, y_n^{(m_n-1)}, \ldots, y_n) + \frac{B_{1j}}{\Delta^*} x_1(t) + \ldots + \frac{B_{nj}}{\Delta^*} x_n(t) \qquad (j = 1, \ldots, n) \tag{1.4}$$

where the upper indices (m_k) $(k = 1, \ldots, n)$ dnote the order of the derivative of y_k with respect to time, F_j is a linear function

Card 2/7

26730
S/040/61/025/003/007/026
D208/D304

On certain indirect methods ...

$\Delta^* = /b_{jk}/ \neq 0$ and B_{ij} is the algebraic complement of b_{ij}. By means of the transformations

$$z_1 = y_1,\ z_2 = \dot{y}_1, \ldots, z_{m_1} = y_1^{(m_1-1)}, \ldots, z_r = y_n^{(m_n-1)} \quad (1.5)$$

where

$$r = m_1 + m_2 + \ldots + m_n \quad (1.6)$$

and

$$X_{\sigma_j}(t) = \frac{B_{1j}}{\Delta^*} x_1(t) + \ldots + \frac{B_{nj}}{\Delta^*} x_n(t) \qquad (\sigma_j = \sigma_1, \ldots, \sigma_n) \quad (1.7)$$

where

$$\sigma_1 = m_1, \quad \sigma_2 = m_1 + m_2, \ldots, \sigma_n = r \quad (1.8)$$

(1.4) is obtained in the equivalent matrix form (1.12)

$$\dot{z} + az = X(t) \quad (1.13)$$

where

$$z = \| z_j \|, \quad a = \| a_{jk} \|, \quad X(t) = \| X_j(t) \|$$

Card 3/7

26730
S/040/61/025/003/007/026
D208/D304

On certain indirect methods ...

(1.12) is solved by operator methods to give

$$z_j(t) = \sum_{k=1}^{r} N_{jk}(t) z_k(0) + \sum_{i=1}^{n} \int_0^t W_{ji}(t-\tau) x_i(\tau) d\tau \qquad (j = 1, \ldots, r) \qquad (1.28)$$

where

$$W_{ji}(t) = \sum_{i=1}^{n} N_{j\alpha_i}(t) n_{li} \qquad \begin{pmatrix} j = 1, \ldots, r \\ l = 1, \ldots, n \end{pmatrix} \qquad (1.27)$$

$N(t) = //N_{jk}(t)//$ (1.19) and the elements of N(t) are known from B.V. Bulgakov (Ref. 3: Kolebaniya. Gostekhizdat, 1949, t. I, str. 164). A new arbitrary origin is chosen and the deviations $S(t_1)$, $S(t_2)$, ..., $S(t_{r+1})$ of the phase coordinate z_s referred to the new origin at some instant of time $t_1, \ldots, t_{r+1}$ are measured. S^* is the deviation of the new origin referred to the original origin. Then

4/7

26730
S/040/61/025/003/007/026
D208/D304

On certain indirect methods ...

$$\sum_{k=1}^{r} [N_{sk}(t_{\mu+1}) - N_{sk}(t_\mu)] z_k(0) = \qquad (\mu = 1, \ldots, r) \qquad (1.32)$$

$$= L_\mu - \sum_{l=1}^{n} \int_0^{t_{\mu+1}} W_{sl}(t_{\mu+1} - \tau) x_l(\tau) d\tau + \sum_{l=1}^{n} \int_0^{t_\mu} W_{sl}(t_\mu - \tau) x_l(\tau) d\tau$$

where $S(t_i) = S^* + z_s(t_i)$ $(i = 1, \ldots, r + 1)$ (1.29), $S(t_{\mu+1}) - S(t_\mu) = L_\mu$ $(\mu = 1, \ldots, r)$ (1.30). Hence, from (1.28) and (1.32), given the initial values of the phase coordinates $z_k(0)$, the values $z_j(t)$ at any subsequent instant of time t may be calculated. Non-stationary systems: In this case the equation of motion is

$$\sum_{k=1}^{n} f_{jk}(D) y_k = x_j(t) \qquad (j = 1, \ldots, n) \qquad (2.1)$$

Card 5/7

On certain indirect methods ...

where the coefficients of the polynomial $f_{jk}(D)$ are not constants, but are themselves functions of time. Transforming as before gives

$$\dot{z}_j + \sum_{k=1}^{r} a_{jk}(t) z_k = X_j(t) \qquad (j = 1, \ldots, r) \tag{2.2}$$

and the solution is

$$z_j(t) = \sum_{k=1}^{r} N_{jk}(t, 0) z_k(0) + \sum_{l=1}^{n} \int_0^t W_{jl}(t, \tau) x_l(\tau) d\tau \qquad (j = 1, \ldots, r) \tag{2.3}$$

where

$$W_{jl}(t, \tau) = \sum_{i=1}^{n} N_{j\alpha_i}(t, \tau) \frac{B_{li}(\tau)}{\Delta^*(\tau)} \qquad \begin{pmatrix} j = 1, \ldots, r \\ l = 1, \ldots, n \end{pmatrix} \tag{2.4}$$

and the matrix $N(t, \tau) = \theta(t)\, \theta^{-1}(\tau)$, where $\theta(t)$ is the fundamental matrix of the homogeneous matrix equation which may be obtained

26730

On certain indirect methods ... S/040/61/025/003/007/026
D208/D304

from (2.2) by putting $X_j(t) \equiv 0$. Similarly to (1.32), one obtains

$$\sum_{k=1}^{r} [N_{sk}(t_{\mu+1}, 0) - N_{sk}(t_{\mu}, 0)] z_k(0) = L_{\mu} - \sum_{l=1}^{n} \int_0^{t_{\mu+1}} W_{sl}(t_{\mu+1}, \tau) x_l(\tau) d\tau + \quad (2.5)$$

$$+ \sum_{l=1}^{n} \int_0^{t_{\mu}} W_{sl}(t_{\mu}, \tau) x_l(\tau) d\tau \qquad (\mu = 1, \ldots, r) \qquad (2.5)$$

Evaluation of the functions of (2.5) by previously established conditions leads to a solution as before. The author observes that electronic computers may be used to solve these equations. There are 4 references: 3 Soviet-bloc and 1 non-Soviet-bloc. The reference to the English-language publication reads as follows: R. Bellman, Dynamic Programming, Princeton University Press, 1957.

