

V. I. Andriychuk

**ON WEAK APPROXIMATION IN LINEAR ALGEBRAIC GROUPS  
OVER PSEUDOGLOBAL FIELDS**

ISSN 0130–9420. *Mathematical methods and physico-mechanical fields.* – 2005. – 48, No. 4. – P. 7-13. – Ref.: 10 names. – Ukr.

*Let  $G$  be a connected reductive linear algebraic group over an algebraic function field  $K$  from one variable with pseudofinite constant field of characteristic zero. Suppose that  $G$  admits a special  $K$ -covering with kernel  $\mu$ . Then for any finite subset  $\Sigma$  of the set of all valuations of  $K$  the defect  $A_\Sigma(G)$  of weak approximation coincides with the cokernel of the restriction map  $H^1(K, \mu) \rightarrow \prod_{v \in \Sigma} H^1(K_v, \mu)$ .*

N. S. Dzhalyuk, V. M. Petrychkovych

**ON SOLUTIONS OF MATRIX POLYNOMIAL EQUATIONS AND ON SIMILARITY OF MATRICES**

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*The solutions of triangular form of the matrix polynomial equations are described. In particular, the conditions under which the solutions of matrix equation with matrix triangular coefficients have the same triangular form are established, and the method of finding them is proposed. The form of all triangular solutions of matrix equation with one elementary divisor and of simple structure is presented.*

V. R. Zelisko, V. P. Shchedryk

**MATRIX OF VALUES ON A SYSTEM OF ROOTS OF DIAGONAL  
ELEMENTS OF MATRIX AND ITS APPLICATIONS**

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*P. S. Kazimirskiy introduced the notion of values of matrix on a system of polynomial. On its base, the concept of values of matrix on a system of roots of diagonal elements of matrix is introduced. The processes of regularization conditions of a matrix polynomial, the description of monic divisors, the factorization of symmetric matrices and the calculation of the Jordan normal form of an integer matrix are essentially simplified due to this new concept.*

M. Ya. Komarnitskiy, I. O. Melnyk

**ON AXIOMATIZABILITY OF A CLASS OF NONCOMMUTATIVE PRUFER RINGS**

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*A question on preserving the properties of one-sided ideals of rings with respect to ultraproducts is studied. Axiomatizability of a class of noncommutative Prufer (in the sense of Gräter) rings is established. It is found that a class of noncommutative Dubrovin valuation rings is non-axiomatizable in contrast to axiomatizability of a class of usual ordinary valuation rings (in the sense of Kaplansky).*

B. Z. Shavarovskii

**ON SIMILARITY OF COLLECTION OF MATRICES AND ON QUASI-DIAGONAL  
EQUIVALENCE OF MATRICES**

ISSN 0130–9420. *Mathematical methods and physico-mechanical fields.* – 2005. – 48, No. 4. – P. 38-42. – Ref.: 8 names. – Ukr.

*The problem on simultaneous similarity of one type of collection of square matrices over the field of complex numbers is reduced to the problem on the special quasi-diagonal equivalence of rectangular matrices, corresponding to these collections. It is shown that it is possible to find a collection of square matrices according to the arbitrary matrix from a class of specially quasi-diagonal equivalent matrices, corresponding to it.*

V. M. Prokip

**ON COMMON DIVISORS OF MATRICES OVER FACTORIAL DOMAINS**

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*The problem on common divisors of matrices over the factorial domains is investigated. The necessary and, with certain restrictions, sufficient conditions are established for existence of a common left nonsingular divisor of two matrices. The results obtained in this paper have found their immediate application in the investigation of common unital divisor of polynomial matrices over a factorial domain.*

V. M. Fedorchuk, V. I. Fedorchuk

**ON FUNCTIONAL BASES OF THE FIRST-ORDER DIFFERENTIAL INVARIANTS  
OF CONTINUOUS SUBGROUPS OF POINCARÉ GROUP  $P(1,4)$**

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*It is determined which functional bases of differential first-order invariants of splitted and not splitted subgroups of Poincaré group  $P(1,4)$  belong to the Abelian subgroups and which of them – to the non-Abelian ones. The obtained sets of functional bases are classified according to dimensions. For each type of the subgroups considered one functional basis of differential invariants is chosen.*

T. M. Kysil'

**STRONG FACTORIAL ELEMENTS OF DUO-DOMAIN**

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*We investigate the maximal non-principal ideals of a duo-ring and their relation to the elements with finite number of atomic divisors. Also we investigate the reduction of matrices over a class of rings, in which any maximal non-principal ideal is a two-sided ideal.*

