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CALCULATION OF ADSORPTION ISOTHERMS OF NaF FROM AQUEOUS SOLUTIONS BY THE SAMPLES OF ALUMINUM OXIDE

V. I. Zelentsov and T. Ya. Datsko

The constant of adsorption equilibrium (K_a) is widely used for calculation of many thermodynamic functions of an adsorption process - standard diminution of mole adsorption energy ($-\Delta F^0$), standard adsorption enthalpy (ΔH^0) and standard adsorption entropy (ΔS^0). In [1] the authors obtained the equation for calculation of adsorption equilibrium constant (K_a) for fluorine adsorption from aqueous solution on aluminum oxide (A200):

$$K_{a2} = \frac{4.6 \cdot 10^4 \cdot \Theta_2 \cdot \gamma_{a2}}{(1 - 0.172 \cdot \Theta_2) \cdot C_2 \cdot \gamma_2} \quad (1)$$

where:

Θ_2 - adsorbent surface covering degree with NaF molecules

C_2 - NaF solution equilibrium concentration, mmol/l

γ_2 and γ_{a2} - the activity coefficients in the equilibrium solution and in the adsorption layer, respectively.

In this paper the constants of adsorption equilibrium obtained by equation (1) were used for calculation of adsorption isotherms of fluoride ions from model aqueous solutions with initial concentration from $5 \cdot 10^{-4}$ to 0,50mmol/l. Adsorption isotherms were calculated as follows: for given values Θ_2 and appropriate K_{a2} the equilibrium NaF concentrations (C_2) were evaluated by formula (1) and by difference of initial and equilibrium fluorine concentrations the adsorption value (a , mmol F/g) was calculated. The samples of aluminum oxyhydroxide obtained by thermal treatment at 200, 400, 600, and 800°C of products of electrochemical dimensional treatment of aluminum alloy [2] were used as fluorine adsorbents.

Comparison is given of adsorption isotherms theoretically calculated and experimentally obtained in system $Al_2O_3 - H_2O - NaF$. It was shown a satisfactory correlation of experimental and theoretically calculated values of isotherms of fluorine adsorption on obtained samples - discrepancy in values of "a" does not exceed 10%.

Similar calculation of fluorine adsorption isotherms may be of great interest for technology of purification of natural and waste waters of such a toxic component and also can be used for other analogical oxide systems.

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UNIVERSAL REGULAR AUTONOMOUS ASYNCHRONOUS SYSTEMS: FIXED POINTS, EQUIVALENCIES AND DYNAMICAL BIFURCATIONS

Șerban E. Vlad

The asynchronous systems are the non-deterministic models of the asynchronous circuits from the digital electrical engineering. In the autonomous version, such a system is a set of functions $x:R \rightarrow \{0,1\}^n$ called states (R is the time set). If an autonomous asynchronous system is defined by making use of a so called generator function $\Phi: \{0,1\}^n \rightarrow \{0,1\}^n$, then it is called regular. The regular autonomous asynchronous systems compute in real time the iterates of Φ when these are not made, in general, on all the coordinates Φ_1, \dots, Φ_n simultaneously. The property of universality means the greatest in the sense of the inclusion.

The purpose of the paper is that of defining and of characterizing the fixed points, the equivalencies and the dynamical bifurcations of the universal regular autonomous asynchronous systems. We use analogies with the dynamical systems theory.

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INVERSE PROPERTY OF QUASIGROUPS (LOOPS)

Mădălina Vrabie

For associative binary systems, the concept of an inverse element or an inverse property is only meaningful if the system has an identity element. Recall that for groups, $a \cdot a^{-1} = a^{-1} \cdot a = e$. A quasigroup is a grupoid (G, \cdot) , (non-empty set “G” together with a binary operation (\cdot) , or a magma in alternative terminology) if there exist unique solution $x, y \in G$ to the equations $x \cdot a = b$ and $a \cdot y = b$ for all $a, b \in G$. In this case any right and any left translation of the grupoid (G, \cdot) is a bijection of the set G. ($L_a : G \rightarrow G$, $L_a x = ax$ for all $x \in G$) is a left translation of a grupoid (G, \cdot) relative to a fixed element $a \in G$, the map $R_a : G \rightarrow G$, $R_a x = x \cdot a$ is a right translation). A quasigroup (G, \cdot) with an identity element $e \in G$ is called a loop.

However, for quasigroups, the inverse property can be meaning fully defined even in the absence of the identity element. A quasigroup (G, \cdot) is said to have the left inverse property (and is called an L.I.P. quasigroup) if there exists a bijection $J_\lambda : a \rightarrow a^\lambda$ on G such that $a^\lambda(ax) = x$ for every $x \in G$.

A quasigroup which has both the L.I.P. and the R.I.P. is said to have the inverse property (and is called an I.P. quasigroup).

The class of I.P. quasigroups is a very important one, and I shall outline some basic properties of such quasigroups

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*	1	2	3	4		\	1	2	3	4		/	1	2	3	4
1	2	3	1	4		1	3	1	2	4		1	4	2	1	3
2	4	1	3	2		2	2	4	3	1		2	1	4	3	2
3	3	4	2	1		3	4	3	1	2		3	3	1	2	4
4	1	2	4	3		4	1	2	4	3		4	2	3	4	3

1. Quasigroup encryption

I can now define a quasigroup cipher in terms of encryption function following (Dimitrova and Markovski, 2004). Let $(Q, *, \backslash, /)$ be a quasigroup and $a_1, a_2, a_3, \dots, a_n \in Q$. I define the encryption function E with respect to the key $a \in Q$ as $E_a(a_1, a_2, a_3, \dots, a_n) = b_1, b_2, b_3, \dots, b_n$, where $b_1, b_2, b_3, \dots, b_n \in Q$ are computed by (i) $b_1 = a * a_1$, and (ii) $b_i = b_{i-1} * a_i$, for $i=2, \dots, n$

2. Quasigroup decryption

The decryption process is similar to the encryption but the left division operation “ \backslash ” is used as operation. The decryption function D is then defined as:

$$D_a(a_1, a_2, a_3, \dots, a_n) = e_1, e_2, e_3, \dots, e_n$$

where the original plaintext is computed by (i) $e_1 = a \backslash a_1$, and (ii) $e_i = a_{i-1} \backslash a_i$, for $i=2, \dots, n$

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ANALYZING THE PROBLEM SOLVING PROCESS: NEW PERSPECTIVES TOWARDS PROBLEM POSING

Cristian Voica and Mihaela Singer

The article discusses the stages of the problem solving process in order to build a framework for analyzing the characteristics of the problems the teachers use or might use for a better training of students. From the text of the problem to its solution, a solver tries to find relations among the data and the operators, to develop a mental model, then to move to a known mathematical model in order to finally arrive at the solution. Within these transformations of the problem, a solver crosses some procedures: decoding, representing, processing, implementing. The study of these procedures might offer insights for more effective teaching.