SUBMITTED: February 27, 1961

Card 7/7

ROYTENBERG, Ya.N. (Moskva)

Theory of the gyrocompass. Prikl. mat. i mekh. 28 no.5:812-828 S-O '64. (MIRA 17:11)

L 31276-65

ACCESSION NR: AR5004813 S/0044/64/000/011/V023/V023

AUTHOR: Roytenberg, Ya. N.

SOURCE: Ref. zh. Matematika, Abs. 11V123

TITLE: On the motion of one nonlinear gyroscopic system under the influence of random forces

CITED SOURCE: Tr. Mezhdunar. simpoziuma po nelineyn. kolebaniyam, 1961. T. 3. Kiyev, AN USSR, 1963, 441-447

TOPIC TAGS: gyroscopic compass, statistical analysis, compass error, random process

TRANSLATION: A hyroscopic compass is considered with mercury ballistic vowls. Under the conditions of a rolling ship, it is necessary to take into account in the differential equations the nonlinear terms, which explain the azimuthal deviation of the compass.

Card 1/3

L 31276-65

ACCESSION NR: AR5004813

A study is made of the behavior of the gyroscopic compass under the assumption that the rolling of the ship is a stationary random process with a bilinear spectral density. The author has shown that the steady-state value of the mathematical expectation of the deviation of the compass in azimuth, as the ship rolls, is determined by the following equation (the steady-state values of the mathematic expectations in the other coordinates are equal to zero):

$$x_1^* = aI^* \sin 2\psi - bJ^* \cos^2 \psi,$$

where ψ -- course of the ship and a and b -- certain constants that depend on the parameters of the compass, on its location in the ship, on the parameters determining the spectral density of the roll of the ship, on the dispersion of the roll angle, and on the latitude of the ship's position; I* and J* depend on the angular frequency of the natural oscillations of the mercury meniscus in the ballistic bowls. It is shown by means of an example that J* is small compared with I*, and consequently the maximum value of the deviation during

Card 2/3

L 31276-65

ACCESSION NR: AR5004813

A study is made of the behavior of the gyroscopic compass under the assumption that the rolling of the ship is a stationary random process with a bilinear spectral density. The author has shown that the steady-state value of the mathematical expectation of the deviation of the compass in azimuth, as the ship rolls, is determined by the following equation (the steady-state values of the mathematic expectations in the other coordinates are equal to zero):

$$x_1^* = aI^* \sin 2\psi - bJ^* \cos^2 \psi,$$

where ψ -- course of the ship and a and b -- certain constants that depend on the parameters of the compass, on its location in the ship, on the parameters determining the spectral density of the roll of the ship, on the dispersion of the roll angle, and on the latitude of the ship's position; I* and J* depend on the angular frequency of the natural oscillations of the mercury meniscus in the ballistic bowls. It is shown by means of an example that J* is small compared with I*, and consequently the maximum value of the deviation during

Card 2/3

26131
S/040/61/025/004/010/021
D274/D306

16.8000 (1031,1132,1344)

AUTHOR: Roytenberg, Ya. N. (Moscow)

TITLE: On the theory of alternating systems

PERIODICAL: Prikladnaya matematika i mekhanika, v. 25, no. 4, 1961, 691-704

TEXT: A system of difference equations is derived which describe the alternating system. The system is solved and the weighting function determined. A method is proposed for determining the position of an alternating system in phase space. It is convenient to pass from alternating systems of differential equations to a system of difference equations, which is derived as follows. During the time interval $n\tau + \varepsilon < t < n\tau + \tau_1$, the motion is described by a system of differential equations with variable coefficients:

$$\dot{z}_j + \sum_{k=1}^{r} b_{jk}(t) z_k = x_j(t) \qquad (j = 1, \ldots, r) \tag{1.1}$$

X

z_j $(j = 1, \ldots, r)$ are the phase coordinates, $x_j(t)$ are given exter-

Card 1/7

nal forces. After some transformations, one obtains, for ε $(0 \leq \varepsilon \leq \tau)$, whose interval corresponds to one period of alternation), the sought-for difference equations:

$$z_v(t + \tau) + \sum_{k=1}^{r} a_{vk}(t)\, z_k(t) = X_v(t) \quad (v = 1, \ldots, r) \qquad (1.30)$$

where

$$a_{vk}^{*}(n\tau + \varepsilon) = - \sum_{j=1}^{r} \sum_{\mu=1}^{r} L_{vj}((n + 1)\tau + \varepsilon, (n + 1)\tau) M_{j\mu}((n + 1)\tau, n\tau + \tau_1) \times L_{\mu k}(n\tau + \tau_1, n\tau + \varepsilon) \qquad (1.15)$$

L and M being matrix weighting functions. Further, the time dependence of $z_j(t)$ in the interval $0 < t < \tau$ is derived. The solution of a system of difference equations with variable coefficients is undertaken. The scalar system (1.30) is equivalent to the matrix equation

$$z(t + \tau) + a(t)\, z(t) = X(t) \qquad (2.1)$$

$$(a(t) = \| a_{vk}(t) \|,\ X(t) = \| X_v(t) \|)$$

The fundamental matrix of the homogeneous matrix equation $z(t + \tau) +$

26131
S/040/61/025/004/010/021
D274/D306

On the theory...