O. V. Gutik, Yu. M. Livach

**EMBEDDINGS OF SEMIGROUPS INTO NILPOTENT-GENERATED SEMIGROUPS**

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*It is proved that for every integer  $n \geq 2$  and for any semigroup  $S$  there exists an embedding of  $S$  into a nilpotent-generated semigroup  $NG_n(S)$  with index of nilpotency  $i_{\text{nil}}(NG_n(S)) = n$ . Green's relations on  $NG_n(S)$  is described. It is shown that any semigroup  $S$  is embedded into a semi-*

*group  $NG_\infty(S)$ , which is generated by a set of nilpotent elements  $N$  such that  $i_{\text{nil}}(NG_\infty(S)) = \infty$ , where  $N = \bigcup_{i=2}^{\infty} N_i$  and  $i_{\text{nil}}(a) = i$  for any  $a \in N_i$ . The analogues of these constructions which preserve compactness, countable compactness, pseudo-compactness, and  $H$ -closedness, absolute  $H$ -closedness, algebraic closedness, algebraic  $h$ -closedness in the class of topological inverse semigroups and in the class of topological semigroups are constructed. The constructions of embeddings of topological semigroups into the path-connected nilpotent-generated topological se-*

migroups and embeddings of countable Hausdorff topological semigroups into the countable connected Hausdorff nilpotent-generated topological semigroups are presented.

Zrum O. V., Skaskiv O. B.

**WIMAN'S INEQUALITIES FOR ENTIRE FUNCTIONS OF TWO COMPLEX VARIABLES WITH RAPIDLY OSCILLATING COEFFICIENTS**

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Let  $f(z_1, z_2) = \sum_{n+m=0}^{\infty} a_{n,m} z_1^n z_2^m$  be an entire function,  $z = (z_1, z_2) \in \mathbb{C}$  and  $K(f) = \left\{ f(z, t) = \sum_{n+m=0}^{+\infty} a_{n,m} e^{2\pi i \theta_{n,m} t} : t \in [0, 1] \right\}$ , where  $(\theta_{n,m})$  is

a fixed Hadamard sequence. In the paper it is established that for all  $\varepsilon > 0$  almost surely in  $K(f)$  there exists a set  $E(\varepsilon, t) \subset \mathbb{R}_+^2$ ,

$\ln_2 - \text{meas } E_R(\varepsilon, t) \stackrel{\text{def}}{=} \int_{E_R(\varepsilon, t) \cap [1, +\infty) \times [1, +\infty)} \frac{dr}{r} = O(\ln R)$ ,  $R \rightarrow +\infty$ ,  $E_R(\varepsilon, t) = E(\varepsilon, t) \cap \Delta_R$ , such that for all  $r \in \mathbb{R}_+^2 \setminus E(\varepsilon, t)$  the inequality

$M_f(r, t) \leq \mu_f(r) \ln^{1/2} \mu_f(r) (\ln \ln \mu_f(r))^{1+\varepsilon}$  holds, where  $M_f(r, t) = \max\{|f(z, t)| : |z_1| = r_1, |z_2| = r_2\}$ ,  $\mu_f(r) = \max\{|a_{n,m}| r_1^n r_2^m : n \geq 0, m \geq 0\}$ ,  $r = (r_1, r_2) \in \mathbb{R}_+^2$ .

P. V. Filevych, S. I. Fedynyak

**ON A RELATION BETWEEN THE MAXIMUM MODULUS, THE MAXIMUM MODULUS OF DERIVATIVE AND CENTRAL INDEX FOR ENTIRE FUNCTIONS**

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Let  $M_f(r)$  be the maximum modulus for transcendental entire function  $f$ , and  $\nu_f(r)$  be the central index, and  $S_f(r) = \left( \frac{1}{2\pi} \int_0^{2\pi} |f(re^{i\theta})|^2 d\theta \right)^{1/2}$ .

The inequality  $\liminf_{r \rightarrow +\infty} \frac{r S_f(r)}{M_f(r) \sqrt[3]{\nu_f(r)}} \geq \sqrt[6]{\frac{3}{16}}$  is established and it is proved that this inequality is exact.

V. M. Kuzakon'

**CALCULATION OF DIFFERENTIAL INVARIANTS OF THE SECOND-ORDER SUBMERSIONS FOR EUCLIDEAN SPACES**

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The method for calculation of differential invariants of submersions  $\varphi : \mathbb{R}^n \rightarrow \mathbb{R}$  is proposed. The explicit formulas for calculation of the second-order differential invariants are found.