CLASIFICACION OF QUASIGROUP-STRUCTURE FROM CRYPTOGRAPHIC PROPER TIES POINT OF VIEW

Mădălina Vrabie

Following (Pflugfelder, 1990), a quasigroup Q can be defined as a group of elements $(1, 2, 3, \dots, n)$ along with a multiplication operator $*$, such that for every element $x, y \in Q$, there exists a unique solution $z \in Q$ such that following two conditions hold a) $x * a = z$ and b) $b \text{ table defining } *$. Conditions a) and b) essentially postulate the existence of unique left and right divisors for each element in Q . This gives rise to an explicit definition of left and right division operations:

Let (Q, \circ) be a quasigroup, then two operation $\backslash, /$ on Q can be defined as:

c) $x * (x \backslash y) = y$ and $x \backslash (x * y) = y$ d) $(y / x) * x = y$ and $(y * x) / x = y$.

The following is an example of quasigroup Q of order 4 given in terms of multiplication tables for all three operations:

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PRE-SERVICE TEACHERS PREPARATION: A PERSPECTIVE ON TEACHING PRACTICE MENTORING

Maria Angheluță and Consuela Luiza Voica

This study presents some conclusions after a mentoring programme for in-service teachers from the University of Bucharest.

The results of a SWOT analyse are presented. The findings are discussed within the context of building more rigorous teacher preparation programs. A mentoring strategy in a teaching practice programme is also presented.

ON THE ROLE OF EXPLORATION TASKS IN LEARNING MATHEMATICS

Cristian Voica

Learning to pose mathematical problems to students is a significant aspect of mathematics teaching. Starting from a previous research, we analyze the role of open problems in teaching mathematics. The questions from this category are characterized by doubt, meaning that a priori one can obtain several answers. We find that exploratory tasks can promote a critical thinking in students.

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CONCURRENCY ANALYSIS FOR COLOURED PETRI NETS

Cristian Vidraşcu

An important area of research in computer science is that of models for concurrent and distributed systems. Finding suitable mathematical models is important in order to cope with the increasing complexity of real systems and for studying their properties. There is a wide range of studies dedicated to this topic and among the most frequent approaches we can enumerate: Petri nets, process calculi, abstract state machines and temporal logic.

Petri nets were introduced by C. A. Petri in the early 1960s as a graphical and mathematical tool for modelling concurrent/distributed systems. They are a suitable formalism for describing and studying information processing systems that are characterized as being concurrent, asynchronous, distributed, parallel, nondeterministic, and/or stochastic.

As a graphical tool, Petri nets can be used as a visual-communication aid similar to flow charts, block diagrams, and networks. As a mathematical tool, it is possible to set up state equations, algebraic equations, and other mathematical models governing the behaviour of systems.

Petri nets have been proposed for a very wide variety of applications because of their generality and adaptability. They have been successfully used for concurrent and parallel systems modelling and analysis, communication protocols, performance evaluation and fault-tolerant systems.

The goal of this paper is to study the relationships between the concurrency-degrees of a coloured Petri net and those of its subnets.

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A NOTE ON DIFFERENTIAL SUBORDINATIONS USING SĂLĂGEAN AND RUSCHEWEYH OPERATORS

Alina Alb Lupaş

In the present paper we define a new operator using the Sălăgean and Ruscheweyh operators. Denote by SR^m the Hadamard product of the Sălăgean operator $S^{m^{\wedge}}$ and the Ruscheweyh operator R^m , given by $SR^m: A_n \rightarrow A_n$, $SR^m f(z) = (S^{m^{\wedge}} * R^m) f(z)$ and $A_n = \{f \in H(U), f(z) = z + a_{n+1}z^{n+1} + \dots, z \in U\}$ is the class of normalized analytic functions. We study some differential subordination regarding the operator SR^m .

Keywords: differential subordination, convex function, best dominant, differential operator, convolution product.

2000 Mathematical Subject Classification: 30C45, 30A20, 34A40.

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RECENT SOFTWARE VULNERABILITY MODELS

Grigore Albeanu

Software vulnerability is an instance of a mistake in the specification, development, or configuration of software such that its execution can violate the explicit or implicit security policy [1]. However, a measure useful to security engineers, called the software vulnerability function, can be defined as below.

Let us consider that: (1) attacker has a vulnerability "discovery rate", with $m_1(t)$ being the cumulative number of discovered vulnerabilities in the interval $[0, t)$; (2) software maintainer is responsible to detect vulnerabilities with "detection rate" and $m_2(t)$ being the cumulative number

of detected vulnerabilities up to t ; (3) maintainer is able to remove $H(t)$ vulnerabilities out of $m_2(t)$, with a “removing rate”; (4) Initially, there are M vulnerabilities, and this number will not be increased by patching.

In order to analyses and estimate the vulnerability function, the following differential model is proposed:

$$\begin{cases} \frac{dm_1(t)}{dt} = b_1(t)(M - m_1(t)), m_1(0) = 0; \\ \frac{dm_2(t)}{dt} = b_2(t)(m_1(t) - m_2(t)), m_2(0) = 0; \\ \frac{dH(t)}{dt} = v(t)(m_2(t) - H(t)), H(0) = 0. \end{cases}$$

After solving such a model the following software vulnerability metrics can be obtained: (5) the mean number of remaining software vulnerabilities, denoted by $B(t)$, and given by $B(t) = M - H(t)$; (6) the cumulative mean time between vulnerability elimination, denoted by $MTBE_c(t) = 1/H(t)$, and (7) the probability to remove a vulnerability in the interval $(t, t+x)$, where t is the current operational time and $x (\geq 0)$ is the observation time, denoted by $V(x|t)$, and called the software vulnerability, is given by $V(x / t) = 1 - \exp(-(H(t+x)-H(t)))t \geq 0$, which is similar to the software reliability function [2]. The described approach is a generalization of [3].

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În [3] este anunțat rezolvarea primei probleme, unde s-au stabilit condițiile necesare și suficiente ca o buclă abstractă să fie ordonată. În lucrarea prezentată acum este cercetată a doua problemă, fiind descrise anumite tipuri de ordine ale buclelor ordonabile. Deasemenea sunt studiate produsele directe de bucle ordonabile și este demonstrat că orice două descompuneri ale buclei ordonate într-un produs direct de bucle ordonate admite rafinări izomorfe.

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DYNAMICAL SYSTEM ASSOCIATED TO A CENTRAL FIELD MOTION ANALYTICAL TREATMENT FOR A FOUR TYPE FORCES

Eugen Vasile

Motion in a central field forces has been studied in classical analytical mechanics and electromagnetism. The general case of central force is nowadays easy solved by numerical methods on computers.

The paper presents a rigorous analytical treatment of this problem taking into account only four types of forces (from Newtonian or Colombian to linear elasticity). The problem is presented from the point of view of dynamical systems theory with appropriate normalization techniques.