+ a(t)z(t) = 0 is denoted by θ(t). The matrix weighting function

$$N(t, j\tau) = \theta(t)\, \theta^{-1}(t - \vartheta\tau + j\tau) \quad (2.11)$$

is introduced. The solution of (2.1) is

$$z_s(t) = \sum_{k=1}^{r} N_{sk}(t, 0)\, z_k^*(t - \vartheta\tau) +$$

$$+ \sum_{k=1}^{r} \sum_{j=1}^{\vartheta} N_{sk}(t, j\tau)\, X_k(t - \vartheta\tau + j\tau - \tau) \quad (s = 1, \ldots, r) \quad (2.13)$$

it coincides in the interval $0 < t < \tau$ with the given matrix $z^*(t)$. On determining weighting function N_{sk}, it is noted that this weighting function is constructed after solving the conjugated system of difference equations

$$Z_k(t) + \sum_{l=1}^{r} a_{lk}(t)\, Z_l(t + \tau) = 0 \quad (k = 1, \ldots, r) \quad (3.3)$$

For a fixed s one obtains

$$N_{sk}(t_1, j\tau) = Z_k(t_1 - \vartheta_1\tau + j\tau) \quad (k = 1, \ldots, r) \quad (3.12)$$

Card 3/7

26131
S/040/61/025/004/010/021
D274/D306

ϑ denotes the integral part of t/τ. The relationships

$$z_\nu((n + 1)\tau) + \sum_{k=1}^{r} a_{\nu k}(n\tau)\, z_k(n\tau) = X_\nu(n\tau) \quad \begin{pmatrix} n = 1,2,\dots \\ \nu = 1,\dots,r \end{pmatrix} \qquad (4.1)$$

$$a_{\nu k}(n\tau) = -\sum_{\mu=1}^{r} M_{\nu\mu}((n + 1)\tau,\, n\tau + \tau_1)\, L_{\mu k}(n\tau + \tau_1, n\tau) \qquad (4.2)$$

$$X_\nu(n) = \sum_{\mu=1}^{r} M_{\nu\mu}((n + 1)\tau, n\tau + \tau_1) \int_{n\tau}^{n\tau+\tau_1} \sum_{k=1}^{r} L_{\mu k}(n\tau + \tau_1, \xi)\, x_k(\xi)\, d\xi + \int_{n\tau+\tau_1}^{(n+1)} \sum_{\mu=1}^{r} M_{\nu\mu}((n + 1)\tau, \xi)\, s_\mu(\xi)\, d\xi \qquad (4.3)$$

are set up; these are obtained by setting $\varepsilon = 0$ in foregoing difference equations; (thus, Eq. (4.2) is ontained from Eq. (1.15). Eq. (4.3), which are valid for integral n only, are difference equations with discrete argument. Hence, the solutions to Eq. (4.1) determine a sequence of phase coordinates z_ν at discrete points which are the

26131
S/040/61/025/004/010/021
D274/D306

limit points of alternation periods, i.e. at moments $t = n\tau$ ($n = 1, 2, \ldots$). These solutions can be obtained by the method exposed above, by replacing Eq. (4.1) by a system of difference equations

$$z_v(t+\tau) + \sum_{k=1}^{r} a_{vk}^{o}(t)\, z_k(t) = X_v^{o}(t) \quad (v = 1, \ldots, r) \quad (4.4)$$

where $a_{vk}^{o}(t)$ and $X_v^{o}(t)$ are step functions: (see Eq. (1.30)). The solution to Eq. (4.4) for values of t which are multiples of τ, is:

$$z_v(\vartheta\tau) = \sum_{k=1}^{r} N_{vk}(\vartheta\tau, 0)\, z_k(0) + \sum_{k=1}^{r} \sum_{j=1}^{\vartheta} N_{vk}(\vartheta\tau, j\tau)\, X_k(j\tau - \tau) \quad (v = 1, \ldots, r) \quad (4.5)$$

With regard to the alternating systems of linear differential equations with constant coefficients, it is found that the coefficients $a_{vk}(t)$ of Eq. (1.30) are periodic functions of time with period equal to τ. Eq. (4.1) will become equations with constant coefficients. Expressions are also given for the form of the functions $X_v(n\tau)$ (which enter the right-hand side of Eq. (4.1)), and for the time dependence of the phase coordinates in the interval $\vartheta\tau < t <$

Card 5/7

28131
S/040/61/025/004/010/021
D274/D306

On the theory...

$(\vartheta + 1)\tau$. A method is given of determining the position of an alternating system in phase space: The method consists in measuring the deviation of one of the phase coordinates. It follows from Eq. (2.13) that at $t = \vartheta\tau$ (ϑ being an integer), the phase coordinate z_s is:

$$z_s(\vartheta\tau) = \sum_{k=1}^{r} N_{sk}(\vartheta\tau, 0) z_k(0) + \sum_{k=1}^{r} \sum_{j=1}^{\vartheta} N_{sk}(\vartheta\tau, j\tau) X_k(j\tau - \tau) \quad (6.1)$$

Assuming that z_s can be measured, and that the initial reading-zero is unknown, the deviation of z_s from some arbitrary reading-zero

$$S(\vartheta_i\tau) = S^* + z_s(\vartheta_i\tau) \quad (i = 1, \ldots, r + 1) \quad (6.2)$$

is measured; S^* is the deviation of the new reading-zero from the initial one; by taking consecutive measurements, one arrives at a relationship which does not contain the unknown S^*. Finally a linear system of algebraic equations is obtained, from which the initial values $z_k(0)$ $(k = 1, \ldots, r)$ of the phase coordinates can be obtained; thereupon, the use of Eq. (2.13) leads to determination of the phase coordinates $z_\nu(t)$ $(\nu = 1, \ldots, r)$ for any t. There are 9

Card 6/7

26131
S/040/61/025/004/010/021
D274/D306

On the theory...

references: 6 Soviet-bloc and 3 non-Soviet-bloc. The references to the English-language publications read as follows: J.R. Ragazzini and L.A. Zadeh, The Analysis of sampled-data Systems, Transactions of AIEE, 1952, v. 71, p. 225; J.R. Ragazzini and G.F. Franklin, Sampled Data Control Systems, McGraw Hill, 1958; R. Bellman, Dynamic Programming, Princeton University Press, 1957.

