Collection of Abstracts of all Lectures
given at the XII International Hutsulian Workshop
“Methods of Mathematical Physics”
Rakhiv, Ukraine, September 11–17, 1995

Editors: Walter Thirring
Thomas Hudetz
Stepan Moskaliuk

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COLLECTION OF ABSTRACTS OF ALL LECTURES
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On the bilocal energy density of gravitational waves in linearized gravitation  

The existence of the conserved tensor densities for massless fields of arbitrary spins is considered. The Weinberg-Witten theorem is discussed. The gauge noninvariant density for the electromagnetic field is introduced. The invariant difference between numbers of left and right quanta forming the field is obtained. The existence of the gauge invariant of bilocal energy density of gravitational waves in linearized gravitation is shown.

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String supported wormhole spacetimes  

We construct a static axisymmetric wormhole from the gravitational field of two collinear Schwarzschild particles which are kept apart by strings (ropes) extending to infinity. The wormhole is obtained by matching two three-dimensional timelike surfaces surrounding each of the particles and thus spacetime becomes non-simply connected. Although the matching will not be exact in general it is possible to make the error arbitrarily small by assuming that the distance between the particles is very much larger than the radius of the wormhole mouths. If the masses of two wormhole mouths are different, causality violating effects will occur.
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Matched differential calculus on the quantum groups $GL_q(2,C)$, $SL_q(2,C)$ and $U_q(2,C)$

We propose the construction of the differential calculus on the quantum group and its subgroup with the properties of natural reduction: the differential calculus on the quantum group have to contain the differential calculus on the quantum subgroup ("quantum matrjoshka"). Using the simplest example of the $GL_q(2,C)$ group we found that there are two differential calculus on the quantum group $GL_q(2,C)$, associated to left differential forms. The classical limit ($q \to 1$) of the "left" differential calculus and of the "right" differential calculus is undeformed differential calculus. The condition $D_q G = 1$ gives the differential calculus on $SL_q(2,C)$, which contains the differential calculus on the quantum plane $C_q(2\mid 0)$.

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Operator-algebraic methods in mixed three-dimensional problems of elasticity theory

The stress state of transversal isotropic plates on the imposition of homogeneous boundary conditions with mixed type on the faces are considered. The symbolic method of A.I. Luré and the semibackward method of I.I.Vorovich are used for the statics of elastic plates. At present, the case is studied most completely when the end faces of a plate are released from stress.

We consider the boundary-value problems of the transtropic plates’ statics with the following boundary conditions: "no" displacement, normal permutations and stress tangents are equal to zero, the absence of normal stress and off-tangent components of displacement vector etc. Six variants of boundary conditions are considered. The boundary conditions on the lateral area of a plate can be arbitrary.
The basic systems of functions satisfy equilibrium equations, and homogeneous boundary conditions on the end faces of a plate are obtained. The general solution is represented as a sum of turbulent and potential solutions, and a penetrating solution appears in a number of cases. These theoretical statements are illustrated by the solution of specific problems.

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Some extensions of a theorem of Burnside
The well-known theorem of Burnside, which states that the sum of the squares of the dimensions of the irreducible linear representations of a finite group is equal to the order of the group, can be extended from the usual context of finite groups to assist in the representations of finitely-generated infinite groups such as space groups. It can also be extended to the case of semi-linear representations such as Wigner co-representations which are relevant to the groups used to describe certain types of magnetic crystals. The results are applicable to all types of co-representations of all types of magnetic space groups.

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Superstrings, twistors and nonlinear exactly solvable equations
The review of the doubly supersymmetric twistor-like approach for superstrings and supermembranes is presented.
It was demonstrated that the geometric (Lund-Regge-Omnes) approach for bosonic $p$-branes and super-$p$-branes can be used to find Lorentz invariant zero curvature representations for the equations of motion (non-linear for $p \geq 2$) for any number $D$ of space-time dimensions. The geometric approach for the $D = 3$ string is described in details. Considered is the relation of the spectral parameter of the associated linear system associated with the nonlinear Liouville equation with manifest $SO(1, 1)$ gauge invariance of the geometric approach. Presented are new supersymmetric generalizations of the nonlinear Liouville equation, which originate from the doubly supersymmetric geometric approach for $N = 1$ and $N = 2$ superstrings in $D = 3$.

