PHASE I BOOK EXPLOITATION SOV/4159

Akademiya nauk SSSR. Komissiya po nauchnoy fotografii i kinematografii

Uspekhi nauchnoy fotografii, tom 7: Priroda fotograficheskoy chuvstvitel'nosti. Izgotovleniye galoidoserebryanykh fotograficheskikh sloyev. Opticheskaya sensibilizatsiya i gipersensibilizatsiya. Khimiko-fotograficheskaya obrabotka svetochuvstvitel'nykh sloyev (Nature of Photographic Sensitivity. Preparation of Haloid-Silver Photographic Layers. Optical Sensitizing and Hyper-Sensitizing. Chemical-Photographic Treatment of Photo-Sensitive Layers) Moscow, 1960. 260 p. Errata slip inserted. 1,800 copies printed.

Editorial Board: K.V. Chibisov (Resp. Ed.) Corresponding Member, Academy of Sciences USSR, V.I. Sheberstov (Deputy Resp. Ed.) Candidate of Chemical Sciences, Docent, Yu. N. Gorokhovskiy, Doctor of Chemical Sciences, Professor, G.A. Istomin, Doctor of Technical Sciences, Professor, and I.I. Levkoyev, Candidate of Chemical Sciences; Ed. of Publishing House: K.I. Markhilevich; Tech. Ed.: G.S. Simkina.

PURPOSE: This collection of articles is addressed to those working in theoretical and applied photography and cinematography, and to researchers in the chemistry and physics of photographic processes.

COVERAGE: The collection contains articles from the editorial files of the Zhurnal nauchnoy i prikladnoy fotografii i kinematografii discussing problems in the preparation and processing of haloid silver light-sensitive layers, the nature of photographic sensitivity, the preservability of photographic layers, the theory and technology of the preparation of photographic emulsions and optical sensitization, and, finally, the chemical photographic processing of black-and-white and color photographic materials. Many of the articles contain the results of scientific investigations made by the authors. The collection also includes several reviews of current problems in the theory of chemical-photographic processes. A bibliography of Soviet and non-Soviet references accompanies each article.

II. OPTICAL SENSITIZATION AND HYPERSENSITIZATION

III. CHEMICAL PHOTOGRAPHIC PROCESSING OF LIGHT SENSITIVE LAYERS

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S/081/62/000/006/065/117
B149/B108

AUTHORS: Markhilevich, K. I., Arnol'd, Ts. S., Abritalin, V. L.

TITLE: Study of the treatment of highly sensitive panchromatic aerial film. IV. The influence of hydrazine on the developing process

PERIODICAL: Referativnyy zhurnal. Khimiya, no. 6, 1962, 505, abstract 6L450 (Tr. Vses. n-i kino-fotoin-ta, no. 35, 1960, 126 - 136)

TEXT: The influence of various hydrazine derivatives added to metolo-hydroquinone developer on the photographic properties of aerial film has been investigated. Some of these derivatives increase the speed of development and the photosensitivity of the layer with a simultaneous increase in image granularity and fog density. It is possible to select such concentrations of hydrazine derivatives that the increase in photosensitivity is not followed by an increase in fog density or granularity. Report III, see RZhKhim, 4L429. [Abstracter's note: Complete translation.]

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ARNOL'D, TS.

Simplified method of processing color negatives. Sov.foto 22 no.5:38 My '62. (MIRA 15:5)

(Color photography)

ARNOL'D, V.

Correction to V. Arnol'd's paper "Small denominators." Part 1. Izv. AN SSSR. Ser. mat. 28 no.2:479-480 Mr-Ap '64. (MIRA 17:3)

ARNOL'D, V.A.

ROZENTUL, M.A., professor; VASIL'YEV, T.V., kand. med. nauk; SOKOLIN, A.I., kand.med.nauk; RAKHMANOVA, N.V., nauchn.sotr.; PRORVICH, L.V., nauchn. sotr.; ZLATKINA, A.R., nauchn.sotr.; ARNOL'D, V.A.,vrach; PETRUSHEV-SKIY, S.I., vrach; PLAVIT, P.Ya., vrach; VELICHKO, N.V., vrach; GLOBUS, R.E., vrach; GOL'DENBERG, M.M.,vrach; TUNGUSKOVA, A.I., vrach

Results of treating syphilis according to the 1949-1951 programs. Vest. ven. i derm. no.1:22-25 Ja-F '55. (MIRA 8:4)

1. Bol'nitsa im. Korolenko (for Arnol'd, Petrushevskiy) 2. 1-y i 2-y kozhno-venerologicheskiye dispansery (for Plavit, Velichko, Globus, Gol'denberg, Tunguskova) 3. Iz otdela sifilidologii (zaveduyushchiy professor M.A.Rozentul) TSentral'nogo kozhno-venerologicheskogo instituta (direktor - kandidat meditsinskikh nauk N.M.Turanov) Ministerstva zdravookhraneniya SSSR.

(SYPHILIS, therapy
in Russia, pattern of ther.)

KARTAMYSHEV, A.I.; ARNOL'D, V.A.

[Cosmetic care of the skin] Kosmeticheskii ukhod za kozhei. Kiev, Gos. med. izd-vo USSR, 1956. 156 p. (MLRA 10:4)
(SKIN--CARE AND HYGIENE)

KARTAMISHEV, A.I.; ARNOL'D, V.A.

[Cosmetic care of the skin] Kosmetichnyi dogliad za shkiroiu. Kyev, Derzhmedvydav URSR, 1957. 147 p. (MIRA 12:1)
(COSMETICS) (SKIN--CARE AND HYGIENE)

KARTAMYSHEV, Anatoliy Ioasafevich, prof.; ARNOL'D, Vera Aleksandrovna, doktor [deceased]; ASTVATSATUROV, K.R., red.; CHUCHUPAK, V.D., tekhn. red.

[Cosmetic care of the skin] Kosmeticheskii ukhod za kozhei. 2. ispr. i dop. izd. Kiev, Gos. med.izd-vo USSR, 1961. 188 p. (MIRA 15:4)

(SKIN--CARE AND HYGIENE) (HAIR--CARE AND HYGIENE)

ARNOLD, V.I.

Kolmogorov ym.

ARNOL'D, V.I.(Moscow)

Visiting the school club of mathematics at the Moscow State University. Mat. pros.no. 2:241-245 '57. (MIRA 11:7)

(Moscow--Mathematics)

TANATAR, I.Ya. (Moscow); SKOPETS, Z.A. (Yaroslavl'); ARNOL'D, V.I. (Moscow); DYNKIN, Ye.B. (Moscow); LORDKIPANIDZE, B.G. (L'vov); KONSTANTINOV, N.N. (Moscow); BEREZIN, F.A. (Moscow)

Problems of elementary mathematics. Mat. pros. no.2:267-270 '57. (MIRA 11:7)

(Mathematics--Problems, exercises, etc.)

ARNOL'D, V.I.

The possibility to represent functions of two variables in the form $\chi[\varphi(x) + \psi(y)]$. Usp.mat.nauk 12 no.2(74):119-121 Mr-Ap '57. (MIRA 10:7)

(Functions of several variables)

20-114-4-1/63

AUTHOR: Arnol'd, V. I.

TITLE: On the Functions of Three Variables (O funktsiyakh trekh peremennykh)

PERIODICAL: Doklady Akademii Nauk SSSR, 1957, Vol. 114, Nr 4, pp. 679-681 (USSR)

ABSTRACT: The present paper deals with a method of proving a theorem which makes the total solution of the thirteenth problem set up by Hilbert possible (in the sense of a refutation of Hilbert's hypothesis).

Theorem 1: Any real steady function $f(x_1,x_2,x_3)$ of three variables assumed on the unit hexahedron E^3 can be represented in the form

$$f(x_1,x_2,x_3) = \sum_{i=1}^{3}\sum_{j=1}^{3} h_{ij}\left[\varphi_{ij}(x_1,x_2),x_3\right].$$

The functions of the two variables h_{ij} and φ_{ij} are in this case real and steady. This theorem is a result of the existence of Kolmogorov's representation $f(x_1,x_2,x_3)=\sum_{i=1}^{3} h_i\left[\varphi_i(x_1,x_2),x_3\right]$,

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On the Functions of Three Variables 20-114-4-1/63

and of the following theorem 2:
With any family F of the real and equally graded steady functions $f(\xi)$ assumed on the "tree" Ξ it is possible to realize the "tree" in such a manner in form of a subquantity X of the three dimensional cube E^3 that any function of the family F can be represented in the form $f(\xi) = \sum_{k=1} f_k(x_k)$. The points of the "tree" Ξ have a small ramification index $\leqslant 3$. $x=(x_1,x_2,x_3)$ is an image $\xi \in \Xi$ in the "tree" X; $f_k(x_k)$ are steady real functions of a variable, where f_k depends steadily on f (in the sense of a uniform convergence). The author then gives several definitions and proofs. There are 2 references, 1 of which is Soviet.

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

PRESENTED: April 10, 1957 by A. N. Kolmogorov, Member, Academy of Sciences, USSR

SUBMITTED: April 4, 1957

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ARNOLD, V. I. and KOLMOGOROV, A. N.

"Some Questions of Approximation and Representation of Functions."

Paper submitted at International Congress Mathematicians, Edinburgh, 14-21 Aug 58.

ARNOL'D, V.I. (Moskva)

Representing functions of several variables by superposition of functions of a smaller number of variables. Mat. pros. no.3: 41-61 '58. (MIRA 11:9)

(Functions of several variables)

ARNOL'D, V.I. (Moskva)

Visiting the school club of mathematics at the Moscow State University (Conclusion). Mat. pros. no.3:241-250 '58.
(Moscow--Mathematics) (MIRA 11:9)

GAL'PERN, S.A. (Moskva); LOPSHITS, A.M. (Moskva); BALK, M.B. (Smolensk); ZHAROV, V.A. (Yaroslavl'); BYAKIN, V.I. (L'vov); ARNOL'D, V.I. (Moskva); MANIN, I.Yu. (Moskva); DYNKIN, Ye.B. (Moskva); PROIZVOLOV, V. (Moskva); ALEKSANDROV, A.D. (Leningrad); VITUSHKIN, A.G. (Moskva).

Problems of elementary mathematics. Mat. pros. no.3:267-270 '58.
(Mathematics--Problems, exercises, etc.) (MIRA 11:9)

ZALGALLER, S.I. (Leningrad); SKOPETS, Z.A. (Yaroslavl'); ROFE-BEKETOV, F.S. (Khar'kov); LANDIS, Ye.M. (Moskva); LEVIN, V.I. (Moskva); STECHKIN, S.B. (Moskva); LYAPUNOV, A.A. (Moskva); ARNOL'D, V.I. (Moskva); LOPSHITS, A.M. (Moskva)

Problems of higher mathematics. Mat.pros. no.3:270-274 '58. (MIRA 11:9)

(Mathematics--Problems, exercises, etc.)