SUBMITTED: April 3, 1961

Card 7/7

38081
S/040/62/026/003/003/020
D407/D301

16.8000
13.2000

AUTHOR: Roytenberg, Ya.N. (Moscow)

TITLE: Problems of dynamic programming for nonlinear systems

PERIODICAL: Prikladnaya matematika i mekhanika, v. 26, no. 3, 1962, 418 - 430

TEXT: The choice of controlling forces is considered, which would ensure the realization of the law of motion (given in the phase space) of a non-linear control system, or would ensure that the nonlinear system passes at given moments through pre-assigned states. The equations of motion are

$$\sum_{k=1}^{n} f_{jk}(D)\, y_k = x_j(t) + q_j(t) + \qquad (1.1)$$

$$+ \psi_j(y_1, \dot{y}_1, \ldots, y_1^{(m_1-1)}, \ldots, y_n, \dot{y}_n, \ldots, y_n^{(m_n-1)}, t) \qquad (j=1,\ldots,n)$$

where y_k are generalized coordinates, $x_j(t)$ - given external forces, $q_j(t)$ - additional external forces, whose law of change is chosen so

Card 1/4

S/040/62/026/003/003/020
D407/D301

Problems of dynamic programming ...

as to ensure the realization of a given motion; $f_{jk}(D)$ denote polynomials of D ($D = d/d\tau$); Ψ_j are nonlinear functions. The original system of equations is replaced (after transformations), by a nonlinear integral matrix-equation; the equivalent scalar integral equations are

$$z_j(t) = g_j(t) + \sum_{l=1}^{n} \int_{t_0}^{t} W_{jl}(t, \tau) q_l(\tau) d\tau + \sum_{l=1}^{n} \int_{t_0}^{t} W_{jl}(t, \tau) \psi_l(z_1(\tau), \ldots, z_r(\tau), \tau) d\tau \quad (j = 1, \ldots, r) \tag{1.20}$$

It is required that certain phase-coordinates z_{p_ν} ($\nu = 1, \ldots, m$) of the system should assume, at the moment t_1, pre-assigned values r_{p_ν}. The additional forces $q_s(t)$ have to be determined in such a way, that

$$z_{p_\nu}(t_1) = r_{p_\nu} \quad (\nu = 1, \ldots, m); \tag{1.22}$$

$q_s(t)$ are taken as step functions, their values in the interval (t_0,

Card 2/4

t_1) remaining unchanged. After transformations, one obtains the sought-for external forces $q_s(t)$:

$$q_{s_i}(t) = q_{s_i}(t_0) = k_{s_i}(t_1) - \sum_{l=1}^{n} \int_{t_0}^{t_1} U_{s_i l}(t_1, \tau)\, \psi_l(z_k(\tau), \tau)\, d\tau \qquad \begin{pmatrix} t_0 \leqslant t < t_1 \\ i = 1, \ldots, m \end{pmatrix} \tag{1.37}$$

Further, the case is considered where the number of additional external forces, which are realizable in the system under consideration, is smaller than the number of phase coordinates which assume pre-assigned values at t_1. For convenience, only a single external force $q_s(t)$ is considered. The system of integral equations is derived, and a formula for $q_s(t)$ obtained. The above method permits realizing a law of motion, given in m-dimensional phase space z_p. The particular case is considered, in which the value of only one phase-coordinate is pre-assigned, and only one nonlinear function Ψ enters the equations of motion. Further, the above methods are applied to the problem of speeding up the precessing of a gyrocompass towards the meridian, in the presence of a nonlinear restoring force. The equation for the precessional motion of a gyrocompass is replaced by a matrix equation, which (in turn) is replaced by a system of scalar integral equations. It is required to determine the law of change of the additional force Q(t), which has to be applied so that the gyrocompass precesses towards the meridian at a given moment of time. The integral equations considered in the foregoing, are solved by numerical methods. The integral equation for the gyrocompass motion was solved on an electronic computer for actual values of the parameters. The results of the calculations are given in a table and a figure. There are 1 figure and 1 table.

SUBMITTED: January 2, 1962

APPROVED FOR RELEASE: 07/19/2001 CIA-RDP86-00513R001445520009-1"

S/179/62/000/004/004/010
E191/E535

AUTHOR: Roytenberg, Ya.N. (Moscow)

TITLE: Some problems in the theory of servo-assisted gyroscopic stabilisers

PERIODICAL: Akademii nauk SSSR. Izvestiya. Otdeleniye tekhnicheskikh nauk. Mekhanika i mashinostroyeniye, no.4, 1962, 100-111

TEXT: This review of the basic types of gyroscopic devices for stabilisation about a single axis was written and had a restricted distribution in 1943. The present publication is an abridged version following an unauthorised reproduction in an allegedly distorted form in the book by P. I. Saydov et al. [Voprosy prikladnoy teorii giroskopov (Problems of the Applied Theory Gyroscopes), Sudpromgiz., 1961]. The devices considered ensure stabilisation in relation to the axle of the gimbal ring, the bearings of which are mounted on the ship's deck. Four configurations are considered. In the first, the gyroscope axis is vertical and the gyroscope housing is horizontal and is supported in bearings mounted on the gimbal ring. The erection