R. V. Andrusjak

**GLOBAL SOLVABILITY OF STEFAN INVERSE HYPERBOLIC PROBLEM**

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The Stefan problem for a linear hyperbolic system of the first-order equations with unknown coefficients in the right-hand sides is considered. By use of the Banach fixed-point theorem and the step-by-step method for construction of solution, the existence of unique generalized solution to the problem is proved on the however large time interval.

Ye. V. Deretc'

**ASYMPTOTICALLY OPTIMAL WEIGHT CUBIC FORMULAS FOR SOME CLASSES OF FUNCTIONS OF MANY VARIABLES**

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A sequence of asymptotically optimal weight cubic formulas on the  $H_{G,\rho}^0$  classes is constructed. The classes are defined by the majorant  $\omega$  of the continuity modulus concerning the metric  $\rho$ . In addition the integration region  $G \subset \mathbb{R}^n$  is Jordan measurable, the weight function is Lebesgue integrable, bounded and separated from zero, and metric  $\rho$  satisfies the conditions of dense imbedding.

R. I. Dmytryshyn

**ON CONVERGENCE OF MULTIDIMENSIONAL  $g$ -FRACTION WITH NON-EQUIVALENT VARIABLES**

ISSN 0130-9420. Mathematical methods and physico-mechanical fields. – 2005. – 48, No. 4. – P. 121-127. – Ref.: 11 names. – Ukr.

We consider the generalization of continued  $g$ -fraction, namely the multidimensional  $g$ -fraction with non-equivalent variables. By multidimensional fraction-linear reflection, we establish that such fraction is an even part of multidimensional  $\pi$ -fraction with nonequivalent variables. And, besides, we investigate the convergence of the multidimensional  $g$ -fraction with non-equivalent variables and establish the truncation errors for such fraction in the same regions of the space  $\mathbb{C}^N$ .

P. O. Savenko, M. D. Tkach

**APPROXIMATE METHOD FOR SOLVING TWO-DIMENSIONAL HAMMERSTEIN TYPE INTEGRAL EQUATIONS ARISING IN THE RADIATING SYSTEMS SYNTHESIS PROBLEMS**

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The generalization of the degenerated kernels method, applied for solving the linear integral equations, on the case of one class of nonlinear integral Hammerstein type solutions, arising in the synthesis problems of various radiating systems, is considered. The convergence of solutions of approximate equation to solutions of exact equation is justified.

N. M. Shcherbyna, M. V. Zhuk

**COMBINED ALGORITHM FOR SOLUTION OF LINEAR**

## **TWO-DIMENSIONAL BOUNDARY-VALUE PROBLEM**

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*In this paper, an algorithm combining Kantorovich's method with numerical-analytical method for solution of the linear two-dimensional boundary-value problem is proposed. First, by applying Kantorovich's method the initial problem is reduced to solution of one-dimensional problem. Then, its solution is determined by use of the numerical-analytical method. The numerical aspects of this approach are considered. As an example, the problem about bending of orthotropic plates is solved. The calculation analysis is made.*

V. V. Meleshko

## **THERMAL STRESSES IN RECTANGULAR PLATES**

**ISSN 0130-9420. Mathematical methods and physico-mechanical fields. – 2005. – 48, No. 4. – P. 140-164. – Ref.: 110 names. – Ukr.**

*This paper addresses the classical two-dimensional biharmonic problem for a rectangular domain. Some aspects of its history are outlined. The method of superposition is effective for solving the mechanical problems concerning thermoelastic equilibrium of an elastic rectangle and thermoelastic bending of a thin clamped rectangular elastic plate. Relations between mathematical and engineering approaches are considered. The method is illustrated by two typical examples.*

M. P. Savruk, A. M. Osyechko

## **INTERACTION OF ARBITRARILY PLACED CRACKS WITH WEDGE CUT UNDER ANTIPLANE STRAIN**

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*The antiplane problems of elasticity theory for an infinite wedge with curvilinear cracks are considered. The boundary-value problems are reduced to singular integral equations on contours of cuts. Numerical solutions for the wedge with an internal rectilinear crack or a crack along an arc of ellipse as well as for the edge cracks originating from the wedge tip are obtained. Influence of a wedge cut and crack positions on the stress intensity factors in the crack and the wedge tips is investigated.*