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Entropy of Bogoliubov actions on the CAR–algebras

The notion of dynamical entropy for actions of a countable free abelian group $G$ by automorphisms of $C^*$-algebras is studied. These results are applied to Bogoliubov actions of $G$ on the CAR–algebra. It is shown that the dynamical entropy of Bogoliubov action is computed by a formula analogous to that found by Stormer and Voiculescu in the case if $G$ has one generator, and also it is proved that the part of action corresponding to singular spectrum gives zero contribution to the entropy. The case of infinite number of generators has some essential differences and requires new arguments.
An averaging method for differential functional equations with ordinary and partial derivatives

We consider the system of differential equations with delay of the following type

\[ \frac{d\nu}{dt} = \varepsilon g(t, (L_1 u)(t), (L_2 u_\sigma)(t), \nu(t - \Delta)) \]  
(1)

\[ \frac{\partial u}{\partial t} - D(\tau, x) \frac{\partial u}{\partial x} = \varepsilon f(t, x, u, u_\sigma, \nu, \nu_\Delta). \]  
(2)

Here \( u = \text{col}(u_1, \ldots, u_n), \nu = \text{col}(\nu_1, \ldots, \nu_m), \sigma(t) \) and \( \Delta(t) \) are bounded functions when \( t \geq 0; \varepsilon > 0 \) is a small parameter, \( \tau = \varepsilon t, u_\sigma(t, x) = u(t - \sigma, x); L_1, L_2 - \) functional depending on the variable \( x \). The elements of the diagonal matrix \( D(\tau, x) \) are different real functions.

For the system (1),(2) with \( \varepsilon \in (0,1) \) and piecewise continuous initial functions, conditions of existence and uniqueness of the generalized solutions to the Cauchy problem in both bounded and unbounded region are established.

Also the averaging method for the system (1),(2) on a time interval \([0, \varepsilon^{-1}]\) is validated. In (1),(2) averaging is conducted on the time variable \( t \). For periodical functions \( f \) and \( g \) in \( t \), the asymptotic behavior of the estimate of error with respect to \( \varepsilon \) has been obtained. The influence of the quantities \( \sigma \) and \( \Delta \), which characterize delay on the averaging method for multifrequent systems of the type

\[ \frac{d\bar{x}}{dt} = \varepsilon X(x, x_\sigma, y, y_\Delta) \]

\[ \frac{dy}{dt} = w(x) + \varepsilon Y(x, x_\sigma, y, y_\Delta) \]  
(3)

\[ w(x) = (w_1(x), \ldots, w_n(x)), \; n \geq 2. \]

is proved in the interval \([0, \varepsilon^{-1}]\) with limited and delimited delay \( D(t) \) in fast variables. This allows to discover in the system (3) difficult resonance events. The phenomenon of resonance is typical for the system (3), therefore some limitation to the frequency should be taken into consideration.
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Solvability of the two-phase Stefan problem globally in time

In this work we introduce a new method that allows us to prove the existence of classical solutions in the two-phase multidimensional Stefan problem in any finite time interval and to establish the smoothness of the free (unknown) boundary. For the last two decades there have been published a lot of papers on this theme. Their authors have successfully investigated the two-phase Stefan problem in the small time interval. The idea of K. Baiocci, which allows to reduce a certain class of one-phase free boundary problems to the variational inequalities in a fixed domain, is also very popular. However, in the presence of two or more phases it turned out to be only possible to prove the existence of generalized solutions by means of this method.

The method we propose here permits to study the smoothness of an unknown boundary not only in the two-phase Stefan problem but in some other well-known stationary problems.

The sketch of the method is as follows: at first we build a sequence of elliptic difference-differential approximating problems and establish their solvability, then we prove some uniform estimates and pass to the limit.

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Parallel rational arithmetic in Groebner Bases computation

Groebner Bases is an essential algorithm for solving systems of polynomial equations, however it is so time consuming that it will fail to deliver a reasonable solution for many practical problems.

We investigate experimentally the proportion of time spent in various parts of the algorithm, finding that, even for simple problems (2 bi-variate polynomials of total degree 5), most of the time is spent in the underlying integer and rational arithmetic. For instance, if the coefficients
of the input polynomials have 5 decimal digits, then the time-weight of the arithmetic is 86 percent, for 50 decimal digits it grows to 99.7 percent. Also, the total computing time increases by a factor of 40, which is entirely due to rational arithmetic.