Card 1/3

device consists of a pendulum mounted on the gimbal ring and an erecting electro-magnet which produces the precession of the gimbal to return the housing axis into the horizontal position. To prevent the stabilising effect from diminishing with increasing angle of precession, a stabilising motor, via a gear train, turns the gimbal axle. The motor is controlled by contacts on the gyroscope housing. In the second scheme, the gyroscope rotor axis is horizontal. The erection device and the stabilising motor are arranged in a manner similar to the first scheme. In the third scheme, two horizontal gyroscopes are used, rotating in opposite directions. The housing axes of the two gyroscopes are linked together by an anti-parallelogram linkage so that the turning angles of the housings, for small angles, are equal and opposite. The contact device for energising the stabilising motor is attached to one of the two housings. The erection mechanism is the same as before. In the fourth scheme, two vertical gyroscopes are arranged with housings interconnected by an anti-parallelogram linkage. Erection and stabilising motor are arranged as before. The equations of motion for the stabilising devices are derived for all four configurations. The gyroscope axis is related to a coordinate frame where the "x" axis is horizontal and lies in a plane perpendicular to the gimbal axis, the "y" axis is the gimbal axis and the "z" axis is perpendicular to both and becomes the equilibrium position of the gyroscope rotor axis. The equations of motion are compared. Further study requires knowledge of the motion of the reference frame. Its orientation is determined by the presence of the erection device and the stabilising motor so that the gyroscope performs small oscillations in relation to the reference frame. The latter moves in space and the gyroscope following up this motion presents an inertia resistance. One component of this resistance is absent in stabilising devices with two gyroscopes. As a consequence, the stabilising motor is much more lightly loaded. The maximum possible erection moment must exceed the corresponding inertia moment. From this condition the minimum rate of erecting correction is derived. The drift of the stabilising device from the horizontal in the absence of artificial erection is given. There are 9 figures.

SUBMITTED: May 14, 1961

41500
S/040/62/026/005/012/016
D234/D308

AUTHOR: Roytenberg, Ya. N. (Moscow)

TITLE: Reduction of some problems of dynamic programming for nonlinear systems to transcendental equations

PERIODICAL: Prikladnaya matematika i mekhanika, v. 26, no. 5, 1962, 950-952

TEXT: The author considers the system of equations

$$z_j(t) = \Gamma_j(t) - \sum_{i=0}^{m-1} \sum_{l=1}^{n} \chi_{ji}(t) \int_{t_0}^{t_1} \Xi_{il}(t_1, \tau) \Psi_l(z_1(\tau), \ldots, z_r(\tau), \tau) d\tau +$$

Card 1/4

$$+ \sum_{l=1}^{n} \int_{t_o}^{t} \mathcal{N}_{jl}(t,\tau) \Psi_l(z_1(\tau), \ldots, z_r(\tau), \tau) d\tau \quad (t_o \leqslant t \leqslant t_1)$$

$$(j = 1, \ldots, r) \qquad (1)$$

derived by himself in a previous paper. The time interval (t_0, t_1) is divided into ν equal or unequal intervals $(\alpha_{\mu-1}, \alpha_{\mu})$, the functions z_j are assumed to be stepped, their values in each subinterval being denoted by $z_{j\mu}$. The equations are then reduced to a system of finite transcendental equations

APPROVED FOR RELEASE: 07/19/2001 CIA-RDP86-00513R001445520009-1"

$$\sum_{\xi=1}^{\nu} E_{j\mu\xi}(z_{1\xi},\ldots,z_{r\xi}) - \sum_{\xi=1}^{\mu} L_{j\mu\xi}(z_{1\xi},\ldots,z_{r\xi}) + z_{j\mu} = \Gamma_j(\alpha_\mu)$$

$$(j = 1,\ldots,r;\ \mu = 1,\ldots,\nu) \qquad (6)$$

where

$$E_{j\mu\xi}(z_{1\xi},\ldots,z_{r\xi}) = \sum_{i=0}^{m-1}\sum_{l=1}^{n} \chi_{ji}(\alpha_\mu)\int_{\alpha_{\xi-1}}^{\alpha_\xi} \Xi_{il}(t_1,\tau)\psi_l(z_{1\xi},\ldots,z_{r\xi},\tau)\,d\tau \qquad (4)$$

$$L_{j\mu\xi}(z_{1\xi},\ldots,z_{r\xi}) = \sum_{l=1}^{n} \int_{\alpha_{\xi-1}}^{\alpha_{\xi}} W_{jl}(\alpha_{\mu},\tau)\Psi_l(z_{1\xi},\ldots,z_{r\xi},\tau)d\tau$$

$$(j = 1,\ldots,r;\ \mu,\xi = 1,\ldots,\nu) \qquad (5)$$

the solutions of which can be taken as zero approximations for an iterative process. If the initial system contains only one nonlinear function of a single argument

$$\Psi_{\lambda} = \Psi_{\lambda}(z_k(t)) \qquad (7)$$

the transcendental system can be reduced to a simpler form.

SUBMITTED: June 21, 1962

S/040/62/026/006/015/015
D234/D308

16,8000

AUTHOR: Roytenberg, Ya.N. (Moscow)

TITLE: Determination of the position of controlled non-linear impulse system in phase space

PERIODICAL: Prikladnaya matematika i mekhanika, v. 26, no. 6, 1962, 1136 - 1140

TEXT: The author extends the method of his previous papers to the above case. The equations of motion are reduced to (1.3), which is replaced by a matrix equation. The operation T is defined by

$$T^{\mu} y_k = y_k(t + \mu\tau). \qquad (1.2)$$

In many cases the law of variation of the functions z is unknown and only one phase coordinate can be measured. For these cases the author reduces the equations to (2.9). The conditions of solvabili- ty of this system are as yet unknown. The number of equations is reduced if the non-linear functions contain only one phase coordi- nate.

Card 1/2

3 8954

S/020/62/144/006/003/015
B112/B104

16.1500

AUTHOR: Roytenberg, Ya. N.

TITLE: Determination of the situation of a non-linear controlling system in the phase space

PERIODICAL: Akademiya nauk SSSR. Doklady, v. 144, no. 6, 1962, 1225-1228

TEXT: The matrix differential equation $\dot{z} + a(t)z = X(t) + \Psi(z_1,\dots,z_r,t)$ is equivalent to the matrix integral equation

$$z(t) = N(t,t_o)z(t_o) + \int_{t_o}^{t} N(t,\tau)X(\tau)d\tau + \int_{t_o}^{t} N(t,\tau)\Psi(z_1(\tau),\dots,z_r(\tau),\tau)d\tau.$$

This equation can be solved if the initial values $z_k(t_o)$ of the phase coordinates are given. The author, however, considers the case where the initial values $z_k(t_o)$ are unknown and where only one of the phase coordinates z_s is measurable. An approximative method of solving this

Card 1/2

L 41514-65 EEO-2/EWT(d)/EEC-4 / Pn-4/Po-4/Pq-4/Pg-4/Pk-4/Pl-4 BC
ACCESSION NR: AP4046265 S/0040/64/028/005/0812/0828 35 B

AUTHOR: Roytenberg, Ya. N.