16(1)

AUTHOR: Arnol'd, V.I. (Moscow) SOV/39-48-1-1/5

TITLE: On the Representation of Continuous Functions of Three Variables by Superpositions of Continuous Functions of Two Variables (O predstavlenii nepreryvnykh funktsiy trekh peremennykh superpozitsiyami nepreryvnykh funktsiy dvukh peremennykh)

PERIODICAL: Matematicheskiy sbornik, 1959, Vol 48, Nr 1, pp 3-74 (USSR)

ABSTRACT: The paper contains the detailed proof of the theorem announced by the author in [Ref 1]: Every real continuous function of the variable $f(x_1,x_2,x_3)$ defined on the unit cube E^3 admits a representation

$$f(x_1,x_2,x_3) = \sum_{i=1}^{3} \sum_{j=1}^{3} h_{ij} \left[\varphi_{ij}(x_1,x_2),x_3\right] ,$$

where the functions of two variables h_{ij} and φ_{ij} are real and continuous. The proof bases on 2 theorems and 23 lemmas which partly, in a somewhat other form, can be found already in the paper of Kolmogorov [Ref 2], where also the final result is somewhat strengthened. In an appendix some constructions of A.S. Kronrod [Ref 4] are collected. The author thanks his

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On the Representation of Continuous Functions of Three Variables by Superpositions of Continuous Functions of Two Variables

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teachers A.G.Vitushkin, and A.N.Kolmogorov for advices. There are 27 figures, and 9 references, 5 of which are Soviet, 1 Polish, 2 German, and 1 American.

SUBMITTED: December 25, 1958

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SOV/42-15-1-21/27

AUTHOR: Arnol'd, V. I., Meshalkin, L. D.

TITLE: A. N. Kolmogorov's Seminar on Selected Problems in Analysis (1958/1959)

PERIODICAL: Uspekhi matematicheskikh nauk, 1960, Nr 1, p 247-250 (USSR)

ABSTRACT: The seminar was devoted to the following two groups of problems: I. Incorrectly posed problems in analysis and mechanics, i.e., problems whose solutions depend discontinuously on a parameter. II. Mathematical models of turbulent motion of an incompressible viscous fluid. The first group dealt mainly with the boundary value problem for the vibrating string. The papers by N. N. Vakhaniya, B. V. Boyarskiy, V. I. Arnol'd and A. N. Kolmogorov presented a survey of this topic. In the second group, Kolmogorov pointed out two facts: (1) In decreasing the viscosity ν the laminar solution of stationary problems becomes unstable, or stable in a very small region, both of which are not observed

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in reality; mass depends only on a typical velocity and a typical length, and is independent of ν. He proposed investigation of solution of the following problem:

$$\left.\begin{aligned} \frac{Du}{Dt} &= -\frac{\partial p}{\partial x} + \nu\Delta u + \gamma \sin y, \\ \frac{Dv}{Dt} &= -\frac{\partial p}{\partial y} + \nu\Delta v, \\ \frac{\partial u}{\partial x} &+ \frac{\partial v}{\partial y} = 0, \end{aligned}\right\} \qquad (2)$$

where

$$\frac{D}{Dt} = \frac{\partial}{\partial t} + u\frac{\partial}{\partial x} + v\frac{\partial}{\partial y},$$

$$\Delta = \frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2},$$

the solutions being periodic in 2a and 2π in x and y, respectively, and satisfying

$$\int_{-a}^{a} v(x, y)\,dx = \int_{\pi}^{\pi} u(x, y)\,dy = 0. \qquad (3)$$

He stated the hypothesis that for small ν turbulent solution should appear, (in the sense of nontrivial invariant measure μ_ν in the (u,v) space) and that $\mu_\nu \longrightarrow \mu$ $(\nu \longrightarrow 0)$. Thus far the hypothesis could not be verified on any mathematical model. There are 25 references, 6 U.S., 12 Soviet, 3 French, 1 German, 2 Dutch, 1 Chinese. 5 Recent U.S. references: W. Wasow, Asymptotic Solution of the Differential Equation of Hydrodynamic Stability in a Domain Containing a Transition Point, Ann. Math., 58 (1953) 222-252; W. Wasow, One Small Disturbance of Plane Coutte Flow, Journn. Res. Nat. Bur. Stand., 51 (1953) 195-202; E. Hopf, Statistical Hydromechanics and Functional Calculus, Journ. Rat.

A. N. Kolmogorov's Seminar on Selected Problems in Analysis (1958/1959)

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Mech. Analysis, 1 Nr 1 (1952) 87-123; C. L. Siegel, Iterations of Analytic Functions, Ann. of Math. 43, 4, (1942), 607; F. John, The Dirichlet Problem for a Hyperbolic Equation, Amer. Journ. Math. 63, (1941), 141-154.

Card 4/4

GEL'FAND, I.M. (Moskva); DYUDENI, N.Ye. (SShA); KIRILLOV, A.A. (Moskva); PODSYPANIN, V. (Tula); TER-MKRTACHAN, M. (Yerevan); KUZ'MIN, Yu.I. (Moskva); VEYL', G. (SShA); FADDEYEV, D.K. (Leningrad); ARNOL'D, V.I. (Moskva); IVANOV, V.F. (San-Karlos, Kaliforniya, SShA); GRAYEV, M.I. (Moskva); LEBEDEV, N.A. (Leningrad); LOPSHITS, A.M. (Moskva); ZHITOMIRSKIY, Ya.I.; MITYAGIN, B.S. (Moskva); SKOPETS, Z.A. (Yaroslavl'); PUANKARE, A. (Frantsiya); GAVEL, V.V. (Brno, Chekhoslovakiya); SOLOMYAK, M.Z. (Leningrad); LEVIN, V.I. (Moskva); BARBAN, M.B. (Tashkent); FRIDMAN, L.M. (Tula)

Problems. Mat. pros. no.5:253-260 '60. (MIRA 13:12)
(Mathematics--Problems, exercises, etc.)

ARNOL'D, V. I., Cand. Phys-Math. Sci. (diss) "On the Representation of Continuous Functions of Three Variables by Superpositions of Continuous Functions of Two Variables" Moscow, 1961. 3 pp (Moscow State Univ.. Mechanical-Math. Faculty) 200 copies (KL Supp 12-61, 249).

ARNOL'D, V.I.

Remarks on numbers of rotation. Sib. mat. zhur. 2 no.6:807-813 N-D '61. (MIRA 15:7)

(Rotating bodies) (Dynamics)

ARNOL'D, V.I.

Nomographic calculability with the aid of the rectilinear abacus of Decartes. Usp. mat. nauk 16 no.4:133-135 Jl-Ag '61. (MIRA 14:8)
(Nomography) (Abacus)

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AUTHOR: Arnol'd, V.I.

TITLE: Small denominators.I. On the mapping of the Circle onto itself

PERIODICAL: Akademii nauk SSSR. Izvestiya. Seriya matematicheskaya, v.25, no.1, 1961, 21-86

TEXT: The paper consists of two parts: I. On analytic mappings of the circle onto itself, II. On the space of mappings of the circle onto itself.
In the first part it is shown that uder certain assumptions an analytic mapping of the circle into itself which is little different from a rotation can be changed in a rotation by an analytic transformation of variables. Let $F(z)$ be a function real on the real axis and analytic in its neighborhood, $F(z+2\pi) = F(z)$, $F'(z) \neq -1$ for $\mathrm{Im}\, z = 0$. Then to the mapping of the strip of the complex plane $z \to Az \equiv z+F(z)$ there corresponds a homeomorphism B of the circular points $w(z)=e^{iz}$; $w = w(z) \to w(Az) \equiv Bw$ which preserves the orientation. In this sense, A is called an analytic mapping of the circle onto itself. Let $2\pi\mu$ be the rotation number of A. If μ is irrational then there exists a continuous real function $\varphi(z)$ of the real z so that $\varphi(z+2\pi) = \varphi(z)+2\pi$ and

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Small denominators. I. On the mapping...

$$\varphi(Az) = \varphi(z)+2\pi\mu \qquad (1)$$

The author conjectures: There exists a set $M \subseteq [0,1]$ of measure 1 so that for every $\mu \in M$ the solutions of (1) are analytic with the rotation number $2\pi\mu$ for an arbitrary analytic mapping A. But he only proves Theorem 2: Given a family of analytic mappings of the circle

$$z \rightarrow A(z,\varepsilon,\Delta) \equiv z+2\pi\mu+\Delta+F(z,\varepsilon) \qquad (2)$$

depending on two parameters ε, Δ, and such numbers $R>0$, $\varepsilon_1>0$, $K>0$, $L>0$, that

1) $F(z+2\pi,\varepsilon) = F(z,\varepsilon)$;
2) for $\operatorname{Im} z = \operatorname{Im}\varepsilon = 0$ it always holds $\operatorname{Im} F(z,\varepsilon) = 0$;
3) for $|\operatorname{Im} z| \leqslant R$, $|\varepsilon| \leqslant \varepsilon_0$ it holds

$$|F(z,\varepsilon)| \leqslant L\,|\varepsilon| \qquad (3).$$

4) For an arbitrary integral m and n, the irrational number μ satisfies the inequality

$$\left|\mu - \frac{m}{n}\right| \geqslant \frac{K}{|n|^3}. \qquad (4)$$

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Then there exist numbers ε' and R', $0 < \varepsilon' \leq \varepsilon_0$, $0 < R' \leq R$, and functions $\Delta(\varepsilon)$, $\varphi(z, \varepsilon)$ real for real ε and z and analytic for $|\varepsilon| < \varepsilon'$, $|\mathrm{Im}\, z| < R'$ so that

$$(A(z, \varepsilon, \Delta(\varepsilon)), \varepsilon) = \varphi(z, \varepsilon) + 2\pi\mu. \qquad (5)$$

The proof consists in the construction of the solution of (1) by the solution of the auxiliary equation $g(z+2\pi\mu)-g(z) = f(z)$. For this equation it is proved:

Theorem 1: Let $f(z) = \widetilde{f}(z)$ be an analytic 2π-periodic function, let $|f(z)| \leq C$ for $|\mathrm{Im}\, z| \leq R$. Let μ be an irrational number, $K > 0$, and

$$\left|\mu - \frac{m}{n}\right| \geqslant \frac{K}{n^3} \qquad (9)$$

for arbitrary m and $n > 0$. Then $g(z+2\pi\mu)-g(z) = f(z)$ has an analytic solution $g(z) = \widetilde{g}(z)$ and for $|\mathrm{Im}\, z| \leq R-2\delta$ and an arbitrary $\delta < 1$, $0 < \delta < \frac{R}{2}$ it holds

$$|g(z)| \leq \frac{4C}{K\delta^3}, \qquad (10)$$

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Small denominators.I. On the mapping... S/038/61/025/001/002/003
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$$|g'(z)| \leq \frac{8C}{K\delta^4} . \qquad (11)$$

For the solution of $g(z+2\pi\mu)-g(z) = f(z)$ with the aid of Fourier series there appear no denominators by which the convergence is rendered more difficult. The calculation of the successive corrections which suit the solution of the auxiliary equation to the equation (1) is carried out according to a method of Newton's type.