A. P. Moysyeyenok, V. G. Popov

## **STRESS CONCENTRATION NEAR THIN ELASTIC INCLUSION UNDER THE ACTION OF NON-STATIONARY LONGITUDINAL SHEAR WAVE**

**ISSN 0130-9420. Mathematical methods and physico-mechanical fields. – 2005. – 48, No. 4. – P. 172-177. – Ref.: 9 names. – Ukr.**

*The non-stationary problem about the elastic stress concentration in the medium, which is under the condition of anti-plane strain near a thin elastic inclusion, is solved. At the initial moment the plane, non-stationary longitudinal shear wave influences the inclusion. The method for solution consists in the Laplace time transformation application and presentation of displacement image by the discontinuous solution of the appropriate differential equation. It has allowed us to reduce the initial problem to the singular integral equation concerning the image of stress jump. The originals of the found images are restored numerically by the method based on the replacement of the Mellin integral by the Fourier series.*

T. S. Nahirnyj, K. A. Tchervinka

## **STRESSED-STRAINED STATE AND STRENGTH OF LOCALLY INHOMOGENEOUS LAYER DURING HEATING PROCESS**

**ISSN 0130-9420. Mathematical methods and physico-mechanical fields. – 2005. – 48, No. 4. – P. 178-183. – Ref.: 8 names. – Ukr.**

*An approach is proposed and temperature influence on the strength limit and its size effect are investigated for a layer during its heating (cooling). The relations of locally-gradient thermoelastic solid model and the first classical criterion of strength are taken as the base for consideration.*

P. I. Kalenyuk, O. Ya. Michuda

## **VARIATIONAL MODEL OF NONLINEAR MECHANICS FOR INERTIAL ELASTIC SYSTEMS**

**ISSN 0130-9420. Mathematical methods and physico-mechanical fields. – 2005. – 48, No. 4. – P. 184-190. – Ref.: 7 names. – Ukr.**

*On the basis of Hamilton functional the variational formulation of the boundary-value problems of nonlinear mechanics for deformable elastic systems is developed. Physical relations of local state, which take into account the interaction effects of translational, rotational and deformable motion forms and relaxation phenomena, are determined.*

A. G. Nikolaev, K. P. Barakhov

## **SOME TYPES OF PHYSICAL FIELDS IN THE CONE WITH HETEROGENEITY AS A SPHERICAL SEGMENT**

**ISSN 0130-9420. Mathematical methods and physico-mechanical fields. – 2005. – 48, No. 4. – P. 191-198. – Ref.: 14 names. – Ukr.**

*By joined application of the method of potential and Fourier generalized method the problem on definition of the electrostatic field, formed by the charged cone and a thin spherical segment and also the problem on definition of the stress field, formed by absolutely hard spherical segment, sealed in an elastic solid of conic form, to which a twisting moment is applied, is solved. Both problems are reduced to the integral second kind Fredholm equations with indefinitely smooth kernels. In the first problem the numerical analysis of distribution density of charge on a spherical segment and capacity of the system versus the geometrical parameter is given. Images of equipotential surfaces in the researched field are presented. In the second one the numerical solution of the integral equation is made, on the basis of which the numerical analysis of tangential stresses in the segment versus the geometrical parameters is carried out.*

Ju. M. Dudzinski

## **ACOUSTIC-HYDRODYNAMIC SENSOR MODELS OF FLUID CAVITATION THRESHOLD**

**ISSN 0130-9420. Mathematical methods and physico-mechanical fields. – 2005. – 48, No. 4. – P. 199-204. – Ref.: 11 names. – Ukr.**

*Two models for measurement of cavitation threshold in fluid are presented. The elastic underwater jet's membranes as the model of uniflow and counterflow sensor are considered. The basic frequency of membrane's auto-vibration depending on characteristics of fluid and geometric parameters of construction is calculated. The numerical calculations and experimental results are compared.*

V. Yo. Tchaban

## **UNIFIED EQUATIONS OF ELECTRODYNAMICS**

**ISSN 0130-9420. Mathematical methods and physico-mechanical fields. – 2005. – 48, No. 4. – P. 205-209. – Ref.: 9 names. – Ukr.**

*In this paper we propose the unified electromagnetic field differential equations of electromagnetic interaction in the immovable and movable media. The results are obtained from differential equations of electromagnetic field in the immovable medium on the base of formal mathematical transformations. The proposed mathematical theory is developed for vectors and vector-potentials of electromagnetic field. The results obtained give the possibility to understand the physical essence of electromagnetic phenomena deeper, including the interaction with mechanical movement.*