Therefore, we show how to speed-up integer and rational arithmetic by systolic implementation on a MasPar computer (SIMD architecture). For multiplication of multiprecision integers we obtain almost linear speedup over the classical sequential algorithm (29 times for 30-word integers), using a serial-parallel systolic scheme on a linear array of processors.

We also implement multiprecision rational arithmetic using new systolic algorithms for exact division and GCD computation. The practical experiments show that the timings are linearly dependent of the lengths of the inputs, hence demonstrating the effectiveness of the systolic paradigm for speeding-up Groebner Bases computation on SIMD architectures.

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Simple method to solve boundary value problems for arbitrary shapes of the boundary

In this lecture a simple collocation method to solve boundary value problems is presented. The method works for arbitrary shapes of the boundary including multiply connected domains. Also nonuniform boundary problems in which 2 different closed boundary curves exist, which belong to different coordinate systems, could be solved. Examples are presented for rectangular domains cut out with a circle, circular membranes and plates cut out in various ways; and toroidal problems solved in cylindrical coordinates are treated in addition.
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Second quantization algebras and quantum statistics

It has been shown that the statistical constraints are already contained in the Lie algebras of creation and annihilation operators and cannot be separately imposed, because of the related Hopf algebra properties. In particular the usual Weyl-Heisenberg algebra $h(1)$ has been displayed to describe classical Boltzmann particles and not bosons that require an $h(1,1)$ algebra.

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Mathematical methods of investigation for the localized physical-mechanical fields in orthotropic shells with slits

The problem of fracture and strength of constructions is known as one of the most important for the progress of science and technology. The subject matter of the present paper is to show a method of investigation of local perturbation of stress-strain state for an orthotropic shell of arbitrary Gaussian curvature with slits. The problem has been solved through the application of the theory of shallow shell equations, without restrictions of the elastic parameters of the shell’s material. With the help of the theory of generalized functions and Fourier integral transformation, the considered problem is transformed to Cauchy’s singular integral equations system. The equations’ kernels are obtained in closed form by using special functions. The results of computer calculations are represented as corresponding graphs. The analysis of the numerical results is presented. The effect of the elastic and geometric parameters on the tree and moment intensity factors, characterizing the stress state of the shell near the tips of the slit, has been studied.
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On the Cauchy problem for parabolic pseudodifferential equations

The properties of the fundamental solutions of the Cauchy problem for some classes of the parabolic pseudodifferential equations and systems of equations have been studied.
There have been established the exact power estimations for parabolic Petrovsky pseudodifferential equations and systems of equations where pseudodifferential operators are constructed over the homogeneous symbols.
There has been established the asymptotic behavior with infinite values of space variables of such solutions, constructed over the non-homogeneous symbols.
The results of investigating the properties of solutions of parabolic Petrovsky equations which include pseudodifferential operators (in particular, the operators of fraction differentiation 0, in spaces of generalized functions of infinite order of Jevres-type ultradistributions) are presented.

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Multiparameter deformations of $gln$, their representations and (quasi)anyonic realization

Multiparameter deformations $U_{q; s_1, \ldots, s_{n-1}}(gln)$ of the universal enveloping algebra $U(gln)$ are considered along with their ($q; s_i$)-dependent finite dimensional representations. A realization for the generators of $U_{q; s_1, \ldots, s_{n-1}}(gln)$ is given in bilinear form using appropriately generalized anyonic oscillators (AOs). Such a modification takes into account the extra parameters $s_1, \ldots, s_{n-1}$ and yields usual AOs when all the $s_i$ are set equal to unity.
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WZNW model on the $SL_q(2,R)$ quantum group and spontaneously breaking symmetry in the $SL_q(2,R)|u_{q}(1)$ $\sigma$-model

We consider the spontaneously breaking symmetry in the frame of the WZNW $\sigma$-model on the $SL_q(2,R)$ quantum group, as well as on the coset $SL_q(2,R)|u_{q}(1)$. It is shown that in distinction to the "classical" group case, group transformations map the lagrangian with some $u_q(1)$ vacuum stability subgroup to the lagrangian with another $u_{q^n}(1)$ subgroup.

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The orbit method in finite-zone integration theory

A construction of integrable hamiltonian systems associated with different graded realizations of untwisted loop algebras is proposed. Such systems have the form of Euler-Arnold equations on orbits of loop algebras. The proof of completeness of the integrals of motion is carried out independently of the realization of the loop algebra. The hamiltonian systems obtained are shown to coincide with hierarchies of higher stationary equations for some nonlinear PDE's integrable by inverse scattering method. We construct the densities of the corresponding conservation laws without using the associated linear problem.