A multi-dimensional version of theorem 2 is given. The results of the first part of the paper overlap partially with the papers of A.Finzi. In the second part the author considers the space of the mappings of the circle onto itself, and he investigates the meaning of mappings of a different type within this space. Applications to the investigation of trajectories on a torus and on the Dirichlet problem for the string are given. The author obtains several partially known results, e.g. Theorem 9: Let $\vec{\mu} = (\mu_1, \ldots, \mu_n)$ be a vector with incommensurable components so that for every integral vector $\vec{k}$ it holds:

$$|(\vec{\mu}, \vec{k})| > \frac{C}{|\vec{k}|^n} .$$

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Then there exists an $\varepsilon(R,C,n) > 0$ so that for every analytic vector field $\vec{F}(\vec{x})$ on the torus (i.e. such one that $\vec{F}(\vec{x}+2\pi\vec{k}) = \vec{F}(\vec{x})$) which is sufficiently small, $|\vec{F}(\vec{x})| < \varepsilon$ for $|\mathrm{Im}\ \vec{x}| < R$, there exists a vector $\vec{a}$ for which the system of differential equations

$$\frac{d\vec{x}}{dt} = \vec{F}(\vec{x}) + \vec{a}$$

changes to

$$\frac{d\vec{u}}{dt} = 2\pi\vec{\mu}$$

by an analytic transformation of variables.

Altogether the paper contains 19 lemmas and 15 theorems. The author mentions A.N.Kolmogorov, V.A.Pliss, A.A.Andronov, L.S.Pontryagin, N.N. Vakhaniya, P.P.Mosolov, S.L.Sobolev, R.A.Aleksandryan and R.Denchev. There are 11 figures, 24 Soviet-bloc and 19 non-Soviet-bloc references. The four most recent references to English-language publications read as follows: F.John, The Dirichlet problem for a hyperbolic equation, Amer.J.Math.,63 (1941),141-154; C.L.Siegel, Iterations of analytic

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Small denominators.I. On the mapping... C111/C222

functions, Ann.of Math., 43, no.4 (1942), 607-612; Anzai, Ergodic skew product transformations on the torus, Osaca math.Journ., 3, no.1 (1951), 83-99; A.Wintner, The linear difference equations of first order for angular variables, Duke Math.J., 12 (1945), 445-449.

SUBMITTED: September 17, 1959

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C111/C222

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AUTHOR: Arnol'd, V.I.

TITLE: The stability of the equilibrium position of a Hamiltonian system of ordinary differential equations in the general elliptic case

PERIODICAL: Akademii nauk SSSR. Doklady, vol.137, no.2, 1961, 255-257

TEXT: Let p = q = 0 be a fixed point of the system

$$\dot{q} = \frac{\partial H}{\partial p}, \quad \dot{p} = -\frac{\partial H}{\partial q}, \qquad (1)$$

where $H(p,q,t) = H(p,q,t+2\pi)$ is analytic in p, q, t. The case where

$$H = \lambda r + c_2 r^2 + \ldots + c_n r^n + \tilde{H}(p,q,t), \qquad (2)$$

where $2r = p^2+q^2$, $\tilde{H} = O(r^{n+1})$ is analytic in p, q, t, $n \geqslant 2$ and at least one c_l $(2 \leq l < \infty$ is different from zero, is called general elliptic. The author considers the case where λ is irrational. Let Λ_k be the set of such λ that for all integral $m, n > 0$ it holds

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$$|\lambda n - m| > \frac{K}{(|m|+|n|)^2} . \qquad (3)$$

Let Λ be the union of the condensation points of all Λ_k.

Theorem 1: If $\lambda \in \Lambda$ then the equilibrium position 0,0 of (1), where the Hamiltonian function H(p,q,t) is of the general elliptic type (2), is stable.

Theorem 2: Under the assumptions of theorem 1, in every neighborhood of the circle p = q = 0 of the p,q,t-space there exists an analytic invariant torus T_μ with the equation $r = r(\varphi, t)$ ($\varphi = \text{arc tg}\,\frac{p}{q}$). On the torus T_μ, the analytic coordinate $\psi(\varphi, t)$ can be introduced so that the equations (1) assume the form $\dot{\psi} = \mu$ on T_μ. The set formed by the tori T_μ has a positive measure in the p,q,t-space.

Theorem 3: Let

$$H(r, \varphi, t) = H_0(r) + \tilde{H}(r, \varphi, t), \qquad (4)$$

where $dH_0/dr = \mu + \Omega(r)$, $\mu \in \Lambda_k$, $\Omega(0) = 0$ and the function

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$$\widetilde{H} = \sum_{m^2+n^2\neq 0} H_{mn}(r)e^{i(m\varphi+nt)}$$

is analytic for $|\mathrm{Im}\,\varphi, t| \leq \varrho$, $|r| \leq \varrho_r - \delta^k$ and satisfies

$$|\widetilde{H}| \leq M = \delta^N, \qquad (5)$$

while $\Omega(r)$ is analytic for $|r| \leq \varrho_r$, and

$$\delta^a = \theta \leq \left|\frac{d\Omega}{dr}\right| \leq \Theta = \delta^{-b}.$$

Here $\delta > 0$ is a certain constant; N,k,a,b are natural numbers. If the equations

$$2k+28+2a+4b < N < 3k-14-2b;$$
$$\delta < 10^{-6}K^2; \quad \delta < 0.1\varrho \qquad (7)$$

are satisfied then there exist functions $R(\varphi,t)$ and $\psi(\varphi,t)$ 2π-periodic in φ and t and analytic for $|\mathrm{Im}\,\varphi,t| \leq 0.1\varrho$ so that on the torus $r = R(\varphi,t)$ from the equations $\dot{\varphi} = \frac{\partial H}{\partial r}$, $\dot{r} = -\frac{\partial H}{\partial \varphi}$

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The stability of the equilibrium... S/020/61/137/002/001/020 C111/C222

it follows $\dot{\psi} = \mu$ (here $\psi = \varphi + \Psi$).

Theorem 4: The equilibrium position of an autonomous Hamiltonian system of equations with two degrees of freedom is stable in the general elliptic case if $\lambda_2/\lambda_1 \in \Lambda$.

Here the general elliptic case is the case where

$$H(p_1,p_2,q_1,q_2) = \lambda_1 r_1 + \lambda_2 r_2 + H_0(r_1,r_2) + \widetilde{H}(p_1,p_2,q_1,q_2),$$

where $H_0(r_1,r_2) = \sum_{i+j=2}^{n} c_{ij} r_1^i r_2^j$, $\widehat{H} = O(r_1+r_2)^{n+1}$, $2r_i = p_i^2 + q_i^2$, and

$h(\varepsilon) = H_0(\varepsilon\lambda_2, -\varepsilon\lambda_1) \not\equiv 0$.

The author mentions A.N.Kolmogorov. There are 2 Soviet-bloc and 2 non-Soviet-bloc references. The reference to the English-language publication reads as follows: D.D.Birkhoff, dinamicheskiye sistemy (Dynamic systems), M.,1941,gl.III.

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

Card 4/5

23797

S/020/61/138/001/001/023
C 111/ C 222

16.5900

AUTHOR: Arnol'd, V. I.

TITLE: Generation of quasi-periodic motion from a family of periodic motions

PERIODICAL: Akademiya nauk SSSR. Doklady, v. 138, no. 1, 1961, 13-15

TEXT: The motion of the point x,y on the torus is called quasi-periodic if

$$\frac{dy}{dx} = \lambda , \qquad (1)$$

where λ is an irrational constant while x,y are coordinates on the torus so that (x + k, y + 1) and (x,y) is the same point of the torus.

The author considers differential equations

$$\frac{dy}{dx} = \lambda + a + \varepsilon f(x,y) \qquad (2)$$

where a and ε are parameters, f(x,y) is an analytic function. In

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C 111/ C 222

Generation of quasi-periodic ...

(Ref. 1: V. J. Arnol'd, Izv. AN SSSR, ser. matem., 25, no. 1, 21 (1961)) it is shown that for small disturbances $\varepsilon f(x,y)$ there always exists an $a(\varepsilon)$ so that (2) for $a = a(\varepsilon)$ can be brought to the form (1) by an analytic coordinate transformation. Here it is shown that in the elaborated case $\lambda = 0$ the undisturbed periodic motion for small disturbances goes over into a quasi-periodic one.

Let Λ_K be the set of those points λ for which $|\lambda n + m| \geq K n^{-2}$ for all integral m and n, $n \neq 0$. Let Λ be the union of all Λ_K for $K > 0$.

Theorem 1: On the torus T let be given the differential equation

$$\frac{dy}{dx} = \varepsilon f(x,y), \qquad (3)$$

where ε -- parameter, f(x,y)-- an analytic function. Let $\int f(x,y)dx > 0$ for all y. Then for every sufficiently small $\lambda \in \Lambda_K$ there exists an $\varepsilon(\lambda)$ and a transformation of variables $z = z_\lambda(x,y)$ analytic in

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x,y so that (3) assumes the form $dz/dx = \lambda$. The set $E(\lambda)$ $(\lambda \in \Lambda)$ has a positive measure; zero is its condensation point.

Theorem 2: The assertion of theorem 1 holds for the differential equation

$$\frac{dy}{dx} = \varepsilon c + \varepsilon^2 F(x,y,\varepsilon) \qquad (4)$$

on the torus, where $c > 0$ is constant and $F(x,y,\varepsilon)$ is analytic. The proof of theorem 1 is given by a reduction of (3) to (4). This reduction is carried out by

$y_1 = y_1(x,y,\varepsilon) = y - \varepsilon \int \tilde{f}(\xi,y)d\xi$, where $\tilde{f} = f - \bar{f}$ and $\bar{f}(y) = \int f(\xi,y)d\xi$ and then $y_2(y_1) = \int \frac{c\,d\eta}{F(\eta)}$, $\frac{1}{c} = \int \frac{dy}{F(y)}$. In y_2, (3) has the form (4).

The proof of theorem 2 is based on the basic

Lemma: Let the differential equation

$$\frac{dy}{dx} = \lambda + F(x,y) \qquad (8)$$

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C 111/ C 222

Generation of quasi-periodic ...

on the torus T have the number of revolution $\lambda(\ldots)$, let $F(x,y)$ be analytic for $|\operatorname{Im} x, y| < \varsigma$, $|F| < M$. For a $\delta > 0$ let

$$\varsigma < 0{,}1; \quad \ldots < 2^{-7}\varsigma, \quad M < \delta^4 ; \ldots \qquad (9)$$

Then there exists a transformation $y = y(x,z)$ analytic for $|\operatorname{Im} x, z| < \ldots$ so that

$$\frac{dz}{dx} = \lambda + F_{new}(x, z)$$

where F_{new} is analytic for $|\operatorname{Im} x, z| < \varsigma$ and

$$|F_{new}| < M_1 = \frac{M^2}{\delta^4(\ldots)} .$$

The author mentions A.N.Kolmogorov. There are 2 Soviet-bloc and 1 non-Soviet-bloc references.

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

PRESENTED: December 9, 1960, by A. N. Kolmogorov, Academician

SUBMITTED: November 26, 1960

Card 4/4

23819

16.2800

S/020/61/138/002/001/024
C 111/C 222

AUTHOR: Arnol'd, V.I.