The integrability of dynamical system is analyzed; for the stationary orbit a four degree algebraic equation is deduced and solved and some stability problems are considered.

MahCAD representations are produced for quantitative evaluations of above analytical modeling.

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BLACK SCHOLES STOCK OPTION PRICING MODEL

Ciprian-Sebastian Turcan and Radu Turcan

Black Scholes Parabolic Partial Derivative Equations are used in stock option pricing. We will refer to the stocks that offer continuous and constant dividend payments, or stock options pricing, taking in consideration that interest rate, volatility and dividends are time-dependent.

CAUCHY EQUATIONS - THE LAMINAR FLOW EQUATIONS FOR THE SLUGGISH ENVIRONMENT

Radu Turcan

Cauchy equations (as a scalar or vector), represent the movement equations for the sluggish environment, in laminar flow.

Using the Principle of Impulse Conservation for the sluggish fluid volume, and the Integral Divergence formula (the Null Integral Theorem), we will obtain the Cauchy Equations (as a scalar or vector).

ASUPRA BUCLELOR ABSTRACTE ORDONABILE

Vasile I. Ursu

O mulțime de elemente L pe care sunt definite operațiile de înmulțire, împărțirea de stânga și de dreapta, \backslash , $/$ se numește buclă abstractă, dacă există în L un element e astfel ca $e \cdot x = x \cdot e = x$ și dacă $x/y \cdot y = y \cdot y/x = (x \cdot y)/y = y \cdot (yx) = x$ pentru orice x, y din L . Bucla abstractă L se numește ordonabilă [1] dacă între elementele și operațiile ei poate fi stabilită o anumită ordine care verifică condițiile:

- (i) pentru orice a, b și c din L este adevărată una și numai una din relațiile: $a < b$, $a = b$, $b < a$;
- (ii) $a < b$ și $b < c$ implică $a < c$;
- (iii) $a < b$ implică $a \cdot c < b \cdot c$ și $c \cdot a < c \cdot b$.

În studiul proprietăților buclelor ordonabile, în mod natural, apar două probleme:

- 1) Care bucle abstracte pot fi ordonate și
- 2) Care din mulțimile ordonate pot fi transformate în bucle ordonate.

De fapt aceste probleme au fost abordate și de L. Fuks [2].

SOME APPLICATIONS OF COGALOIS THEORY TO ELEMENTARY FIELD ARITHMETIC

Toma Albu

Cogalois Theory is a fairly new topic of Field Theory. Roughly speaking, it investigates field extensions, finite or not, that possess a Cogalois correspondence. This theory is somewhat dual to the very classical Galois Theory dealing with field extensions possessing a Galois correspondence.

The aim of the talk is to present some basic concepts and results of Cogalois Theory, as well as their applications to elementary Field Arithmetic like:

When is a sum of radicals of positive rational numbers a rational number?

For what positive integers n, d , is $\sqrt[n]{n + \sqrt{d}}$ a sum of radicals of positive rational numbers?

$\mathbb{Q}[\sqrt[n]{a_1}, \dots, \sqrt[n]{a_r}] = \mathbb{Q}[\sqrt[n]{a_1 + \dots + \sqrt[n]{a_r}}]$ for any positive integers r, n_1, \dots, n_r and any positive rational numbers a_1, \dots, a_r .

Effective computation of $[\mathbb{Q}[\sqrt[n_1]{a_1}, \dots, \sqrt[n_r]{a_r}]: \mathbb{Q}]$.

If r, n_0, n_1, \dots, n_r are positive integers and a_0, a_1, \dots, a_r are positive rational numbers, when $\sqrt[n_0]{a_0}$ can be written as a finite sum of monomials of form $c \cdot \sqrt[n_1]{a_1}^{j_1} \cdot \dots \cdot \sqrt[n_r]{a_r}^{j_r}$, with $j_1, \dots, j_r \in \mathbb{N}$ and $c \in \mathbb{Q}^*$?

When a positive algebraic number can be written as a finite sum of real numbers of type $\pm \sqrt[n_i]{a_i}, 1 \leq i \leq r$, with $r, n_1, \dots, n_r, a_1, \dots, a_r$ positive integers?

Each of the numbers $\sqrt{1 + \sqrt{2}}, \sqrt{2 + \sqrt{2 + \sqrt{2 + \dots + \sqrt{2}}}}$ cannot be written as a finite sum of real numbers of type $\pm \sqrt[n_i]{a_i}, 1 \leq i \leq r$, with $r, n_1, \dots, n_r, a_1, \dots, a_r$ positive integers.

DYNAMIC AND STABILITY OF DEFORMABLE PLATES UNDER AEROHYDRODYNAMICAL ACTION

A.V. Ankilov and P.A. Velmisov

The dynamic and the stability of deformable (elastic, viscoelastic) plates or deformable elements-plates of the constructions (aircrafts, underwater apparatus, pipe-line systems, measuring sensor of the parameters of the gas-fluid environments) in the interaction with subsonic or supersonic flow of a fluid (a gas) is studied. In particular, the problems subject to the heat efficiency on the plates and the delay effects of the different external actions is considered. Aerodynamic load is determined by asymptotic aerohydrodynamics equations [1]. The behavior of the elastic material is described by the nonlinear model taking into account the longitudinal and transverse components of the plates strain. The definition of deformable body's stability corresponds to Lyapunov's concept of the dynamical system's stability. The dynamic and the stability of deformable plates are studied under different forms of their fastenings and different places of their locations on the constructions.

The analytical methods of the stability investigation in the aerohydroelasticity problems based on the construction of the functionals for the differential equations in the partial derivatives, including the equations with retarded argument. The dynamic investigation is realized with the help of developed numerically-analytical methods.

Similar problems were earlier considered in works [2-4].

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$$\min F_r = \frac{\sum_{i=1}^m \sum_{j=1}^n c_{ij}^r x_{ij}}{\max_{i,j} \{t_{ij} \mid x_{ij} > 0\}}$$

$$\min F_{r+1} = \max_{i,j} \{t_{i,j} \mid x_{i,j} > 0\}$$

in conditions:

$$\sum_{j=1}^n x_{ij} = a_i, \quad \forall i = \overline{1, m}$$

$$\sum_{i=1}^m x_{ij} = b_j, \quad \forall j = \overline{1, n}$$

$$\sum_{i=1}^m a_i = \sum_{j=1}^n b_j$$

$$x_{ij} \geq 0, \quad i = \overline{1, m}, \quad j = \overline{1, n}$$

where: $c_{ij}^k, k = 1, \dots, r, i = 1, \dots, m, j = 1, \dots, n$ correspond to the concrete interpretation of the respective criteria, a_i – availability at source i , b_j – requirement at destination j , x_{ij} – amount transported from source i to destination j , t_{ij} – time of transporting a unit from source i to destination j .