We apply the general scheme for the principal and homogeneous realizations of the loop algebra $sl_3(R) \otimes \varphi(\lambda,\lambda^{-1})$. The corresponding Euler-Arnold equations on the degenerated orbit are interpreted as the Boussinesq and two-component modified KdV equations respectively. The scalar Lax representation for the Boussinesq equation is found in terms of coordinates on the orbit applying the Drinfeld-Sokolov reduction procedure.
Quantum topological entropy: interpretation and computation

The author’s 1992 Dissertation on “quantum topological entropy” had been announced in the short preliminary version [1] and had inspired K. Thomsen to his counterproposal [2], which also contains proofs of some additional properties of the resp. entropy functionals. This has in turn led to the modified (and corrected) version [3] of the original theory as in [1], where also the additional properties from [2] have been equivalently incorporated. As announced in [3], the forthcoming proceedings contribution by the author, whose talk at the Rakhiv workshop had the same title as this abstract, will on the one hand provide the detailed natural physical interpretation of the theory developed in [1,3] as contrasted with [2], and on the other hand it will contain detailed proofs for the results stated in [3] of the computation with the defined entropy in all the hitherto tractable examples, also compared with other entropy definitions.


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On general boundary value problems for parabolic equations
The Green matrices of the parabolic and elliptic boundary value problems were constructed and investigated.
The correct solvability in the spaces of increasing functions of the parabolic boundary value problems are proved in the non-limited domains with limited and increasing coefficients by the space variables.
The necessary end uniqueness conditions of the solutions are obtained for the uniform parabolic Petrovsky systems, the degenerate parabolic equations of the Kolmogorov type, parabolic systems with the Bessel operator, and parabolic systems with the weak degeneration on the initial hyperplane. These solutions, which are defined on semi-open layer, are represented by Poisson integrals of the functions from the special weight \(L_p\)-spaces (\(1 \leq p \leq \infty\)) and the Orlicz spaces, or the special spaces of generalized functions.
The solvability of some recurrent problems is considered for the parabolic equations with Bessel’s operator and increasing coefficients.

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Global variational principles
Variational principles on a fibered manifold and its jet prolongations are considered, and the corresponding (global) Euler-Lagrange mapping is discussed. The main tool consists in using the so-called variational sequence which is the quotient sequence of the de Rham sequence on the \(r\)-jet prolongation of the underlying fibered manifold with respect to a subsequence formed by contact forms. As an example, the variational sequence of the 1st order for one-dimensional base manifolds is analysed. The Helmholtz-Solin expressions, describing local variationality conditions, are derived, and their global interpretation is given.
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**New look at the Dirac theory of constrained systems**

An exterior differential systems approach to the Hamiltonian theory of singular Lagrangians is presented, providing an exact and unambiguous background for studying the dynamics of constrained systems.

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**General treatment of all 2d covariant models**

General matterless models of gravity include dilaton gravity, arbitrary powers in curvature, but also dynamical torsion. They are a special class of "Poisson-sigma-models" whose solutions are known completely, together with their general global structure. Beside the ordinary black hole, arbitrary singularity structures can be studied. It is also possible to derive an action "backwards", starting from a given manifold. The role of conservation laws, Noether charge and the quantization have been investigated. Scalar and fermionic matter fields may be included as well.

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**The differential invariants for submersions of local-Euclidean manifolds**

The functional basis of differential invariants for submersions \( \phi(\Gamma) : V_n \to V_1 \), where \( V_n \) is \( n \)-dimensional Euclidean space, \( \Gamma \) a structural pseudogroup generated by \( V_n \)-Euclidean space motion and all kinds of "reparametrizations", i.e. \( V_1 \) - space motion, is obtained.
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An alternative look on recursion operators

Recursion operators for a given partial differential equation $E$ are alternatively defined as Bäcklund auto-transformations of another equation, $VE$, the universal linearization of $E$. This definition covers all recursion operators in dimension 2 known to the author, and under a very natural requirement of linearity it essentially coincides with another definition published recently by G. Cuthrie.