TITLE: Some remarks on flows of line elements and frames

PERIODICAL: Akademiya nauk SSSR. Doklady, v. 138, no. 2, 1961, 255-257

TEXT: The notion of geodesic flow is generalized by the introduction of the so-called isotropic flows. The properties of the isotropic flows is considered.
Let M - - n-dimensional Riemannian manifold; let $\omega = (x, \xi^k)$, where $x \in M$ is the carrier and ξ^k - - ordered set $(\xi_1, \dots \xi_k)$ of pairwise orthogonal vectors of the space tangential to M in x, be a k - frame or k - hedron. The frames with a common carrier form a homogeneous space Ξ_k; all frames on M form the space Ω_k. Let $d\Omega = dMd\Xi$, where $d\Xi$ - - invariant measure in Ξ.
The one-parametric transformation group S^t of Ω is called the flow of the k - hedra : $\omega \to S^t\omega$. Trajectories of the flow are curves Γ on M formed by the carriers x(t) of the elements $S^t\omega$. A tangential flow is a
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flow of n-hedra the frame $S^t\omega$ of which is the accompanying frame of the trajectory $x(t)$. Let v be the velocity of $x(t)$ on Γ; let $k_1,\dots,k_{n-1}$ be the curvatures of Γ.

Definition: A tangential flow for which v = const, and $k_1 = k_1(x),\dots,k_{n-1} = k_{n-1}(x)$ depend only on the carrier x and not on the directions of the vectors $\xi_1,\dots,\xi_n$ of the frame, is called an isotropic flow.

For a geodesic flow it holds : $v \equiv 1$; $k \equiv 0$.

Theorem 1: The transformations S^t of an arbitrary isotropic flow preserve the measure $d\Omega$.

Furthermore, on manifolds of constant curvature K the author considers cyclic flows for which $k_1,\dots,k_{n-1}$ are constant.

Theorem 2 : Every hypercyclic $(k^2 + K < 0)$ flow on a surface of constant negative curvature K is isomorphic to a geodesic flow.

Theorem 3 : Every cyclic flow on an n-dimensional manifold of constant (in every two-dimensional direction) negative curvature - 1 belongs to one of the following three types :

1. The flow is isomorphic to the generalized geodesic flow ($k_1 = 0$).
2. The flow is isomorphic to the generalized oricyclic flow ($k_1=1, k_2= 0$).
3. The flow is isomorphic to a flow the carrier $S^t\omega$ of which is immovable.

Theorem 4 : In the 2r-dimensional space of the curvature -1, the cyclic flow belongs to the type 1,2 or 3 depending on the fact whether k_1^2 is smaller than, equal to or greater than

$$\varkappa^2 = 1 + \frac{k_2^2}{k_3^2} + \frac{k_2^2 k_4^2}{k_3^2 k_5^2} + \dots + \frac{k_2^2 k_4^2 \dots k_{2r-2}^2}{k_3^2 k_5^2 \dots k_{2r-1}^2} .$$

In the (2r + 1) - dimensional space, all flows with $k_{2r} \neq 0$ are of the type 1 ; but if $k_{2r} = 0$ then the flow is of the type 1,2 or 3 depending on the fact whether k_1^2 is smaller than, equal to or greater than $\varkappa^2$.

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Some remarks on flows of line ...

Theorem 5 : A flow of the type 1 on a compact manifold of constant negative curvature is a K - system (Ref. 4 : Ya. G. Sinay, DAN 131, Nr.4, 752 (1960), Ref. 7 : Ya. G. Sinay DAN 133, Nr. 6, 1303 (1960)). The orispherical flow (Ref. 4, Ref. 7) is conjugate to S^t.
I.M. Gel'fand and S.M. Fomin (Ref. 3 : UMN 7, v.1, 118 (1952)) found the spectra of the geodesic flow and oricyclic flow with a certain group G and its subgroups.
Theorem 6 : If G is the motion group of the n-dimensional Lobachevskiy space, and K is the group of revolutions of the (n-k)-dimensional Euclidean space then the corresponding dynamic system is isomorphic to the cyclic flows of the k-frames on the manifold of constant negative curvature ; reversely, all these flows can be obtained in this manner.
Theorem 7 : If an isotropic flow on a Riemannian manifold which is different from the two-dimensional torus and from the bottle of Klein is ergodic then all rotation numbers are equal to zero and the flow has no continuous eigenfunction being different from a constant.

The author mentions I.I. Pyatetskiy-Shapiro and B.M. Gurevich.

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S/020/61/138/002/001/024

Some remarks on flows of line ... C111/C222

There are 7 Soviet-bloc and 6 non-Soviet-bloc references. The reference to the English-language publication reads as follows : J. Birkhoff, Dinamicheskiye sistemy (Dynamic systems) M. - L., 1941.

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

PRESENTED: December 9, 1960, by A.N. Kolmogorov, Academician

SUBMITTED: November 26, 1960

Card 5/5

ARNOL'D, V. I.

"Perturbation theory and the problems of stability for planetary systems"

report submitted at the Intl Conf of Mathematicas, Stockholm, Sweden, 15-22 Aug 62

ARNOL'D, V.I.

Letter to the editor. Mat.sbor. 56 no.3:392 Mr '62. (MIRA 15:4)

(Functions, Continuous)

34465
S/020/62/142/004/002/022
B112/B102

16.3400

AUTHOR: Arnol'd, V. I.

TITLE: The behavior of the adiabatic invariant for slow periodic variation of the Hamilton function

PERIODICAL: Akademiya nauk SSSR. Doklady, v. 142, no. 4, 1962, 758 - 761

TEXT: A function $I(p, q, \lambda)$ is said to be an adiabatic invariant of a dynamic system which depends on a slowly varying parameter $\lambda = \varepsilon t$ if the variation of $I(t) = I(p(t), q(t), \lambda(t))$ is small within a time $t \sim 1/\varepsilon$. The author demonstrates that an adiabatic invariant I of a non-linear system with a slowly varying, periodic analytic Hamilton function $H(p, q, \lambda)$ has the property of conservation: for an arbitrary $\eta > 0$ there is an $\varepsilon_0(\eta) > 0$ such that $|I(t) - I(0)| < \eta$ for $|\varepsilon| < \varepsilon_0$ $(-\infty < t < \infty)$. There are 6 Soviet references.

4

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

Card 1/2

The behavior of the ...

S/020/62/142/004/002/022
B112/B102

PRESENTED: October 6, 1961, by A. N. Kolmogorov, Academician

SUBMITTED: May 28, 1961

Card 2/2

38401

S/020/62/144/004/001/024
B172/B112

16.1500
16.2600

AUTHORS: Arnol'd, V. I., and Sinay, Ya. G.

TITLE: Small disturbances of the automorphism of a torus

PERIODICAL: Akademiya nauk SSSR. Doklady, v. 144, no. 4, 1962, 695-698

TEXT: A twodimensional torus T^2 is considered, represented as a unit square of the (x_1,x_2)-plane with pairwise identified sides. An automorphism A of T^2 is a mapping $x \to Ax = \overline{x}$ where $A = \|a_{ij}\|$, det $A = \pm 1$, a_{ij} integral, $\overline{x}_i = \sum_j a_{ij}x_j \pmod 1$, $i = 1,2$. Certain properties of A are emphasized, and the following mappings are considered:

$$x \longrightarrow A_\varepsilon x = Ax + \varepsilon B(x)$$

$(B(x) = (b_1(x_1,x_2), b_2(x_1,x_2))$; b_i are three times continuously differentiable functions having the period 1 with respect to x_1 and x_2; ε is a small parameter). It is shown that (1) if ε is sufficiently small,

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A_ε also has the above properties; (2) an ergodic automorphism is structurally stable (that is, with sufficiently small ε) a homeomorphism $x \leftrightarrow y$ exists so that

$$y(A_\varepsilon x) = Ay(x).$$

Two further theorems contain generalizations for the n-dimensional case.

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

PRESENTED: January 20, 1962, by A. N. Kolmogorov, Academician

SUBMITTED: January 17, 1962

ARNOL'D, V.I.

Classical theory of perturbations and the problem of the stability of planetary systems. Dokl.AN SSSR 145 no.3:487-490 Jl '62. (MIRA 15:7)

1. Moskovskiy gosudarstvennyy universitet imeni Lomonosova. Predstavleno akademikom I.G.Petrovskim.
(Mechanics, Celestial)

S/020/63/148/001/001/032
B172/B186

AUTHORS: Arnol'd, V. I., Krylov, A. L.

TITLE: Uniform distribution of points on a sphere and some ergodic properties of the solutions to ordinary linear differential equations

PERIODICAL: Akademiya nauk SSSR. Doklady, v. 148, no. 1, 1963, 9 - 12

TEXT: Δ denotes an arbitrary domain on a sphere S^2; x is a point of S^2. Rotations A,B of S^2 are considered. The points

$$x; Ax,\ Bx;\ A^2x,\ ABx,\ BAx,\ B^2x;\ \ldots. \qquad (1)$$

are uniformly distributed on S^2 if

$$\lim_{n\to\infty} \frac{p_n(\Delta)}{2^n} = \frac{\text{mes}\ \Delta}{\text{mes}\ S^2}$$

where $p_n(\Delta)$ is the number of points of the sequence

A^nx, $A^{n-1}Bx$, $A^{n-2}BAx$, ... B^nx lying in Δ. If the points (1) are every-

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S/020/63/148/001/001/032
B172/B186

Uniform distribution of...

where dense on S^2, then their distribution on S^2 is uniform. This theorem may be understood as an ergodic hypothesis in which a semi-group with two generatrices plays the role of time. The authors generalize this theorem; S^2 is replaced by a homogeneous space on which a compact Lie group is defined, whereas a free group with two generatrices or a group with three generatrices a,b,c, for which abc=e is valid, is taken as "time". Then, sets of linear differential equations

$$\frac{dx}{dz} = A(z)x$$ are considered

(z = a complex variable, x = a vector $(x,\ldots, x_n)$ of the n-dimensional complex space, A = a matrix which, except for three singular points lying on a Riemann sphere, depends analytically on z). The following theorem is formulated: If the monodromic group of such a system is bounded, then the system has a unique first integral $(B(z)x,\bar{x})$ = const, where B(z) is a positive definite, self-adjoint matrix. For Gauss' hypergeometric equation, the assumption of this theorem is fulfilled. Arising from this, the authors mention finally a number of unsolved problems.

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S/020/63/148/001/001/032
B172/B186

Uniform distribution of...

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

PRESENTED: June 23, 1962, by A. N. Kolmogorov, Academician

SUBMITTED: June 18, 1962

Card 3/3

S/199/63/004/002/012/013
B187/B102

AUTHOR: Arnol'd, V. I.

TITLE: Dynamic problems integrable over a Liouville theorem

PERIODICAL: Sibirskiy matematicheskiy zhurnal, v. 4, no. 2, 1963, 471-474

TEXT: The Liouville theorem considered states that the canonical system of differential equations $p = -\frac{\partial H}{\partial q}$; $q = \frac{\partial H}{\partial p}$, with n degrees of freedom can be solved by quadratures if n first integrals $H = F_1, F_2, \ldots F_n$, pairwise in involution, are known. The equations $F_i = f_i$ = const (i=1,.....,n) from the 2n-dimensional. Euclidean space (p,q) produce an xn-dimensional compact manifoldness $M = M_f$ where x is a point in this space. In each of their points the vectors grad F_i are assumed linearly independent. It is proved that then M is an n-dimensional torus and the point x(t) which maps a solution to the differential equation x = I grad H moves on it

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S/199/63/004/002/012/013
B187/B102

Dynamic problems integrable over a ...

conditionally periodically (uniformly on the surface). This is valid necessarily for all systems that are integrable in the way prescribed by the Liouville theorem. The proof is based on topological considerations. The restriction that the initial space must be Euclidean is unessential. An arbitrary manifoldness of canonic structure would not bring about any changes. It is also possible to assume M_f non-compact. It is shown that the compact manifoldness M admits k irrotational tangential vector fields grad F_j, independent in each point, if and only if M is the vector product with a k-dimensional torus as the base.