In the paper-work I suggested reducing the model (1) to another multicriterial linear model, in order to solve the first. The theorems that prove the equivalence of the both models, meaning the common set of their basic efficient solutions are given. Since I developed an iterative procedure of finding the optimal solution for every time period for the model (1) applying the fuzzy approach technique. The proposed algorithm was tested on some concrete examples.

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THE DESCRIPTION OF THE UNARY FUNCTIONS OF 16 ORDER TOPOLOGICAL BOOLEAN ALGEBRA WITH ONE OPEN ATOM

E. Tikhonov

We construct 256 unary functions of iterative algebra indicated in the paper title.

We present 256 modal unary formulas which realize these constructed functions and show that they are non-equivalent two by two in logics of iterated algebra studied, and demonstrate that the other unary formulas which are non-equivalent to those given in this logics do not exist.

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FUZZY TECHNIQUE FOR SOLVING THE FRACTIONAL MULTIPLE CRITERIA TRANSPORTATION PROBLEM

Alexandra Tkachenko

We are often concerned about the optimization of the ratios like the summary cost of the total transportation expenditures to the maximal necessary time to satisfy the demands, the total benefits or production values into time unit, the total depreciation into time unit and many other important similar criteria, what may appear in order to evaluate the economical activities and make the correct managerial decisions. These problems led to the multiple criteria transportation model of fractional type with identical denominators, where the "bottleneck" criteria appear as a "minmax" time constraining. In the proposed paper I studied the transportation problem of "bottleneck" type with multiple fractional criteria that is defined as follows:

$$\min F_1 = \frac{\sum_{i=1}^m \sum_{j=1}^n c_{ij}^1 x_{ij}}{\max_{i,j} \{t_{ij} \mid x_{ij} > 0\}} \quad (1)$$

SPACES, CONTINUITY AND TOPOLOGICAL GAMES

Alexander V. Arhangel'skii, Mitrofan M. Choban and Petar S. Kenderov

We introduce the notions of fan-complete spaces, q-complete spaces, densely fan-complete spaces, densely q-complete spaces. The class of fan-complete spaces is very wide and has the following properties: it contains the classes of compact spaces, of countably compact spaces, and of pseudocompact spaces; every $G\delta$ -subspace of a fan-complete space is fan-complete; any open continuous image of a fan-complete space is fan-complete; any locally fan-complete space is fan-complete.

The other classes of spaces have the similar properties.

In this paper, using the language and techniques of topological games of the Banach-Mazur type, we give a condition for a semitopological group to be a topological group. We prove that a paratopological group is a topological group provided that the underlying space is strongly beta-unfavorable in the GI -game.

Moreover, a semitopological group is a topological group provided that it contains a dense p-space with the Baire property, or a dense M-space with the Baire property. Some other new results are also obtained. This improves, in particular, some results of R. Ellis, D. Montgomery, Z. Zhelazko, N. Braundt, L. G. Brown, A. V. Arhangel'skii, E. A. Reznichenko, P. S. Kenderov, I. S. Kortezov, and W. B. Moors (see References).

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LAGRANGIAN ASSOCIATED TO DYNAMIC SYSTEMS OF FIRST ORDER. LAGRANGIAN SPACES

Dumitru Bălă

In this paper there are presented some aspects connected to holonomic varieties, self- adjoints systems, some own results in the study of dynamic systems of first order and some aspects connected to lagrangian spaces.

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METHODICAL ASPECTS CONCERNING THE MATHEMATICS USE INTO ECONOMY

Dumitru Bălă

In this paper there are presented some psychological, teaching and methodical techniques, which appear in teaching mathematics at economical profyle colleges. There are specified the difficult aspects in understanding the concepts of maximum, minimum and optimum.

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PSYCHOPEDAGOGICAL ASPECTS OF THE ORGANIZATION AND CONDUCTING OF MATHEMATICAL BATTLES IN SCHOOLS

Marcel Teleucă and Larisa Sali

Starting from the facts that a society can not be democratic without participation and public debate, and discussion is the fastest and the most constructive way to learn, we believe that the practice of organizing and conducting mathematical battles is worth to be promoted. In this context there are two methods used in the discussion: the method of demonstration and the method of argument. Demonstration is a rigorous reasoning that goes from premises, that are not controversial, and is developed through the use of formal languages. Argumentation aims the field of opinions – reasoning is not rigorous. The goal of a demonstration is to establish legal facts. The aim of argumentation is to convince someone to accept a certain opinion.

For years, mathematical battles have become popular in various countries in the form of competitions. Regardless of the rules under which the mathematical battle takes place, this is a debate between a "presenter" and an "opponent". During this debate they show not only the power of their intellects, but also their arts of speaker. Mathematical battle involves mathematical thinking, competitive spirit and theatrical artistry, allows practice of communication skills, critical reasoning and logic argumentation in the public space.

Mathematical battle is an attempt to establish the value of truth of statements expressed during debate by the opposite teams. For this reason it is especially attractive for those who feel and understand mathematics.

In the organizational plan we distinguish the aspects related to the work of teams of participants, usually consisting of students, and those related to the work of jury, usually consisting of teachers and students. In the psycho-pedagogic plan the involvement in the organization and conducting the mathematical battles has an observable progressive impact on the organizers. This fact led to the initiation of research of conditions that increase the efficiency of this process. The fact also led to the learning of opportunities for graduates of mathematical specialities to gain specific professional skills.

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SOME APPLICATIONS OF GENERALIZED RINGS

Mirela Stefanescu and Camelia Ciobanu

This is a survey on the applications of near rings and other generalized rings in theory of block designs, dynamical systems and computer science, but also in geometry.

The idea of such generalized rings appeared in 1905, by L.E. Dickson in connection with discussions on independence of the field axioms, has been considered by Hans Zassenhaus and Olga Taussky in thirties of the other century, but the theory has been developed tremendously after 1950. These generalizations have deleted some of the axioms in the definition of rings or have introduced partial operations.

Now the researchers study some algebraic structures with hyperoperations, i.e. binary operations with a subset as the result. We also show some applications of hyperrings.

In computer science, the semirings have played a nice role in the last decades, as one can see by consulting the Golan's book. We expose also some of such applications.

IDF CURVES FOR ROMANIAN CATCHMENTS

Alina Bărbulescu and Pelican Elena

In order to dimension projects concerning hydraulic structures the most important fact is to know the design flood. Since it is not economic to dimension the hydraulic works for the most intense precipitations, it is necessary to determine the optimum flow putting in balance the cost of an over sizing hydraulic work and the damage produced by a weak hydraulic structure. To solve this problem it is necessary to determine the maximum intensities of a rain having a frequency of a given event.

For small basins, the most used method for estimating the maximum annual discharge starting from the rainfall intensity is the "Rational Method". According to it the rainfall intensity, I , is considered for a duration that is at least equal to the time of concentration T of the basin. This means that for punctual rainstorms, a relationship between the intensity - duration - frequency (IDF curves) has to be established.

For a given return period, a set of IDF curves represents the variation of the maximum annual rainfall intensity with the time interval length.