TITLE: Theory of the gyroscopic compass

SOURCE: Prikladnaya matematika i mekhanika, v. 28, no. 5, 1964, 812-828

TOPIC TAGS: gyroscopic compass, ship maneuvering, navigation, Euler's angle, undamped gyroscope

ABSTRACT: The author has investigated the motion of a two-rotor gyroscopic compass. A two-rotor gyroscopic compass is a sphere immersed in liquid, inside of which there are two gyroscopes with horizontal rotor axes. The axes of the housing of the gyroscopes are vertical and are connected to each other by a four-link mechanism. (See enclosure) Therefore, the rotation of the gyroscopes about the axis of their housing takes place in opposite directions by equal angles. Detail mathematical analysis and results are tabulated. Orig. art. has: 6 figures, 4 tables, 92 equations

Card 1/2

L 41514-65
ASSOCIATION: AP4046265

ASSOCIATION: None

SUBMITTED: 02Jan64 ENCL: 01

SUB CODE: MA, NG NO REF SOV: 006 OTHER: 001

0

Card 2/3

L 16057-66 EWT(d)/T IJP(c)
ACC NR: AP6004066 SOURCE CODE: UR/0040/65/029/005/0821/0827

AUTHOR: Roytenberg, Ya. N. (Moscow)

ORG: none

20
B

TITLE: Construction of Lyapunov functions for systems of linear equations in finite differences with variable coefficients

16,44,55

SOURCE: Prikladnaya matematika i mekhanika, v. 29, no. 5, 1965, 821-827

TOPIC TAGS: difference equation, stability

ABSTRACT: The author treats

$$x_j(t+\tau)+\sum_{k=1}^{n} b_{jk}(t)\,x_k(t)=0 \qquad (j=1,\ldots,n) \qquad (1)$$

which is a system of difference equations with variable coefficients. He proposes a method for construction Lyapunov functions and for obtaining sufficient conditions for asymptotic stability of the zero solution of such systems, extending his approach in (Ob odnom metode postroyeniya funktsiy Lyapunova dlya lineynykh sistem s peremennymi koeffitsiyentami. PMM, 1958, t. 22, vyp. 2.) for differential

Card 1/2

2

L 16057-66

ACC NR: AP6004066

equations. In that article he presented a region in which the variable coefficients can vary without violating stability. As a particular case he considers

$$T\dot{x}_1 - x_1 - kx_2 = 0, \quad T\dot{x}_2 + m(t)x_1 - (1 - \lambda k)x_2 = 0, \quad (2)$$

Orig. art. has: 46 formulas.

SUB CODE: 12/ SUBM DATE: 14May65/ ORIG REF: 003

Card 2/2

ACC NR: AM6021065 Monograph UR/

Roytenberg, Yakov Naumovich

Gyroscopes (Giroskopy) Moscow, Izd-vo "Nauka," 1966. 399 p. illus., biblio., index. Errata slip inserted. 8,000 copies printed

TOPIC TAGS: gyroscope, gyrocompass, gyroscopic stabilizer

PURPOSE AND COVERAGE: This monograph is devoted to the theory of gyroscopic instruments installed on moving objects, such as ships, airplanes, etc. Special attention is given to explaining the conditions for effectiveness of such gyroscopic systems, determining their accuracy under actual operating conditions, searching for ways to synthesize the most rational schemes for gyroscopic devices, and selecting their dynamic characteristics. This book is based on articles written by the author which have appeared over a number of years in various journals. The monograph is intended for adequately prepared readers who are familiar with the basic works on the applied theory of gyroscopes. The author hopes that this monograph will also contribute to the further development of the applied theory of gyroscopes.

TABLE OF CONTENTS [abridged]:

Card 1/2 UDC: 531.383

ACC NR: AM6021065

SUB CODE: 17/ SUBM DATE: 16Mar66/ ORIG REF: 073/ OTH REF: 012/

Card 2/2

L 4040-66 EWT(d) BC

ACCESSION NR: AP5021304 UR/0040/65/029/004/0723/0728

34
B

AUTHOR: Roytenberg, Ya. N. (Moscow)

44

TITLE: A self-correcting horizon gyrocompass 9,44

SOURCE: Prikladnaya matematika i mekhanika, v. 29, no. 4, 1965, 723-728

TOPIC TAGS: navigation, navigation system, guidance, gyrocompass, Lyapunov function 9

ABSTRACT: The author presents a basis for a self-correcting horizon gyrocompass having a sensitive element consisting of a gyrosphere of common gyroscopic compass construction. The device is unique in that its center of gravity coincides with its geometric center. and hence the gyrosphere's equations of motion are

$$[2B\cos(\varepsilon-\delta)\sin\beta]' + 2B\cos(\varepsilon-\delta)(u_1\cos\alpha\cos\beta + u_2\sin\alpha\cos\beta) = M_\zeta$$

$$2B\cos(\varepsilon-\delta)(\alpha'\cos\beta + u_1\sin\alpha\sin\beta - u_2\cos\alpha\sin\beta + u_3\cos\beta) = M_x,$$

$$[2B\cos(\varepsilon-\delta)]' = M_z$$

$$2B\sin(\varepsilon-\delta)(\alpha'\sin\beta + \gamma' - u_1\sin\alpha\cos\beta + u_2\cos\alpha\cos\beta + u_3\sin\beta) = \varkappa\sin\delta\cos\delta - M_{y_1}$$

$$\left(u_1 = -\frac{v_N}{R},\quad u_2 = U\cos\varphi + \frac{v_E}{R},\quad u_3 = U\sin\varphi + \frac{v_E}{R}\operatorname{tg}\varphi\right),$$