SUBMITTED: January 29, 1962

Card 2/2

ARNOL'D, V.I.; KIRILLOV, A.A.; SINAY, Ya.G.

Dynamic systems and representations of groups at the Stockholm Mathematical Congress. Usp. mat. nauk 18 no.2:189-196 Mr-Ap '63. (MIRA 16:8)
(Mathematics--Congresses)

ARNOL'D, V.I.

Proof of A.N.Kolmogorov's theorem on the conservation of conditionally periodic motions with small variations in the Hamilton function. Usp. mat. nauk 18 no.5:13-40 S-O '63. (MIRA 16:12)

ARNOL'D, V.I. (Moscow)

"Integration of equations of mechanics without secular terms; theory of small divisors"

report presented at the 2nd All-Union Congress on Theoretical and Applied Mechanics, Moscow, 29 January - 5 February 1964

ARNOL'D, V. I.

Instability of dynamic systems with many degrees of freedom.
Dokl. AN SSSR 156 no. 1:9-12 My '64. (MIRA 17:5)

1. Moskovskiy gosudarstvennyy universitet im. M. V. Lomonosova.
Predstavleno akademikom A. N. Kolmogorovym.

ARNOL'D, V.I.

Small denominators and problems of the stability of motion in classical and celestial mechanics. Usp. mat. nauk 18 no.6:91-192 '63. (MIRA 17:3)

APPROVED FOR RELEASE: 06/05/2000 CIA-RDP86-00513R000102120008-7"

ACCESSION NR: AP4035800 S/0020/64/156/001/0009/0012

AUTHOR: Arnol'd, V. I.

TITLE: On the instability of dynamical systems with many degrees of freedom.

SOURCE: AN SSSR. Doklady*, v. 156, no. 1, 1964, 9-12

TOPIC TAGS: stability theory, perturbation theory, dynamical system

ABSTRACT: Recent results in the theory of perturbations (by the author and by A. N. Kolmogorov) imply the existence of many conditionally periodic motions in a dynamical system close to an integrable one. (A conditionally periodic motion with period $w = (w_1, .., W_k)$ is defined by equations of the form $\dot{\varphi} = w$, where $\varphi_1, \dots, \varphi_k$ are angular coordinates, and $\sum n_i \omega_i \neq 0$ for integers n_i such that $\sum n_i^2 \neq 0$.) But only if the phase space is of dimension ≤ 4 does it follow from those results that all motions of the system are stable. Here the author gives an example of a system with a 5-dimensional phase space, which satisfies the hypotheses of the previous work, but is not stable. The differential equations of the system are:

$$\dot{\varphi}_1 = I_1, \dot{\varphi}_2 = I_2, \dot{I}_1 = \varepsilon \sin \varphi_1 [1 + \mu B], \dot{I}_2 = \varepsilon (1 - \cos \varphi_1) \mu \cos \varphi_2, \quad B = \sin \varphi_2 + \cos t. \qquad (3)$$

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ACCESSION NR: AP4035800

and the phase space ($I_1, I_2; \varphi_1, \varphi_2, t$) is the product of the plane (I_1, I_2) and the torus (φ_1, φ_2, t) (mod 2π). The unperturbed system corresponds to $\varepsilon = 0$, there is a $\mu_0 > 0$ such that for $0 < \mu < \mu_0$, system (3) is unstable: there is a trajectory connecting the region $I_2 < A$ with the region $I_2 > B$. The proof is based on V. K. Mel'nikov's recent extensions of H. Poincaré's methods, and a certain number of new concepts, for example that of a "whisnered" torus, i.e. an invariant torus T in the phase space, which is a component of the intersection of two invariant open manifolds Y^-, Y^+, such that any trajectory in the whisner Y^- approaches T as $t \to +\infty$, and any trajectory in the whisner Y^+ approaches T as $t \to -\infty$. (The author corrects an error in a computation by Mel'nikov.) Orig. art. has: 15 equations.

ASSOCIATION: Moskovskiy gosudarstvenny*y universistet im. M. V. Lomonosova (Moscow State University)

SUBMITTED: 30Jan64 ENCL: 00

SUB CODE: MA NO REF SOV: 005 OTHER: 001

Card 2/2

ARNOL'D, V.I.

Applicability and assessment of the error involved in the method of averaging for systems which pass through resonances in the course of their evolution. Dokl. AN SSSR 161 no.1:9-12 Mr '65.

(MIRA 18:3)

1. Moskovskiy gosudarstvennyy universitet. Submitted October 7, 1964.

differential equation, hydrodynamics, stability, incompressible fluid,

NO REF SOV: 004 OTHER: 005

Card 2/2

L 17840-66 EWP(m)/EWT(1)/ETC(m)-6/EWA(d)/EWA(1) DJ/WW

ACC NR: AP6004069 SOURCE CODE: UR/0040/65/029/005/0846/0851

AUTHOR: Arnol'd, V. I. (Moscow)

ORG: none

65
B

TITLE: Variational principle for three-dimensional stationary flows of an ideal fluid

SOURCE: Prikladnaya matematika i mekhanika, v. 29, no. 5, 1965, 835-845

TOPIC TAGS: fluid mechanics, hydrodynamics, planar flow, analog system, fluid flow, flow stability, dimensional flow

ABSTRACT: It is shown that stationary flow has an extremal kinetic energy in comparison with "level swirling" flows. The equations of three-dimensional hydrodynamics of an ideal fluid are an infinite-dimensional analogue of the following finite-dimensional situation. In the space $x = (x_1, \ldots, x_n)$ there is given a system of ordinary differential equations

$$\dot{x} = f(x).$$

It is assumed that in the space x there is a "k-dimensional layering" (see Fig. 1) that is, the space is divided into k-dimensional sheets. The layering is system-

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L 17840-66

ACC NR: AP6004069

Fig. 1.

invariant, i.e., the trajectory x(t) begins and ends on sheet F. E(x) is the first integral of the system, and, subject to the satisfaction of additional definitions and assumptions, the following three theorems are proved: 1) the point x_o is a point of system equilibrium, $f(x_o) = 0$; 2) if an extremum point, the point of equilibrium x_o, is stable relative to finite small disturbances; and 3) the spectrum of the corresponding problem on small vibrations $A\xi = \lambda\xi$ ($A = \partial f / \partial x$ in x_o) is symmetrical with respect to the real and imaginary axes of λ. A hydrodynamic analogue of this set of theorems is formulated, and an independent proof of the analogue is developed. The result is applied to the study of stationary flows: if an extremum is a minimum or a maximum, then the flow is stable, that is, a small variation of the initial velocity field exerts little effect on the velocity field at all moments in time. The character of extremal points is carefully detailed. It is shown that, in the case of planar flows, the sufficient conditions of

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ACC NR: AP6004069

O

stability relative to minor disturbances are close to the necessary conditions. The analysis may be applied to circular as well as planar flows. Orig. art. has: 20 equations and 1 figure.

SUB CODE: 20/ SUBM DATE: 14Jun65/ ORIG REF: 001/ OTH REF: 002

Card 3/3 nst

L 23440-66 EWT(d)/EWT(l)/EWP(m)/EWT(m)/EWA(d)/T/ETC(m)-6/EWA(l) IJP(c) WW

ACC NR: AP6007586 SOURCE CODE: UR/0040/66/030/001/0183/0185

AUTHOR: Arnol'd, V. I. (Moscow)

ORG: none

TITLE: On the topology of three-dimensional stationary flows of an ideal fluid

SOURCE: Prikladnaya matematika i mekhanika, v. 30, no. 1, 183-185

TOPIC TAGS: flow field, flow surface structure, vortex, vortex effect, vortex trajectory, Bernoulli equation

ABSTRACT: Stationary vortex flows of an incompressible nonviscous fluid in a bounded region D are studied. It is supposed that the velocity vectors and the vortex are not everywhere co-linear. The author shows that the flow region D is generated by specific Bernoulli surfaces on a finite number of cells in each of which the lines of flow are either closed or densely wound around the surface of the torus. The Euler-Newton equations of motion are given as

$$\frac{dv}{dt} = -\operatorname{grad} p, \quad \operatorname{div} v = 0 \quad \left(\frac{dv}{dt} = \frac{\partial v}{\partial t} + \frac{\partial v}{\partial x} v\right).$$

These are equivalent to the Bernoulli form

$$\frac{\partial v}{\partial t} = [v, \operatorname{rot} v] - \operatorname{grad} \alpha, \quad \operatorname{div} v = 0 \quad (\alpha = p + {}^1\!/_2 v^2),$$

which in stationary form is

$$[v, \operatorname{rot} v] = \operatorname{grad} \alpha, \quad \operatorname{div} v = 0.$$

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ACC NR: AP6007586

The stationary Bernoulli form combines with rules of vector analysis to yield the commutative equation

$$(v, \text{rot } v) = 0,$$

Then, letting v be the analytic stationary velocity field not everywhere co-linear with its rotor $[v, \text{rot } v] \neq 0$, the author offers proof that nearly all streamlines are either closed or everywhere densely packed on two-dimensional tori; all lines of either type fill a finite number of analytic subcells of D. The two cases of a Bernoulli surface with and without an edge are considered and illustrated. Orig. art. has: 2 figures and 10 equations.

SUB CODE: 20, 12 SUBM DATE: 16Aug65/ ORIG REF: 001/ OTH REF: 001

Card 2/2

ACC NR: AP7008920 SOURCE CODE: UR/0140/66/000/005/0003/0005

AUTHOR: Arnol'd, V. I. (Moscow)

ORG: none

TITLE: A priori estimate of the theory of hydrodynamic stability

SOURCE: IVUZ. Matematika, no. 5, 1966, 3-5

TOPIC TAGS: hydrodynamics, perturbation

SUB CODE: 20

ABSTRACT: The present article gives the proof for the stability theorem formulated in an earlier article by the author. Let D be a domain bounded by the curves Γ_i on the plane x, y. The solution u(x, y; t) of the "vortex equation"

$$\frac{\partial \Delta u}{\partial t} = [\nabla u, \nabla \Delta u]$$

is said to be the stream function for the flow of an ideal fluid in D.