The purpose of this study is mainly to produce IDF - curves for some Romanian catchments and to compare them.

SWITCHOVER TIME DECOMPOSITION IN PRIORITY QUEUING SYSTEMS

Andrei Bejan

Priority queuing systems $M_r | G_r | 1$ with switchover times of the server and r independent incoming Poisson flows have been studied extensively for over half a century now (see [1] with references therein).

An account on the systems with instantaneous service switches and the number of priority lines exceeding two is presented in [2]. The authors of [3] gave consideration to the systems with any (finite) number of priority lines and nonzero random switchover times of special structure: it was assumed by the authors that switchover times depend on the destination line only. Similarly, the authors of [4] presented a comprehensive analysis of the systems with additively decomposed switchover times C_{ij} (it was assumed

by the authors that the time of switching from line i to line j is represented as a sum of two components: terminating work lasting time T_i , associated with interrupted or completed service, and starting work lasting time S_j , associated with the service that is about to start, that is to say $C_{ij} = T_i + S_j$, $i \neq j$.

To the best of the author's knowledge there are no analytical results concerning the case of general form of switchover times C_{ij} , $i, j = 1, \dots, r$, $i \neq j$. It is considered therefore a problem of approximation of a priority queuing system with switchover times C_{ij} by a system in which the switches are additively decomposed as it is assumed in [4]. We investigate the ways in which such an approximation can be done and also the adequateness of the subsequent analysis. This work is an extension of results presented in [5].

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NUMERICAL K - BUSY PERIODS ALGORITHMS FOR POLLING SYSTEMS WITH SEMI-MARKOV SWITCHING

Diana Bejenari and Gh. Mishkoy

The queuing systems of Polling type is widely used in wireless networks with broadband centralized management (see, e.g., [1]). One of the important characteristics of these systems is the k - busy period [2]. In [3] is

VECTOR OPTIMIZATION PROBLEMS

Elena-Cristina Stamate

We consider vector optimization problems for multifunctions, defined with infimal and supremal efficient points in locally convex spaces ordered by convex, pointed closed cones with nonempty interior.

Using the algebraic and topological results for these efficient points we obtain saddle points theorems and duality results using a suitable Lagrangian adapted for the INFSUP problem, a generalization of the MINMAX problem.

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MODELLING OF AN X-RAY WAVEGUIDE FOR PHASE CONTRAST MICROSCOPY WITH LABORATORY SOURCE

A. Sorrentino, D. Pelliccia, F. Scarinci, M. Ilie, I. Vasile, E. Vasile, M. Fratini, I. Burkeeva, A. Cedola and S. Lagomarsino

X-ray waveguides are important elements in experiments of X-ray phase-contrast microscopy for biomedical engineering and not only. The physical and mathematical modeling of X-ray waveguides fits very well to integrated optical waveguide.

The paper presents a consistent physical modeling for propagation modes determination, depending on materials parameters.

A normalized mathematical model, appropriate to numerical simulation of an X-ray waveguide, is also presented.

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SOME RESULTS ON LINEAR APPROXIMATION PROCESSES IN BANACH SPACES

Ligia-Adriana Sporis and Ali Beazit

In this note, we would like to study some aspects of direct problem of approximation by particular linear approximation processes in Banach spaces.

ABOUT SOME NUMERICAL RESULTS ON ADI - DOUGLAS TYPE METHODS

Ligia-Adriana Sporis and Ali Beazit

In this note, we discuss about some numerical aspects of parabolical PDE's problems.

showed that analytical results for k - busy periods can be viewed as generalization of classical Kendall functional equation [4]. Unfortunately, analytical solution for such type of generalized equations does not exist. However, using the methodology of generalized priority systems and generalized algorithms elaborated in [3], numerical solutions with necessary required accuracy can be obtained. In our communication such numerical algorithms, elaborated in C++, will be presented and discussed. Some examples and numerical results also will be presented.

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NUMERICAL RESULTS BY FEM FOR THE PROBLEM OF SPATIAL LINEAR HYDRODYNAMIC STABILITY FOR TWO PARALLEL FLOWS

Cătălin Liviu Bichir and Adelina Georgescu

The e^N - method for the prediction of laminar – turbulent transition is based on the solution of Orr - Sommerfeld equation. In order to solve the two - point nonlinear (relative to α) eigenvalue problem for this equation, in the case of the plane Blasius and Poiseuille flows, we use the finite element method.

ON PARAMEDIAL LOOPS

Natalia Bobeica

A groupoid G is called paramedial if it satisfies the law $xy \cdot zt = ty \cdot zx$ for all $x, y, z, t \in G$. If a paramedial quasigroup G contains an element e such that $e \cdot x = x$ ($x \cdot e = x$) for all $x \in G$, then e is called a left (right) identity element of G and G is called a left (right) paramedial loop.

Lemma 1. Let P be a subset of topological right paramedial loop G and $e \in P$. If $P_1 = P \cap eP$, then:

1. $eP_1 = P_1$;
2. If P is open, then P_1 is open too;
3. If P is closed, then P_1 is closed too;
4. If P is compact, then P_1 is compact too.

Proposition 2. Let G be a right paramedial loop. Then the mapping $f : G \rightarrow G$, where $f(x) = ex$, is an involuntary mapping, i.e. $f = f^{-1}$.

Theorem 3. Let G be a right paramedial topological loop with the identity $x^2 = e$. If P is an open compact subset such that $e \in P$, then P contains an open compact right paramedial subloop Q and $e \in Q \subseteq P$.

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analytical and numerical results. The existence, uniqueness and convergence of the proposed methods are proved. Numerical example is studied to demonstrate the accuracy of the present methods.

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$$A\varphi = f, \quad (1)$$

defined on the infinite-dimensional spaces X and Y , an approximate equation

$$A_n\varphi_n = f_n, \quad (2)$$

defined on the finite-dimensional spaces X_n and Y_n . Two ways of construction this scheme was studied in [1], [2]. The operator A_n in (2) present a matrix of specific form, that depend of the exact operator A and of reduction from (1) to (2).

We study the special form of matrices in equation (2) for the equation of evolution

$$\frac{d\varphi}{dt} + A\varphi = f$$

with $A = A_1 + A_2$. The approximate equation is obtained using the method in differences and principle of decomposition for the operator A . The specific form of matrix A_n is used in analysis of the stability for different computational schemes of this problem that partially was studied in [3], [4].

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NUMERICAL SOLUTION FOR SOLVING THE NONLINEAR FOKKER-PLANCK EQUATION

Sadigh Behzadi Shadan and Marjan Lofti

In this paper, a nonlinear Fokker-Planck equation is solved by using the modified Adomian decomposition method (MADM), variational iteration method (VIM), homotopy analysis method (HAM).