Card 1/3

L 4040-66

ACCESSION NR: AP5021304

where the coordinate spherical trigonometry variables are as defined in Figure 1 on the Enclosure. The origin of coordinates is at the center of the gyrosphere; axis ζ is directed along a radius of the earth, and axes ξ and η are horizontal and directed respectively to the east and north. The angles α, β, and γ are Euler angles of rotation of the gyrosphere about certain axes. Additional angular relationships are defined for the positions of the two rotor axes; B is the variable name for gyroscope kinetic moment; u and v variables denote relative angular velocity components, and M variables are applied moments of external forces, R is the earth's radius, and ϕ is the latitude of the subject craft. Expressions for correction moments and forces are related to the defined coordinate system. Parametric definitions and the derived solution are established following the introduction of the Lyapunov function (see Ya. N. Roytenberg. Ob odnom metode postroyeniya funktsiy Lyapunova dlya lineynykh sistem c peremennymi koeffitsiyentami. PMM, 1958, t. 22, vyp. 2). Reference is also made to the Sylvester theorem. An example of the uses of the method for a particular set of parameter values is given. Orig. art. has: 31 equations and 1 figure.

ASSOCIATION: none

SUBMITTED: 06Apr65 ENCL: 01 SUB CODE: NG, MA, ES

NO REF SOV: 004 OTHER: 001

Card 2/3

L 4040-66 ENCLOSURE: 01

ACCESSION NR: AP5021304

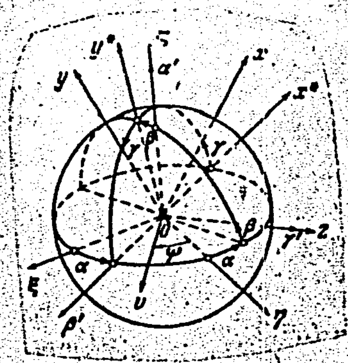

Fig. 1

Card 3/3

ROYTENBERG, Ya. N.

An adjustable gyrocompass. Dokl. AN SSSR 163 no.2:311-314 Jl '65. (MIRA 18:7)

1. Moskovskiy gosudarstvennyy universitet im. M.V.Lomonosova. Submitted December 29, 1964.

L 65180-65 EWT(d) BC

ACCESSION NR: AP5018738 UR/0020/65/163/002/0311/0314

24
22
B

AUTHOR: Roytenberg, Ya. N. 55

TITLE: A corrected gyrocompass 9,55

SOURCE: AN SSSR. Doklady, v. 163, no. 2, 1965, 311-314

TOPIC TAGS: gyrocompass, linear differential equation, approximation method

ABSTRACT: A corrected gyrocompass is a gyrocompass, the sensitive element of which is set up on a platform stabilized in the horizontal and which is brought into the meridian by means of correcting moments of rotation applied to the gyroscope. It is shown that, for any ship movements, the corrected gyrocompass does not have a deviation in angular velocity on the axis. The equations for the movement of the compass form a system of linear differential equations

$$+ H\frac{v_E}{R}\operatorname{tg}\varphi\cos\beta\,(1-\cos\alpha) - H\frac{v_N}{R}\operatorname{tg}\varphi\sin\alpha\cos\beta - K\sin\beta = 0.$$

for which the sufficient conditions for asymptotic stability of a solution are found. Orig. art. has: 26 formulas, 1 figure.

Card 1/2

L 65180-65

ACCESSION NR: AP5018738

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

SUBMITTED: 16Dec64 ENCL: 00 SUB CODE: ME

NO REF SOV: 001 OTHER: 001

Card 2/2

S/3037/63/003/000/0441/0447

ACCESSION NR: AT4017770

AUTHOR: Roytenberg, Ya. N. (USSR)

TITLE: The motion of a nonlinear gyroscopic system under the influence of random forces

SOURCE: International Symposium on Nonlinear Oscillations. Kiev, 1961. Prilozheniya metodov teorii nelineyny*kh kolebaniy k zadacham fiziki i tekhniki (Applying methods of the theory of nonlinear oscillations in problems of physics and technology); trudy* simpoziuma, v. 3. Kiev, Izd-vo AN UkrSSR, 1963, 441-447

TOPIC TAGS: automation, automatic control, control system, gyroscope, nonlinear gyroscope, gyroscopic compass, gyroscope motion, gyrocompass

ABSTRACT: The gyroscopic compass with mercury ballistic tanks is a nonlinear mechanical system. The presence of nonlinear terms in the differential equations for the motion of a gyrocompass gives rise to compass deviations in azimuth as the ship rolls. If the parameters of the gyrocompass are not properly chosen, these deviations may be very great, reaching values under real conditions of the order of 10-15 degrees. In the present work, the motion of a gyroscopic compass with mercury ballistic tanks is studied, on the assumption that the rolling of the ship

Card 1/2

ACCESSION NR: AT4017770

is a stationary random process with a fraction-rational spectral density. It is shown that the accuracy of the gyrocompass on a rolling ship can be ensured by the proper choice of the period of free oscillations of the mercury in the ballistic tanks; that is in order to avoid intercardinal deviation, the parameters of the mercury ballistic tanks must be so selected that the value of the angular frequency n of the free oscillations of the mercury mirror are sufficiently close to that value of argument n* at which the function I*(n) vanishes. In the case considered, n* = 0.843. Orig. art. has: 38 formulas and 1 figure.

ASSOCIATION: none

SUBMITTED: 00 DATE ACQ: 28Feb64 ENCL: 00

SUB CODE: CG NO REF SOV: 001 OTHER: 002

Card 2/2

AM4020386 BOOK EXPLOITATION S/

Roytenberg, Yakov Naumovich

Some problems of motion control (Nekotory*ye zadachi upravleniya dvizheniyem) Moscow, Fizmatgiz, 1963. 138 p. illus., biblio. 10,000 copies printed. Errata printed inside back cover. Editor: Gnoyenskiy, L. S.; Technical editor: Brudno, K. F.; Proofreader: Pletneva, T. S.