Here $[u, v] = u_1 v_2 - u_2 v_1$, with the boundary conditions

$$u|_{\Gamma_i} = c_i(t)^{1)}, \quad c_1 = 0, \quad \frac{d}{dt}\oint_{\Gamma_i} \frac{\partial u}{\partial n} ds = 0.$$

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Let (x, y) be the stream function for stationary flow

$$[\nabla\psi, \nabla\Delta\psi] = 0,$$

so that vectors $\nabla\Psi$ and $\nabla^{\Delta}\Psi$ are collinear. It is further assumed that $\psi = \Psi(\Delta\psi)$, for which it is sufficient that $\nabla^{\Delta}\Psi \neq 0$. Let $u = \Psi + \varphi(x,y;t)$ be the stream function for another flow, the relations

$$\oint_{\Gamma_i} \frac{\partial\varphi}{\partial n} ds = 0$$

being satisfied for t = 0; then according to the law of conservation of circulation these relations are satisfied for all t. Finally, it is assumed that in domain D

$$c < \frac{\nabla\psi}{\nabla\Delta\psi} < C, \quad \text{where} \quad 0 < c < C < \infty.$$

The following theorem is proved: The perturbation $\varphi(x, y; t)$ at any moment of time is evaluated through initial perturbation $\varphi_0 = \varphi(x, y; 0)$ according to

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ARNOLD, ZDENEK,

Distr: 4E3d/4E2c(j) 7

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7 Synthetic reactions of dimethylformamide. II. Reactions of ketals with dimethylformamide and phosgene. Zdeněk Arnold and Jiří Žemlička (Čsl. akad. věd, Prague). Chem. listy 52, 458-67(1958); cf. C.A. 51, 18761e.—Reactions of ketals with $HCONMe_2$ (I) and $COCl_2$ (II) in molar ratio 1:5:2.5 gave various derivs. of β-dicarbonyl compds. II (12.37 g.) in $(CH_2Cl)_2$ (III) was dropped into an ice-cooled stirred soln. of 18.28 g. I in III over 30 min. (the total amt. of III being 160 ml.), to the stirred suspension added under ice-cooling 9.71 g. $PhCMe(OEt)_2$ during 5 min., the mixt. heated 3 hrs. at 40°, cooled, decompd. with 20.5 g. anhyd. NaOAc and 100 g. ice, the aq. layer extd. twice with 20 ml. III and the org. layer three times with 50 ml. H_2O, and the org. ext. distd. giving 5.8% *PhCCl:CHCHO*, $b_{0.1}$ 55-70°. The aq. layer was treated with stirring with K_2CO_3, extd. 5 times with 60 ml. 1:1 C_6H_6-EtOH, the volatile components distd. *in vacuo*, the residue shaken with 100 ml. H_2O and 8 30-ml. portions C_6H_6, and the benzene ext. evapd. giving 25.7% *PhC(NMe₂):CHCHO*, $b_{0.1}$ 180°, m. 61° (Et_2O). The aq. layer filtered with C and evapd. *in vacuo* gave a solid residue which was dissolved in 150 ml. III, the soln. filtered, evapd. to 50 ml., and treated with 100 ml. Et_2O to give 44.6% hygroscopic amorphous [PhC(NMe₂):CHCH:NMe₂]Cl, m. 205-7° (decompn.); *picrate*, m. 89-90° (50% EtOH). Similar treatment of 10.42 g. PhCEt$(OEt)_2$ yielded 92.1% PhC(OEt):CMeCHO (IV), $b_{0.15}$ 86-94°. Heating 1.43 g. IV with 20 ml. 4*N* $NHMe_2$ in C_6H_6 in a sealed tube 1.5 hrs., distg. the C_6H_6, washing the residual oil several times with petr. ether, extg. the petr. ether soln. with 7 20-ml. portions of H_2O, evapg. the aq. layer *in vacuo* to 30 ml., extg. the soln. with 3 30-ml. portions of C_6H_6, and distg. the ext. gave 53.4% PhC(NMe₂):CMeCHO, $b_{0.1}$ 110-25°, m. 80-1° (Et_2O). The formylation of iso-PrPhC$(OEt)_2$ (V) (b_{13} 115°, n_D^{20} 1.4823) in the described manner failed. Treating 50 g. mossy Zn (activated with a grain of iodine) in 15 ml. C_6H_6 in 30 min. with 22.71 g. $PhCOCMe_2Br$ and 20 ml. $CH(OEt)_3$ in 35 ml. C_6H_6 on the steam bath, adding 50 g. Zn dust, heating the mixt. 3 hrs. on the steam-bath, decanting the mixt. to a new portion of Zn activated with iodine, refluxing the mixt. 4 hrs., adding 50 g. Zn dust, refluxing the mixt. 3 hrs., treating the cooled mixt. with 50 g. ice and 100 ml. Et_2O, adding 50 g. AcOH, sepg. the ether layer, washing it with $NaHCO_3$ and H_2O, and distg. gave 15.9 g. crude and 14.7% pure $PhCOCMe_2CH(OEt)_2$ (Va), b_{15} 148°, n_D^{20} 1.4040. Adding 0.5 g. Va to 20 ml. stirred and cooled 80% H_2SO_4 during 30 min., decompg. the mixt. with ice, and filtering off the cryst. product with suction gave 100% *PhCOCMe₂CHO*, m. 168-8.5° (75% EtOH), subliming at 145°/0.1 mm. Heating 3 g. V with a trace of *p*-$MeC_6H_4SO_3H$ with a free flame and distn. yielded *PhC(OEt):CMe₂*, b_{12} 98-100°, n_D^{20} 1.5109. Formylation of 6.61 g. $Me_2C(OEt)_2$ by heating the mixt. 3 hrs. at 40°, decompg. the mixt. with ice, treating the aq. layer with K_2CO_3, extg. it with 4 50-ml. portions of 1:1 C_6H_6-EtOH, evapg. the solvents *in vacuo*, dissolving the cryst. residue in 100 ml. H_2O, extg. the soln. with $CHCl_3$, filtering the aq. layer with C, and evapg. the filtrate *in vacuo* gave 56% *[MeC(NMe₂):CHCH:NMe₂]Cl* (Vb), m. 193-7° (C_5H_5N); *picrate*, m. 100-1°. Combined C_6H_6 and $CHCl_3$ exts. evapd. and chromatographed on paper in $CH_2(OEt)_2$-H_2O (VI) gave a mixt. of *AcCH:CHNMe₂* (VII) (R_F 0.21) and *MeC(NMe₂):CHCHO* (VIII) (R_F 0.05).

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Zdeněk Arnold and Jiří Zemlička

Treating 2.41 g. of the *$HClO_4$ salt* (IX) of V in 25 ml. H_2O with 2.8 g. KOH in 20 ml. H_2O at 25° 2 hrs., filtering off the $KClO_4$, adding K_2CO_3 to the filtrate, extg. the mixt. with 3 20-ml. portions C_6H_6, evapg. the ext., and chromatographing the residue (72.8%) in VI gave a 1:1 mixt. of VII and VIII. Dissolving 3 g. IX in 30 ml. hot H_2O, adding 1.5 g. KCl in 10 ml. H_2O, sepg. the $KClO_4$ after cooling, treating the filtrate at 30–40 mm. with 0.8 g. NaOH in 10 ml. H_2O, heating the mixt. at 40°/15 mm. 30 min., treating it with K_2CO_3, extg. with six 25 ml. portions C_6H_6, and evapg. the solvent gave 55.4% VIII, m. 54° (Et_2O); *picrate*, prepd. in dioxane, m. 140°. Treating 31.4 g. CHCl:CHAc in 20 ml. 1:1 C_6H_6–C_7H_8 with stirring and ice-cooling with 300 ml. 2.3*N* $NHMe_2$ in C_6H_6 and 50 ml. PhMe, filtering off the sepd. $NHMe_2.HCl$, and evapg. the filtrate gave 77.5% VII, b_7 111–12°. Treating 10 mg. VIII with 2 ml. 3*N* $NHMe_2$ in C_6H_6 16 hrs. at room temp. yielded VII. Formylation of 4.87 g. $Me_3CCMe(OEt)_2$ (b_{50} 66–7°, n_D^{20} 1.4123) at 50° (2 hrs.), decompn. of the mixt. with ice, and treatment of the aq. layer in the described manner yielded *$Me_3CC(OEt)$:CHCHO*, b_{11} 105–10°, n_D^{20} 1.4705; *semicarbazone*, m. 163–5° (50% EtOH). Paper chromatography of the cryst. higher boiling fraction [0.2 g., m. 88.5° (Et_2O), subliming at 35–40° at 0.1 mm.] gave *Me_3CCOCH:CHNMe$_2$*, R_F 0.55 (cyclohexane-MeOH). Treating 7.82 g. K in 100 ml. liquid NH_3 with 5.91 g. pinacol, adding 150 ml. C_6H_6, evapg. the NH_3, refluxing the mixt. 1 hr. on the steam-bath, treating the cooled mixt. with 46.29 g. Et_2SO_4, refluxing the stirred mixt. 4.5 hrs., adding 31.55 g. $Ba(OH)_2$ in 200 ml. H_2O, stirring and refluxing the mixt. 3 hrs., filtering, washing the benzene layer with 3 100-ml. portions H_2O, and evapg. the C_6H_6 ext. gave 72.8% $[Me_2C(OEt)]_2$ (X), b_{50} 65–7°, n_D^{25} 1.4128. Treating 2.87 g. X with a reagent prepd. from 6.84 g. II and 4.57 g. III and refluxing the mixt. 1 hr. at 50° and 3 hrs. at 70° recovered the X. Treating II and III with 7.91 g. cyclopentanone di-Et acetal (XI) at 35° 3 hrs. yielded 47.6% orange oil, b_1 117–21°, m. 87–7.5° (Et_2O), and *$(CH_2)_3.C(CHO)$:CNMe$_2$*, R_F 0.045 (in VI). From the mother liquor *$CO.(CH_2)_3.C$:CHNMe$_2$* was isolated, R_F 0.2. Treating a mixt. of II and III with 8.61 g. XI and heating the mixt. 3 hrs. at 35–40° yielded 59% *$(CH_2)_4.C(OEt)$:CCHO*, b_{11} 140–60°, m. 30° (Et_2O), n_D^{20} 1.5100 (supercooled); *semicarbazone*, m. 207–7.5° (50% EtOH).