The approximation solution of this equation is calculated in the form of series which its components are computed easily. The accuracy of the proposed numerical scheme is examined by comparing with other

COMPARATIVE ANALYSIS OF THIN-FLUID FLOW WITH AND WITHOUT SURFACE TENSION GRADIENT

Emilia-Rodica Borșa and Diana-Luiza Borșa

In this paper we are interested in the study of the thin liquid layer flow. The flow, first is driven by gravity alone and then by gravity and a surface tension gradient. We remark that when we take into account surface tension gradients, they give rise to some extra terms in the expressions of velocity, free surface velocity and the volume flux of the fluid. This fact is very plausible from physical point of view.

Keywords: viscous fluid, thin film approximation, surface tension gradient
MSC: 76D08, 76D27, 76D45

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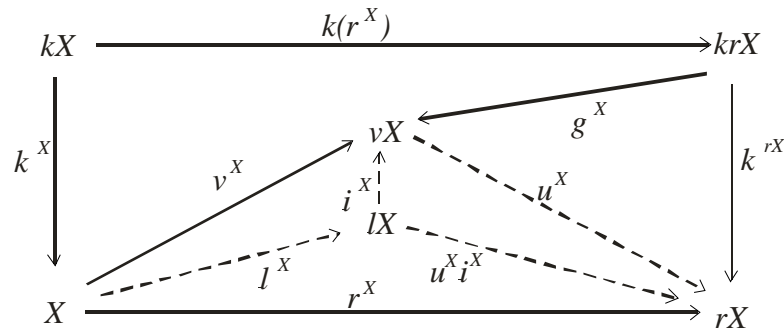
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THE FACTORIZATION OF THE RIGHT PRODUCT OF TWO SUBCATEGORIES

Dumitru Botnaru and Alina Țurcanu

The right product $K *_{\mathfrak{d}} R$ coreflective subcategory K and of reflective subcategory R of category C se is constructed in the following way. Let be $k^X: kX \rightarrow X$, $r^X: X \rightarrow rX$ and $k^{rX}: krX \rightarrow rX$ K -corepliques and R -replique of respective objects. Then $r^X k^X = k^{rX} t$ for some morphism t , where $t = k(r^X)$. On morphisms k^X and $k(r^X)$ is constructed the puschout square $v^X k^X = g^X k(r^X)$, where $v^X: X \rightarrow vX$. Then $r^X = u^X v^X$ and

$k^{rX} = u^X g^X$ for some morphism u^X . The full subcategory isomorphic closed of all object of form vX and is $K *_{\mathcal{d}} R$.



Generally, the right product is not a reflective subcategory of category C . In [2] are indicate conditions when $K *_{\mathcal{d}} R$ is a reflective subcategory in case of locally convex spaces.

Let K be a coreflective subcategory, R - a reflective subcategory in the Th category of Tikhonov space, and (P, I) - a structure of factorization in the category Th. We examine (P, I) -factorization of morphism $v^X = i^X I^X$. We note with L the subcategory of I -subobjects of objects from $K *_{\mathcal{d}} R$.

We note with $K(\tau)$ the subcategory of spaces Tikhonov in which any set $G \tau$ is open, and $Q(\tau)$ - the subcategory of τ complete spaces (see [1], [3], [4]).

Theorem 1. The correspondence $X \rightarrow (IX, I^X)$ define the subcategory L as a epi-reflective subcategory.

2. Let be $K = K(\tau)$, $R = \text{Comp}$, and $(P, I) = (\text{Epi}, M_f)$. Then $L = Q(\tau)$.

3. $Q(\tau)$ - replique of object X is closing of set X in the space $k \beta X$ with induced topology from βX .

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$$\varphi(x) = \frac{1}{\sqrt{2\pi_{\mathbb{R}}}} \int \Phi^+(t) e^{-ixt} dt, x > 0 \quad (3)$$

The investigation of the Riemann differential boundary problem (2) we do basing on the investigation of the singular integral equation with the Cauchy kernel at the real axis, such as

$$A(x)\rho(x) + B(x)(\pi i)^{-1} \int_{\mathbb{R}} (t-x)^{-1} \rho(t) dt + (T\rho)(x) = 0, x \in \mathbb{R} \quad (4)$$

It is also shown that the Riemann differential boundary problem (2) and the singular integral equation (4) are equivalent and solutions of the problem (2) are expressed over solutions of the equation (4) according to the formula

$$\Phi^+(x) = \frac{1}{\sqrt{2\pi_{\mathbb{R}}}} \int P^+(t, x) \rho(t) dt, x \in \mathbb{R} \quad (5)$$

It is shown that the equation (1) and the equation (4) are equivalent in such a sense that they are solvable simultaneously or are not, and there is one and only one solution $\varphi(x)$ of the equation (1) for the every solution $\rho(x)$ of the equation (4) and vice versa, expressed by the formulas (5), (3).

It is proved that the equation (1) is not a Noetherian one and it has the unique solution which belongs to the space $L_2[-r; 0], r \geq 1$.

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THE SPECIAL FORM OF MATRICES IN COMPUTATIONAL APPROXIMATE SCHEMES

Ivan Secieru and Vitalie Ticău

The study of main notions for numerical approximate solving of a different problems, which represent the mathematical modeling of a great number of real process or phenomenon, depend of the method to construct the approximate equation. This scheme consist to obtain from the exact equation

open problem. V. Belousov and A.Gwaramija considered π -quasigroups isotopic to groups in [1] and [2]. π -quasigroups isotopic to abelian groups are considered in the present work. Necessary and (or) sufficient conditions for abelian groups to be isotopic to a π -quasigroup are given.

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TO THE THEORY OF ONE WIENER-HOPF TYPE EQUATION

Alexandra Scherbakova

The present work is devoted to studying the next Wiener-Hopf type integral equation [1] such as

$$x\varphi(x) - \int_0^{+\infty} k(x-t)\varphi(t)dt = 0, x > 0, \quad (1)$$

where \mathbb{R} is the real axis and $k(x) \in L$ is a known function.

We are studying the equation (1) using the results of [2]. With the help of Fourier transformation the investigation of the equation (1) reduces to the investigation of the following Riemann differential boundary problem

$$[\mathfrak{t}\Phi^+(x) + K_1(x)\Phi^+(x)] - \Phi^-(x) = 0, x \in \mathbb{R} \quad (2)$$

where $K_1(x) = \sqrt{2\pi}K(x)$ is the Fourier transformation of the given function $k_1(x) = \sqrt{2\pi}k(x)$. $\Phi^+(x)$ and $\Phi^\pm(x)$ are the boundary values at \mathbb{R} of functions $\Phi^+(z)$ and $\Phi^\pm(z)$ accordingly, where $\Phi^+(z), \Phi^-(z)$ are analytical unknown functions. It is shown that the Riemann differential boundary problem (2) and the equation (1) are equivalent and solutions of the equation (1) are expressed over solutions of the problem (2) by the formula:

SOME PROPERTIES OF SEMIREFLECTIVE SUBCATEGORIES

Dumitru Botnaru and Olga Cerbu

In the category of locally convex Hausdorff spaces we study some classes of semireflective subcategories. Indicate some relationship that exists between such subcategories, and we examine the properties of these subcategories.