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Method of trees in the theory of representations of quantum algebras

The method of trees is applied to constructing quantum algebras. In this way many notions of the representation theory of Lie algebras can be transferred onto their quantum $q$-analogues. In particular, it is shown how to state $q$-analogues for many objects of Wigner-Racah algebra, for example, Clebsch-Gordan coefficients and $3j$-symbols, Racah coefficients and $6j$-symbols and so on.
Covariant quantum algebras

Two kinds of quantum algebras, universal enveloping algebra and non-commutative coordinate ring, are unified into $g$-covariant/contravariant tensor formalism. Various kinds of $g$-creation/annihilation operators ($g$-Hartree-Fock Bosons/Fermions, $g$-Bogoliubov Bosons, etc.) are introduced which obey $g$-covariant commutation relations. Emphasis is put on $g$-deformations of Kronecker products. The quantum algebra $SU_g(2) \otimes SU_g(2)$ is exploited to clarify the $g$-deformations in the following cases:

1. $g$-Kronecker product for $g$-rotation functions,
2. $g$-Kronecker product for $g$-covariant/contravariant tensors,
3. $g$-deformation of adjoint Kronecker product.

Various identities involving $g - q_j$ symbols ensure $g$-covariance of $SU_g(2) \otimes SU_g(2)$.

Spectral and probabilistic aspects of matrix models

The paper deals with the eigenvalue statistics of $n \times n$ random Hermitian matrices as $n \to \infty$. We consider a certain class of unitary invariant matrix probability distributions which have been actively studied in recent years in the quantum field theory (QFT). These ensembles are natural extensions of the archetype Gaussian ensemble well known and widely studied in the field called random matrix theory (RMT) and having applications in a number of areas of physics and mathematics. Our goal is to analyze the QFT motivated matrix ensembles from the point of view
of the RMT. We consider the normalized counting functions of matrix
eigenvalues (NCF), discuss the RMT content of various physical results
(limiting form of the NCF, the eigenvalue spacing distribution, etc.),
present rigorous versions and extensions of some of them and other rig-
orous results, and discuss open mathematical problems, conjectures, and
links with other areas.

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On the integrability of some Hamiltonian systems
The Hamiltonian system of three-body-on-the-line-with-a pair-interacti-
on with the Hamiltonian

\[ H = \frac{1}{2}(p_1^2 + p_2^2 + p_3^2) + V(x_1 - x_2) + V(x_2 - x_3) + W(x_1 - x_3) \quad (1) \]

is considered.
All the functions \( V(x) \) and \( W(x) \) (with an additional condition on their forms) for which the Hamiltonian system (1) is completely integrable by Liouville are described.
As a corollary the complete integrability of the corresponding quantum system is obtained.

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About the Poisson field approach to classical statistical mecha-
nics of charged particles
A Poisson integral representation for distribution functions of charged
particles in finite volume with many-body potential satisfying stability
conditions, convenient for constructing cluster expansions of Brydges-
Federbush type is obtained. Convergence of such cluster expansions
for sufficiently small inverse temperature and activity of the particles is proved with the assumption that the many-particle potential satisfy an "integrability and decreasing property" which is natural from the physical point of view. So we do not use cumbersome conditions of regularity needed in previous publications concerning many-body interactions. The same result is obtained for a system of charged balls with Yukawa interactions.

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The method of the homogeneous solution in problems of mathematics and physics

We discuss the problems of the transition from three-dimensional tasks of the theory of elasticity to two-dimensional problems of mathematics and physics, as for the bodies of limited sizes. Among the methods of solution of the mentioned tasks, the basic place is occupied by the method of homogeneous solutions, whose possible construction procedures are mentioned. The questions of using this method are illustrated, and its generalization to the solution of concrete boundary problems for which the method may be used effectively, leading to the mathematical problems, appear by using this method.

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Parallelizing algorithms for symbolic computation

Increasing accuracy of mathematical models requires more exactness in the computations. Numerical instabilities become a serious problem in the experimental verification of the theory. Fortunately symbolic methods will solve this problems, but the algorithms used there are usually too slow to solve larger problems.
Using the \textit{MAPLE} (speak: parallel Maple) system, we present some methods and algorithms, which increase the performance of symbolic computations, by getting access to the high performance of today's parallel computers.

The implementation of different parallel programming paradigms shows that it is fairly easy to parallelize even complex algebraic algorithms using this system.

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\textbf{Spinors from Pythagoras to Penrose}

Some facts from the history of spinor theory are discussed. The role of spinors in nonquantum physics is stressed. The spinor description of rigid body, the spinorial regularization of the Kepler problem, the Penrose theorem on spin-tensors, the Maxwell poles and axes are considered. The existence of the square root of a spinor and its connection with the infinite-component Dirac equation are discussed.