M. Hudlický

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CZECH

Synthetic uterotonics. I. Substituted 1-benzylpiperidines. Karel Hejno and Zdeněk Arnold (Farm. biochem. výzkumný ústav, Prague, Czech.). *Chem. Listy* 47, 601-12 (1953).—A series of hydroxylated and alkoxylated 1-benzylpiperidines has been prepd. by hydrogenation of a mixt. of $C_5H_{11}N$ (I) with an aldehyde over Raney Ni, by the condensation of I with substituted $PhCH_2Cl$, by the reduction of $BzNC_5H_{10}$ with $LiAlH_4$, or by the Mannich condensation of I with an aldehyde and a phenol. 2,5-$(MeO)_2C_6H_3$-$CH_2NC_5H_{10}$ and 2,5-HO(MeO)$C_6H_3CH_2NC_5H_{10}$, especially, were strong uterotonics. I.*HCl*, m. 177.8-8.2°, was prepd. with HCl gas in dioxane. o-$MeOC_6H_4CHO$ (40.8 g.) and 49 ml. I in 100 ml. EtOH gave, by hydrogenation over 9 g. Raney Ni at 130° and 130 atm. initial pressure, 35.9 g. (58.1%) *o-MeOC₆H₄CH₂NC₅H₁₀*, $b_{1.4}$ 103°; *HCl salt*, m. 176-7° (from dioxane), *picrate*, m. 116.5-18° (from H_2O). m-$MeOC_6H_4CHO$ similarly yielded 28 g. (45.4%) *m-MeOC₆H₄CH₂NC₅H₁₀*, $b_{1.5}$ 108-9°; *HCl salt*, m. 181.5-2.5°; *picrate*, m. 132-4°. From p-MeC_6H_4CHO was prepd., in the same way, 33.6 g. (54.3%) *p-MeOC₆H₄CH₂NC₅H₁₀*, $b_{1.4}$ 111-12°; *HCl salt*, m. 184°; *picrate*, m. 162.5-3°. o-*Isoeugenol* (100 g.) methylated with 126 g. Me_2SO_4 in 50 g. NaOH and 800 ml. H_2O gave 103.5 g. (95.2%) 2,3-$(MeO)_2$-C_6H_3CH:CHMe, b_{4} 119-20°, which yielded, by oxidation 67.2% 2,3-$(MeO)_2C_6H_3CHO$ (II), b_{11} 128-9°, m. 52-4°. II (33.3 g.) and 34.1 g. I dild. with EtOH to 200 ml., hydrogenated with 7 g. Ni at 130° and 110 atm. initial pressure, yielded 22.2 g. (47.2%) 2,3-$(MeO)_2C_6H_3CH_2NC_5H_{10}$, $b_{\ldots}$ 120-1°; *HCl salt*, m. 141-3°; *picrate*, m. 160-1.5° (from aq. EtOH). 2,3-HO(MeO)$C_6H_3CH_2NC_5H_{10}$, m. 98-100°, gave in EtOH the *HCl salt*, m. 181-7°. 2,4-$(MeO)_2C_6H_3CHO$, m. 68-70° (from CCl_4) [prepd. in 67.9% yield from 2,4-$(HO)_2C_6H_3CHO$], (40.8 g.) 40 ml. I, 120 ml. EtOH, and 9 g. Ni, hydrogenated at 130° and 125 atm., yielded 52 g. (65.3%) *2,4-(MeO)₂C₆H₃CH₂NC₅H₁₀*, $b_{1.5}$ 130°; *HCl salt*, m. 175-7°; *picrate*, m. 130-1° (from dil. EtOH). p-$C_6H_4(OMe)_2$ (13.8 g.) in 30 ml. C_6H_6, mixed with 50 ml. concd. HCl, the mixt. satd. with HCl, treated with 8.5 ml. 49% CH_2O, satd. again with HCl, allowed to stand 1.5 hrs., the aq. layer removed, the C_6H_6 layer washed 3 times with H_2O, dried with $CaCl_2$, filtered, and the filtrate refluxed 4 hrs. with 20 ml. I yielded 11.3 g. (49%) 2,5-*(MeO)₂C₆H₃CH₂NC₅H₁₀*, $b_{\ldots}$ 137°. *HCl salt*, prepd. in MeOH with HCl in MeOH, m. 128-30° (from MeOH-Me_2CO), m. 157-61° (after drying in vacuo at 100°); *picrate*, m. 117.5-19.5°. p-$MeOC_6H_4OH$ (24.85 g.) in 90 ml. EtOH mixed with 17 ml. I in 50 ml. H_2O and the mixt. treated with 15.5 g. 38.7% CH_2O at 15° during 20 min. gave, after standing 2 days, 22 g. (50%) *2,5-HO(MeO)C₆H₃CH₂NC₅H₁₀*, $b_{\ldots}$ 124-8°, *HCl salt*, prepd. in EtOH, m. 183-3.5° (from EtOH), *picrate*, m. 143.5-4.5° (from H_2O and EtOH). 2,6-$(MeO)_2C_6H_3CHO$ (16.6 g.) in 100 ml. EtOH hydrogenated over 200 mg. PtO_2 with a trace of $FeSO_4$ gave 2,6-$(MeO)_2C_6H_3CH_2OH$, m. 55.5-6°, which,

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treated with $SOCl_2$ in C_6H_6 with cooling yielded, after evapn. in vacuo below 40°, unstable 3,6-$(MeO)_2C_6H_3CH_2Cl$. This compd. (18.6 g.) refluxed with 20 ml. I in 100 ml. C_6H_6 2 hrs. gave 10 g. (42.5%) *3,6-$(MeO)_2C_6H_3CH_2NC_5H_{10}$*, $b_{1.5}$ 127.5°, m. 66-7° (from petr. ether); *HCl salt*, m. 161-2° (after drying); *picrate*, m. 171.5-2° (from aq. EtOH). Hydrogenation of 16.6 g. 3,4-$(MeO)_2C_6H_3CHO$ (T) in 100 ml. EtOH with 100 mg. PtO_2 and a trace of $FeSO_4$ at 1391 mm and 18° yielded 15.53 g. (92.5%) 3,4-$(MeO)_2C_6H_3CH_2OH$ which was transformed, by way of the chloride, to 17.35 g. (73.8%) 3,4-$(MeO)_2C_6H_3CH_2NC_5H_{10}$, b 131-1.5°; *HCl salt*, m. 162-4° (from dioxane); *HCl salt monohydrate*, m. 99-101° (from moist Me_2CO); *picrate*, m. 183-4° (from aq. EtOH). Satg. the mixt. of 69 g. III, 100 ml. C_6H_6, 27.5 g. $(AcH)_3$, and 60 ml. concd. HCl at 0-5° with HCl, keeping the temp. 30 min. at 2-4° and 1 hr. at 20°, draining the aq. layer, and refluxing the org. layer with 100 ml. I 1.5 hrs. yielded 24.0 g. (20%) 4,1,2-MeCH-$(NC_5H_{10})_2C_6H_2(OMe)_2$, $b_{0.1}$ 111.5-12°; *HCl salt*, m. 211.5-12.5°; *picrate*, m. 181.5-2°. Piperonal (60.4 g.) in 130 ml EtOH, 31.25 g. I, and 7.5 g. Ni, hydrogenated at 70° and 112 atm. initial pressure, gave 43.8 g. (59.5%) 3,4-$(CH_2O_2)C_6H_3CH_2NC_5H_{10}$, b_1 127-8.5°; *HCl salt*, m. 235-6.5°; *picrate*, m. 185-6.5°. Benzodioxan (123 g.) in 300 ml. C_6H_6 mixed with 280 ml. concd. HCl, the mixt. satd. with ice cooling with HCl gas, treated with 81 ml. 33.5% CH_2O, satd. again with HCl, and the org. layer heated with 162 g. I 6 hrs. on the steam-bath gave 104.4 g. (58.8%) *3,4-$(CH_2O)_2C_6H_3CH_2NC_5H_{10}$* (IV), b_5 176-8; *HCl salt*, m. 234-5.5°; *picrate*, m. 170.5-3°. Oxidation of IV with $KMnO_4$ gave 3,4-$(CH_2O)_2C_6H_3CO_2H$, m. 136.5-7.5°. Vanillin (30.4 g.) and 18.7 g. I in 150 ml. EtOH, hydrogenated with 7 g. Ni at 75° and 120 atm. initial pressure, [illegible] g. (60%) 3,4-MeO(HO)$C_6H_3CH_2NC_5H_{10}$, m. 87-9° (from Et_2O or Pr_2O); *HCl salt*, m. 194.5-5.5°; *picrate*, m. 152.5-3.8°. 3,5-$(MeO)_2C_6H_3CO_2H$, m. 182-4° (prepd. in 60% yield by methylation of α-resorcylic acid) (47.1 g.) was transformed with $SOCl_2$ in C_6H_6 to its chloride which with 51.1 g. I in 200 ml. C_6H_6 gave 39.9 g. (62%) 3,5-$(MeO)_2C_6H_3CONC_5H_{10}$ (V), m. 62.5-4° (from CCl_4). Dropping 24.9 g. V in 250 ml. Et_2O into 250 ml. Et_2O contg. 4 g. $LiAlH_4$ and refluxing the mixt. 21 hrs. gave 21.65 g. (92.1%) *3,5-$(MeO)_2C_6H_3CH_2NC_5H_{10}$*, $b_{1.5}$ 134-8°; *HCl salt*, m. 185.5-7° (from dioxane-MeOH); *picrate*, m. 134.5.5°. Treating 16.8 g. 1,2,3-$C_6H_3(OMe)_3$, mixed with 3.3 g. $(AcH)_3$, 25 ml. $CHCl:CCl_2$, and 15 g. $CaCl_2$, with 12.0 ml. 38% HCl at 10-12° during 30 min., and refluxing the org. layer, after evapg. the solvent in vacuo, 2 hrs. with 10 ml. I and 40 ml. C_6H_6, yielded 9.1 g. *2,3,4-$(MeO)_3C_6H_2CH_2NC_5H_{10}$*, $b_{1.5}$ 140-2°, $b_{0.1}$ 133°; *HCl salt*, 157-61° (from dioxane and then from Me_2CO); *picrate*, m. 107-8°. Similar reaction of 67.3 g. 1,2,4-$C_6H_3(OMe)_3$, 13.2 g. $(AcH)_3$, 35 ml. HCl and 200 ml. C_6H_6 satd. with ice cooling with HCl, and 87 ml. I gave 53.2 g. (50.1%) *2,4,5-$(MeO)_3C_6H_2CH_2NC_5H_{10}$*, $b_{0.15-0.2}$ 135°; *picrate*, m. 159-60°. Syringyl alc. (44.4 g.) in 500 ml. MeOH treated with CH_2N_2 in Et_2O gave a quant. yield of 3,4,5-$(MeO)_3C_6H_2CH_2OH$ which was transformed to the chloride. This dissolved in 100 ml. C_6H_6, refluxed 2 hrs. with 45 g. I, yielded 46.2 g. *3,4,5-$(MeO)_3C_6H_2CH_2NC_5H_{10}$*, m. 43.4°, $b_{0.4-0.5}$ 157-60° (72.5% based on the syringyl alc.); *HCl salt*, m. 192-4°; *picrate*, m. 157-8.5°. Trimethylgallic acid (172 g.) was transformed to 74.0 g. (59.7%) 2,6-$(MeO)_2C_6H_3OH$ (VI), m. 54-5°, b_{14} 138-40° according to Ger. patent 162658, in the presence of 10 g. $Na_2S_2O_4$. Treating 67.6 g. VI in 200 ml. EtOH with 37.5 g. I and 33.3 ml. CH_2O (contg. 0.397 g. CH_2O in 1 ml. soln.) gave, after 13 days at room temp., 95.1 g. (86.8%) *4,3,5-HO$(MeO)_2C_6H_2CH_2NC_5H_{10}$*, m. 134-6°; *HCl salt*, m. 120-37° (from MeOH-Me_2CO); *picrate*, m. 162-4° (from AcOEt).