Examples are constructed.

INTERDISCIPLINARITATEA-UTILIZAREA MATEMATICII, FIZICII, CHIMIEI ȘI BIOLOGIEI ÎN ȘTIINȚELE TEHNICE

Viorica-Cornelia Bront

Materialul pregătit, prezintă felul în care matematica, fizica, chimia și biologia se împletesc într-un mod surprinzător de armonios în predarea de zi cu zi la clasă, în procesul instructiv-educativ. La fel de armonios, aceste materii vin în ajutorul științelor tehnice la predarea materiilor de specialitate la clasele de profil profesional (tehnic).

De altfel puține sunt acele domenii unde matematica nu este prezentă. Matematica, fizica, chimia, biologia sunt prezente peste tot în viața noastră de zi cu zi. Astfel putem spune că interdisciplinaritatea este o formă ce ajută dezvoltarea creativității și a gândirii logice ale elevilor. Ea vine în ajutorul înțelegerii fenomenelor și tuturor lucrurilor ce ne înconjoară. Științele reale se integrează în cadrul științelor tehnice în așa fel încât științele tehnice fără științele reale nu pot exista.

Cuvinte cheie: Interdisciplinaritate, matematică, fizică, chimie, biologie, științe tehnice.

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A NEW APPROACH OF SOME PROBLEMS IN FLUID MECHANICS

Ilie Burdujan

A great deal of mathematical models in fluid mechanics are obtained as limiting cases of a mathematical object consisting of a differential equation with fractional derivatives together some appropriately initial and boundary conditions. This paper deals with solving a particular such a problem defined on an annular region bounded by two infinitely long coaxial cylinders. The obtained solution is presented as the sum of the solution of the corresponding Newtonian limiting case and a non-Newtonian contribution. It contains as a limiting case the solution for Taylor-Couette flow formation in a generalized Oldroyd-B fluid filling the annular region between two infinitely long coaxial cylinders, due to an axial time-dependent shear applied on the surface of the inner cylinder. Further, this solution was been specialized to give the solution for generalized second grade or Maxwell fluids as well as the solution for ordinary fluids. Actually, we have obtained very simple forms of some exact solutions which either have already been obtained or are first time obtained as limiting cases of our solution.

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POETRY AND EMINESCIAN MATHEMATICS – AN EXAMPLE OF MULTIDISCIPLINARY EDUCATION BY THE MATHEMATICAL FOUNDATION MODELING

Gheorghe Săvoiu and Liliana-Camelia Săndulescu

This paper reviews the importance of two major domains in the complex activities of our great poet Mihai Eminescu for the multidisciplinary modelling in education based on poetic imagination and crystal clarity of mathematics, with a great impact during the last century. Mihai Eminescu is not only the great national Romanian poet but also a good mathematician, which is combined in an exquisite way, with his amazing abilities as a poet, a physicist and a statistician. Some examples from his unprinted manuscripts called “notebooks” remain the best proof to offer as a short analysis of this article.

Key words: poetry, mathematician, physicist, statistician, multidisciplinary modelling of education.

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ON π - QUASIGROUPS ISOTOPIC TO ABELIAN GROUPS

Parascovia Sârbu

A classification of minimal identities, i.e. identities of length five with two free elements, consisting of seven identities, was given by V. Belousov and by F. Bennet. Every minimal identity can be reduced to the form $A(x, B(x, C(x, y))) = y$, where A, B and C are quasigroup operations. A quasigroup satisfying an identity of the form ${}^\alpha A(x, {}^\beta A(x, {}^\gamma A(x, y))) = y$, where $\alpha, \beta, \gamma \in S_3$, is called a π -quasigroup of type $[\alpha, \beta, \gamma]$. The description of π -quasigroups is still an

THE MATHEMATICAL BACKGROUND AND WAY OF THINKING AND THE ADVANTAGES OF THEIR EDUCATIONAL VALUE IN BUILDING UP A COHERENT SYSTEM OF SCIENTIFIC PEDAGOGICAL RESEARCH

Gheorghe Săvoiu and Liliana-Camelia Săndulescu

In a relevant way, the model and modelling have been situated, through their initial practical uses, close to geometry than any other scientific domain. The appearance of the term as such is linked to the year 1868, when the mathematician Eugenio Beltrami managed to construe an early Euclidian model for non-Euclidian geometry. This paper tries to define not only the mathematical origin of the modelling, but even to detail the advantages of the mathematics in any contemporary coherent system of scientific thinking. The conclusion of this article is that pedagogical scientific research means a coherent system of thinking based on mathematics' thought, too.

Key words: mathematics' thought, mathematical modelling system, coherent scientific research.

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AUTOMORPHISMS AND DERIVATIONS OF HOMOGENEOUS QUADRATIC DIFFERENTIAL SYSTEMS AND COMMUTATIVE ALGEBRAS

Ilie Burdujan

Homogeneous quadratic differential systems (shortly, HQDSs) on \mathbb{R}^n are the autonomous systems of the form (S) where is a quadratic vector form on \mathbb{R}^n (i.e., $F(tX)=t^2F(X)$). The polar form G of F allows to define an algebra structure on \mathbb{R}^n . The obtained algebra is commutative but nonassociative (more exactly, it is not necessarily associative) and is denoted by $A(\cdot)$. The properties of (S) which are invariant with respect a center-affinity are in a 1-to-1 correspondence with the properties of $A(\cdot)$ invariant up to an isomorphism. Further, recall that the existence of a derivation $D(\neq 0)$ for $A(\cdot)$ is intimately reflected in its structure. Mainly, it assures the existence of an ascending sequence of subalgebras or ideals which suggests the use of some special bases named adapted bases. The obtained results are used for classifying, up to an isomorphism, of some classes of real 3-dimensional commutative algebras which have a derivation. Accordingly, it is obtained a classification, up to an affinity, of the corresponding HQDSs. For example, there exist 9 nonisomorphic classes of such algebras having a nilpotent of order three derivation and 7 classes of nonisomorphic real 3-dimensional algebras without nilpotent elements.

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MATHEMATICS - A MAJOR PROBLEM OF CURRENT EDUCATION

Marian Cață, Gheorghe Samoilescu and Camelia Ciobanu

In this paper we try to present the fact that the teacher is not an entertainer, while the student is not only a consumer. Teachers must help

students understand the concepts of mathematics, not just the mechanics of how to solve a certain problem.

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ON RADII OF STARLIKENESS AND CLOSE-TO-CONVEXITY OF A SUBCLASS OF ANALYTIC FUNCTIONS WITH NEGATIVE COEFFICIENTS

Adriana Cătaș

By making use of a multiplier transformation, a subclass of p -valent functions in the open unit disc is introduced. The main results of the present paper provide various interesting properties of functions belonging to the new subclass. Some of these properties include, for example, several coefficient inequalities and distortion bounds for the function class which is considered here.