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\textbf{Wave problems of mathematical physics for anisotropic media}

The represented results are related to the elaboration of numerical-analytical methods of analysis of mathematical physics boundary problems in propagation of electromagnetic, elastic, electroacoustical and several other types of coupled waves, in low-symmetric (by physical-mechanical properties) waveguides with multiconnected complicated geometry of cross-section.

The methods are based on the new way of integration of dynamical wave equations and systems of such equations using the theory of generalized complex variables and obtaining the base set of new classes of special functions of generalized complex variables.
The dispersion equations for the investigated classes of the wave motions in the waveguides, in the form of equality to zero of infinitely-long determinants with the elements having new non-classical special functions, are obtained.

The particular examples of the application of the proposed methods are the analysis of spectra of normal elastic waves in cylindrical crystallic waveguides of the orthorombical class. The application of the suggested method for waveguides made of plasma is examined.

The research described in this publication was made possible in part by Grant No K4G100 from the Joint Fund of the Government of Ukraine and the International Science Foundation.

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Chaotic properties of quantum field theories

The various notions of classical ergodic theory can be transcribed in a simple way into quantum mechanics and the question is which quantum mechanical systems show the features of classical mixing systems. It turns out that Galilei and Poincare invariant field theories automatically satisfy the quantum mechanical generalization of topologically mixing.

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Supersymmetric electrodynamics of charged and neutral fermions in the extended Wheeler-Feynman approach

The principal possibility has been shown of the unification of the action-at-a-distance theory together with the conception of supersymmetry.
This unification permits to generalize for spinor fields the idea of the construction of fields from world coordinates.
Another important result of the approach presented here is the generalization of the minimality principle taking into account the electromagnetic interaction via the anomalous magnetic moment of superparticles.
The significance of this extended minimality principle falls outside the frame of the action-at-a-distance theory and may be used as a general principle in the supergauge field theories.

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Group extensions in Mathematical Physics

The problem of group extensions consists in the solution of the question: given two groups, G and H respectively, find all groups E such that the sequence $0 \to G \to E \to H \to 1$ is exact. Stated equivalently one has to find all groups E such that G is isomorphic to an invariant subgroup of E and H isomorphic to the factor group $E/G$. Any such E is called an extension of G by H. If the sequence splits and G is abelian, then E is the semi-direct product of G by H, well-known to theoretical physicists: Euclidean group, Galilei group, Poincare group etc. If the sequence does not split there are two prominent examples of more general extensions: projective representations on Hilbert space of a symmetry group in Quantum Mechanics become representations of a central extension of this group. Also within the framework of crystallography new groups of this kind have been detected in connection with Quasi-crystals, that go beyond the so-called non-symmorphic space groups which have been known for a long time.
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Explicit formulae for associative algebra deformations
An explicit formula for deformations of an algebra $A$ is connected with an action of a bialgebra on the algebra $A$. The formulae of Moyal-Weyl, Gerstenhaber and Drinfeld are discussed.

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Monopole currents and the confinement mechanism in $U(1)$ lattice gauge theory
The compact formulation of quantum electrodynamics (QED) has a strongly coupling phase, where electric charges are confined. This phenomenon is known to be related to magnetic monopoles. Electric flux lines align the monopole current which is seen in our lattice simulations of $U(1)$ gauge theory. These induced currents on the other side expel the electric flux, which leads to the formation of a flux tube between positive and negative charges. This scenario can be described by the dual version of Maxwell-London equations, including a dual Dirac string connecting the charges. In this effective model one can derive a potential with a linearly rising term. In order to get agreement with lattice $U(1)$ results we have to take into account fluctuations of the string, which is done on a lattice of the same size as used for the lattice simulations.

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An approximate method for problems in elastodynamics of multiply-connected media
The decision problems of elastodynamic and thermoelastodynamic conditions for isotropic and straightline-anisotropic media are solved by an
approximate method. It requires the application of the apparatus of analytical functions of complex variables. The media reside in multiconnected domains. They deform under the activity of external strains or else of uneven heating (cooling).
Particular cases are examined. The decision problems support coordinate functions. An asymptotic approximation of the functions is received. The tensions and then low natural frequencies depend on them. Their dependence is arranged for physical-mechanical parameters of the body and its geometry.