M. Hudlický

ARNOLD, ZDENEK

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Pseudoionone. Zdeněk Arnold and Karel Hejno. Czech. 85,207, Dec. [illegible] The older method (cf. *Org. Syntheses* 23, 78) of prepn. was improved by carrying out the condensation of citral (I) with Me_2CO in the presence of dry PhONa (II) in C_6H_6, thus raising the yields to 74-81%. II (4.7 g.) in a boiling 250 ml. dry C_6H_6 and 125 ml. dry Me_2CO treated dropwise during 90 min. with 30.4 g. I in 50 ml. dry C_6H_6, boiling continued, the mixt. cooled 30 min., the II, sepd., and the product distd., yields 28.4-31.7 g. pseudoionone, used in the synthesis of vitamin A.

L. I. Urbánek

Arnold, Zdeněk

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Dichloroacetyl chloride. Zdeněk Arnold and Karel Hejno. Czech. 85,208, Dec. 1, 1955. Oxidation of CH_2C:CHCl (I) is considerably accelerated by addn. of 3% org. peroxides, thus lowering the losses caused by escaping gases. Into a boiling mixt. of 1 kg. I and 5 g. Bz_2O_2 is passed O 12-24 hrs., the mixt. then added with stirring and cooling to 20 g. $Cl_2CHCOCl$ (II) and 2 ml. pyridine, the temp. kept 1 hr. at 60-70°, and the product distd., gave 670 g. II, used in the synthesis of chloramphenicol. L. J. Urbánek

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ARNOLD, Z

... 3,4-(MeO)... NH... A series ... were prepd. and tested for their uterotonic action. 3,4-$(MeO)_2C_6H_3CH_2OH$ (16.8 g.) in 100 ml. C_6H_6 was treated with 14.3 g. $SOCl_2$ in an ...

ARNOLD, ZDENĚK

ARNOLD, ZDENEK

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Me, m. 88–0.0° (from C_6H_6); *Et*, m. 63

iso-*Pr* ... 62.3°. *Pr*, m. 54.5°

Z. Arnold

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Distr: 4E2c(j)

General synthesis of β-chloroacrylaldehydes. Z. Arnold and J. Žemlička (Czechoslovak. Akad. Sci. Prague). Proc. Chem. Soc. 1958, 227.—Substituted formamides with $POCl_3$ or $COCl_2$ can formylate carbonyl compds. to yield β-chloroacrylaldehydes, proceeding via the quaternary salt [R'CCl:CRCH:NMe_2]X; this is supported by independent synthesis of the salts from the corresponding dimethylaminomethylene deriv. The quaternary salts are readily hydrolyzed to β-chloroacrylaldehydes. By the former method the following R'CCl:CRCHO are prepd. (R, R', % yield, and n_D^{19} given): H, Me, 38.5, 1.4820; Me, Me, 66.6, 1.4915; Me, Et, 77.0, 1.4871; H, Bu, 80.0, 1.4769; H, Ph, 47.1, 1.6166; Me, Ph, 90.7, 1.5833; [RR' = $(CH_2)_3$], 46.0, 1.5162; [RR' = $(CH_2)_4$], 54.1, 1.5225; SRR' = $(CH_2)_5$], 65.2, 1.5227; [RR' = $(CH_2)_6$], 63.1, 1.5248. By the latter method: H, H, 73.0, 1.4823 (prepd. from $CHNa(CHO)_2$ and $COCl_2$); Me, H, 55.7, 1.4800; Et, H, 83.7, 1.4745; C_5H_{11}, H, 70.2, 1.4718; Ph, H, 80.2, (m. 25-6°); $PhCH_2$, H, 81.5, — (m. 32-3°). C. A. P.

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Country : Czechoslovakia
Category : Organic Chemistry. Synthetic Organic Chemistry G-2

Abs. Jour. : Ref. Zhur.-Khimiya No. 6, 1959 19357

Author : Arnold, Z.; Zemlicka, J.
Institut. :
Title : Synthetic Reactions of Dimethylformamide. II. Interaction of Ketals with Dimethylformamide and Phosgene.

Orig. Pub. : Chem. listy, 1958, 52, No 3, 458-467

Abstract : Study of formylation of diethyl-ketals $RC(OC_2H_5)_2CH_2R'$ [acetophenone (I), propiophenone (II), acetone (III), pinacoline (IV), cyclopentanone (V), cyclohexanone (VI)] with dimethylformamide (VII) and $COCl_2$ (VIII). On the basis of investigations of the products of formylation of ketals the assumption is made that the reaction takes place over the stage of an intermediate quaternary salt $[C_2H_5OCR{=}CR'CH{=}N(CH_3)_2]^+X^-$ (IX), the decomposition of which occurs, depending upon the nature of R and R' and of the reactants used, according to different schemes: IX $\xrightarrow{OH}$ $RC(OC_2H_5){=}CR'CHO$ (X); I $\xrightarrow{(CH_3)_2NH}$ $[(CH_3)_2NCR{=}CR'CH{=}N(CH_3)_2]^+Cl^-$ (XI)

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Country : Czechoslovakia
Category : G-2

Abs. Jour. : 19357

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Abstract : (XI) $\xrightarrow{OH^-}$ $(CH_3)_2NCR{=}CR'CHO$ (XII) $\xrightarrow{(CH_3)_2NH}$ RCO-$CR'{=}CHN(CH_3)_2$ (XIII) $\xleftarrow{OH^-}$ XI. By the action of $(CH_3)_2NH$ the X is converted to XII. Attempts to formylate diethyl ketal of isobutyrophenone (BP 115°/10 mm, $n^{20}D$ 1.4823) and diethyl ether of pinacone (XIV) were unsuccessful. All ketals were synthesized from ketones and $HC(OC_2H_5)_3$. Diethyl ketal of IV, BP 66-67°/23 mm, $n^{20}D$ 1.4123. To 0.25 mole VII and 0.125 mole VIII in 160 ml dichlorethane added at 0° 0.05 mole ketal of I, heated 3 hours at 40°, decomposed with 0.2 mole CH_3COONa and ice; distillation of CH_2ClCH_2Cl-layer yielded β-chloro-cinnamic aldehyde, yield 5.8%, BP 55-70° (bath temperature)/ /0.2 mm; aqueous layer saturated with K_2CO_3 and extracted

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Country : Czechoslovakia
Category= : G-2

Abs. Jour. : 19357

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Abstract : with C_6H_6- alcohol, 1:1. Extract evaporated in vacuum, from aqueous solution of residue extraction with C_6H_6 gave XII, R = C_6H_5, R'= H, yield 25.7%, BP 130°/0.2 mm, MP 61° (from ether)(submitates at 60°/0.12 mm); aqueous layer evaporated in vacuum, residue dissolved in dichlorethane and used ether to precipitate XI, R = C_6H_5, R'= H, yield 44.6%, MP 205-207°(decomposes); picrate (PC) $C_{19}H_{21}O_7N_5$ MP 89-90° (from 50% alcohol). After formylation of ketal of II at 50° from CH_2ClCH_2Cl-layer was separated X, R = C_6H_5, R'= CH_3, yield 92.1%, BP 86-94°/0.15 mm. By heating of X, R = C_6H_5, R'= CH_3, with 4 N solution of $(CH_3)_2NH$ in C_6H_6 for

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Country : Czechoslovakia
Category : G-2

Abs. Jour. : 19357

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Abstract : 1.5 hours was synthesized XII, R = C_6H_5, R'= = CH_3, yield 53.4%, BP 50°/0.08 mm, MP 80-81° (from ether). Formylation of ketal of III gave mixture (yield 4.6%, BP 120-140°/10 mm) of XII, R = CH_3, R'= H (XIIa) and XIII, R = = CH_3, R'= H (XIIIa)(identified by paper chromatography) and 56% XI, R = CH_3, R'= H, MP 193-197°(decomposes; from pyridine) PC $C_{14}H_{19}N_5O_7$, MP 100-101°; perchlorate $C_8H_{17}N_2ClO_4$ (XV), MP 156°. Hydrolysis of XV with aqueous KOH at 25° yielded (72.8%) mixture of XIIa and XIIIa, while treatment of XV with aqueous KCl and hydrolysis of resulting chloride in moderate vacuum gave XIIIa, yield 55.4%, MP 64° (from ether); PC, MP 140°. XIIa was synthesized from $CH_3COCH{=}CHCl$ (0.3 mole)
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Country : Czechoslovakia
Category : G-2

Abs. Jour. : 19357

Author :
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Orig. Pub. :

Abstract : and 300 ml 2.3 N solution of $(CH_3)_2NH$ in toluene (at 0°), yield 77.5%, BP 111-112°/7 mm. Formylation of ketal of IV at 50° gave X, R = tert-C_4H_9, R'= H, yield 82%, BP 105-110°/9 mm, n20D 1.4705; semicarbazone (SC), MP 163-165° (from 50% alcohol), and small amount of XIII, R = tert-C_4H_9, R'= H, MP 38.5° (from ether at − 75°), sublimates at 35-40°/0.1 mm. Formylation of ketal of V gave 2-dimethylamino-cyclopenten-1-al, yield 47.6%, BP 117-121°/1 mm, MP 87-87.5° (from ether)(sublimates at 75-80°/0.1 mm). From ketal of VI was obtained 2-ethoxy-cyclohexene-1-al, yield 59%, BP 140-160°/11 mm, MP 36° (from ether at − 75°)

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Country : Czechoslovakia
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Abs. Jour. :
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Abstract : (sublimates at 30-35°/0.1 mm), n^{20}_D 1.5100; SC, MP 207-207.5° (from 50% alcohol). To 0.2 mole K in 100 ml liquid NH_3 added 0.05 mole pinacone, replaced NH_3 by C_6H_6 and boiled for 4.5 hours with 0.3 mole $(C_2H_5)_2SO_4$ and then for 3 hours with 31.55 g $Ba(OH)_2$ and 200 ml water; obtained 72.8% XIV, BP 65-67°/20 mm, n^{20}_D 1.4128. From 0.1 mole C_6H_5-$-COCBr(CH_3)_2$, $HC(OC_2H_5)_3$ and Zn in C_6H_6 (boiling 10 hours) was synthesized $C_6H_5COC(CH_3)_2CH(OC_2H_5)_2$ (XVI), yield 14.7%, BP 148/12 mm, n^{20}_D 1.4940. 0.5 g XVI treated with 20 ml 80% H_2SO_4, cooling with ice, for 30 minutes, decomposed with ice, precipitate sulimated at 145°/0.1 mm, to get $C_6H_5COC(CH_3)_2CHO$ yield 100%, MP 158-158.5° (from 75% alcohol). Pyrolysis of
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Country : CZECHOSLOVAKIA

Category : Organic Chemistry. Synthetic Organic Chemistry G

Abs. Jour : Ref Zhur - Khim., No 5, 1959, No. 15277

Author : Arnold, Z.

Institut. : -

Title : Preparation of Tetramethylformamidine Salts and Their Vinylogs

Orig Pub. : Chem. listy, 1958, 52, No 3, 468-473

Abstract : Dimethylcarbamyl chloride (I) is condensed with $HCON(CH_3)_2$ (II) (by heating), causing the separation of CO_2 and formation of the salt $[(CH_3)_2NCH{=}N(CH_3)_2]Cl$ (III); the same reaction with vinylogs of II of the general type $(CH_3)_2NCH{=}CROHO$ (IV) yields the salts $[(CH_3)_2NCH{=}CRCH{=}N(CH_3)_2]X$ (V), obtained earlier as intermediate compounds during the synthesis of

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