TOPIC TAGS: motion control theory, continuous action systems, linear systems, gyro compass, linear control system, phase space, nonlinear systems, pulse systems, difference equations

PURPOSE AND COVERAGE: This monograph is devoted to problems of achieving a selected strategy of motion and to certain problems of identification, and summarizes the author's studies on these problems of the theory of the control of motion. The author thanks I. A. Balayev and V. A. Cheprasov for setting up the computation programs for the examples presented and L. S. Gnoyenskiy for his valuable editorial assistance.

Card 1/3

AM4020386

TABLE OF CONTENTS:

Card 2/3

AM4020386

SUB CODE: MM, CG SUBMITTED: 18Sep63 NR REF SOV: 14

OTHER: 6 DATE ACQ: 31Jan64

Card 3/3

ROYTENBERG, YA.N. (Moscow)

"On the motion of gyroscopic systems under the action of random forces"

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

ROYTENBERG, YA.N. (Moscow)

"Some problems of motion control"

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

ROYTENBERG, Yakov Naumovich; GNOYENSKIY, L.S., red.; BRUDNO, K.F., tekhn. red.

[Some problems concerning the control of motion] Nekotorye zadachi upravleniia dvizheniem. Moskva, Fizmatgiz, 1963. 138 p. (MIRA 17:1)

(Motion)

ROYTENBERG, Ya.N., doktor fiz.-matem.nauk

"Mechanics of gyroscopic systems" by A.IU.Ishlinskii. Reviewed by IA.N.Roitenberg. Vest. AN SSSR 33 no.8:131-134 Ag '63. (MIRA 16:8)

(Gyroscope) (Ishlinskii, A.IU.)

ROYTENBERG, Ye.M.

PHASE I BOOK EXPLOITATION SOV/4132

Liyk, Rol'f Vladimirovich, and Yefim Mikhaylovich Roytenberg

Avtomaticheskaya telefonnaya stantsiya dekadno-shagovoy sistemy ATS-54 (ATS-54 Ten-Step Automatic Telephone Exchange) Moscow, Svyaz'izdat, 1959. 115 p. 5,000 copies printed.

Resp. Ed.: L. Ya. Eydel'man, Ed.: L. M. Kirillov; Tech. Ed.: G. I. Shefer.

PURPOSE: This book is for personnel of telephone exchanges, scientific research institutes, planning and designing offices, and industrial enterprises.

COVERAGE: The book describes the technical aspects and special features of ATS-54 equipment for local and long-distance telephone sets. In 1959 this equipment was operated on an experimental basis in Moscow and Leningrad, and its serial production is planned for the current year. Chapters I, III, IV and V, and the appendix were written by Y. M. Roytenberg; the foreword and Chapters II, VI, and VII were written by R. V. Liyk. There are 12 references, all Soviet.

Card 1/5

ROYTENBERG, Yefim Mikhaylovich; KHARKEVICH, Anatoliy Dem'yanovich; MATYUSH, B.I., otv.red.; RYAZANTSEVA, M.M., red.; KARABILOVA, S.F., tekhn.red.

[Crossbar trunk and its use in designing selection units on automatic telephone exchanges] Koordinatnyi soedinitel' i ego ispol'zovanie pri postroenii blokov iskaniia na ATS. Moskva, Gos.izd-vo lit-ry po voprosam sviazi i radio, 1960. 47 p. (MIRA 13:10)

(Telephone, Automatic)

L 45578-66 EWT(d)/EWP(v)/EWP(k)/EWP(h)/EWP(l) BC

ACC NR: AP6030986 SOURCE CODE: UR/0378/66/000/004/0052/0056

AUTHOR: Boltyanskiy, V. G.; Roytenberg, Ye. Ya.

40
B

ORG: none

TITLE: An example of the synthesis of a nonlinear, second-order system

SOURCE: Kibernetika, no. 4, 1966, 52-56

TOPIC TAGS: time optimal control, nonlinear control system, second order ~~system, control synthesis~~ differential equation

ABSTRACT: A control system whose behavior is described by a second-order differential equation of the form

$$\ddot{x} = u - f(x, \dot{x}, u), \qquad (1)$$

where u is a real control parameter constrained by the inequality

$$-1 \leqslant u \leqslant 1, \qquad (2)$$

and $f(x, \dot{x}, u)$, which is considered as a not substantial addition to the right-hand side of equation (1) is a continuously differentiable function with respect to all its arguments and satisfies the conditions

UDC: 62—501.3

Card 1/3

L 45578-66

ACC NR: AP6030986

$$f(x, \dot{x}, 1) < 1, f(x, \dot{x}, -1) > -1 \quad \text{for all } x \text{ and } \dot{x} \qquad (3)$$

$$\frac{\partial f(x, \dot{x}, u)}{\partial x} \leqslant 0, \quad \frac{\partial f(x, \dot{x}, u)}{\partial u} < 1 \quad \text{for all } x, \dot{x}, \text{ and } u. \qquad (4)$$

Equation (1) and conditions (3), (4) are written in phase coordinates and the problem of synthesizing such a control system is defined as follows: to find that control u(t) which takes the phase point from the given initial state into the origin of coordinates in the shortest time. The distribution and the approximate form of phase semitrajectories of the system corresponding to u = 1 and entering the point (a, 0) (designated by α_a) and of semitrajectories corresponding to u = -1 and entering the point (b, 0) (designated by α_b) are determined which is presented in Fig. 1. The part of the phase plane between the lines Δ and Δ_1 and the lines formed by semitrajectories α_0 and α_0' (see Fig. 1) are designated by G and Γ, respectively. Then, the synthesis of the time-optimal control system is formulated by the following theorem: For the control system (1), (2) which satisfies conditions (3), (4), the time-optimal motion from an arbitrary point of domain G to the origin of coordinates is possible; from the points which are not located in domain G, in general, it is impossible to get to the origin of coordinates. In domain G, synthesis of optimal control is realized in the following manner: at points located above the line Γ and on the