Relevant connections of some of the results obtained in this paper with those in earlier works are also provided.

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ABOUT THE IMPORTANCE OF LINEAR ALGEBRA, IN THE PROCESS OF TRAINING THE FUTURE GRADUATES OF TECHNICAL UNIVERSITIES

Gheorghe Samoilescu, Marian Cață and Camelia Ciobanu

In these paper we present the fact that we believe, that linear algebra deserves a central place in the curriculum of math majors, and other students as well, because it widely applicable, because it is a subject where students can see, even without axiomatic, the development of a substantial mathematical theory, because it is a subject that provides the opportunity for students to see the role of that theory in doing computations and applying mathematics, and because it provides a vital arena where students can see the interaction of mathematics and machine computation. We believe that the integration of computation and theoretical mathematics is so natural in linear algebra that students (and faculty!) can use their experience with linear algebra as a starting point for seeking similar integration in other mathematical areas.

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ABOUT THE DIOPHANTINE EQUATION $x^4 - q^4 = py^R$

Diana Savin

In this paper, we prove a theorem about the integer solutions of the Diophantine equation $x^4 - q^4 = py^f$, extending previous work of K.Gyory, H. Darmon and of the author.

Keywords: Kummer fields, cyclotomic fields
2000 MSC: 11D41, 11R18

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ABOUT THE PARTICULARITY OF UTILIZATION OF HUMOR AT THE MATHEMATICAL EXTRACURRICULAR ACTIVITIES

Larisa Sali

The humor is considered a pedagogical mean used to activate the educational process. The sense of humor is a particularity of the individual style of a teacher. The use of the humor in the educational process allows to the teacher to improve the psychological climate in the class, to draw pupils' attention to some learning topics, to motivate them to study mathematics etc. Scientists welcome entering of elements of humor into manuals in the form of cheerful stories, drawings, jokes, humoresque and sketches. The conducted researches specify in fear of many teachers to apply humor at a lesson. In the pedagogical activity the humor has the multipurpose nature. Humor functions in pedagogical activity are the following: informatively-cognitive, emotional, motivational, communicative, developing, diagnostic and regulative. The mathematical humor has some specific particularities. The development of the sense of humor and the formation of competences of using humor as a mean of activation of the process of assimilation of the mathematical skills have a direct contribution in the intrinsic motivation of the students for the future mathematical extracurricular activities. The sense of humor is an individual particularity of a person, but in didactical aspect we can point out some conditions which contribute to the improvement of mathematical teaching-learning process.

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PROXIMAL POINT METHOD FOR VARIATIONAL INEQUALITIES INVOLVING METRICALLY REGULAR MAPPINGS

Corina Lăcrămioara Chiriac

In this paper we consider a general version of the proximal point algorithm for solving the variational inequality: find $x \in C$ such that there exists $y \in T(x)$ with:

$$\langle x - u, y \rangle \leq 0 \quad \forall u \in C, \quad (1)$$

where $T: X \rightarrow 2^{X^*}$ is a set-valued mapping from a Banach space X with its dual X^* , and $C \subset X$ a closed, convex subset. First, choose any sequence of functions $f_n: X \rightarrow X^*$ that are Lipschitz continuous. Then take an initial element $x_0 \in C \cap D(T)$; given x_n , define x_{n+1} by the inclusion

$$0 \in (T + N_C + f_n)(x_{n+1}) - f_n(x_n), \quad (2)$$

where $N_C(\cdot)$ is the normality operator associated to C .

We prove that if the Lipschitz constants of f_n are bounded by half the reciprocal of the modulus of regularity of T , then there exists a neighborhood V of \bar{x} (\bar{x} being a solution to (1)) such that for each initial point $x_0 \in V$ one can find a sequence x_n generated by the algorithm (2) which is linearly convergent to \bar{x} . Convergence results are studied for the cases when the mapping T is strongly subregular and strongly regular.

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TOPOLOGICAL PARAMEDIAL GROUPOIDS WITH MULTIPLE IDENTITIES

Liubomir Chiriac and Natalia Bobeica

We consider a groupoid $(G,+)$. For every two elements a, b from $(G,+)$ we denote $1(a,b,+)= (a,b,+)$ $1 = a + b$, and $n(a,b,+)= a + (n-1)(a,b,+)$, $(a,b,+)$ $n = (a,b,+)(n-1) + b$ for all $(n \geq 2)$. If a binary operation $(+)$ is given on a set G , then we shall use the symbols $n(a,b)$ and $(a,b)n$ instead of $n(a,b,+)$ and $(a,b,+)$ n .

Definition 1. Let $(G,+)$ be a groupoid $n \geq 1$ and $m \geq 1$. The element e of a groupoid $(G,+)$ is called:

- an (n,m) -zero of G if $e + e = e$ and $n(e,x) = (x,e)m = x$ for every $x \in G$;
- an (n,∞) -zero if $e + e = e$ and $n(e,x) = x$ for every $x \in G$;
- an (∞,m) -zero if $e + e = e$ and $(x,e)m = x$ for every $x \in G$.

Clearly, if $e \in G$ is both an (n,∞) -zero and an (∞,m) -zero, then it is also an (n,m) -zero. If (G,\cdot) is a multiplicative groupoid, then the element e is called an (n,m) -identity. The notion of (n,m) -identity was introduced in [1]. In the multiplicative groupoid (G,\cdot) the element e is called an (n,m) -identity.

A groupoid G is called paramedial if it satisfies the law $xy \cdot zt = ty \cdot zx$ for all $x, y, z, t \in G$. Other properties of paramedial groupoids was studied in [2,3].

Theorem 2. Let (G,\cdot) be a multiplicative groupoid, $e \in G$ and the following conditions hold:

EXISTENCE AND UNIQUENESS OF FUZZY SOLUTION FOR LINEAR VOLTERRA FUZZY INTEGRAL EQUATIONS WITH ADOMIAN DECOMPOSITION METHOD

H. Rouhparvar, T. Allahviranloo and S. Abbasbandy

In the present paper, the existence and uniqueness of fuzzy solution for a the linear Volterra fuzzy integral equation is found via the Adomian decomposition method.

Keywords: Linear Volterra fuzzy integral equation, Adomian decomposition method.

1. Introduction

The concept of integration of fuzzy functions has been introduced by Dubois and Prade [1], Goetschel and Voxman [2], Kaleva [3] and others. However, if the fuzzy function is continuous, all the various procedures yield the same result. The fuzzy integral is applied in fuzzy integral equations, such that there is a growing interest in fuzzy integral equations particularly in the past decade. The fuzzy integral equations have been studied by [4, 5, 6] and another authors.

In this paper, we prove the existence theorems for linear Volterra fuzzy integral equation by means of the Adomian Decomposition Method (ADM) [7, 8, 9] involving fuzzy set-valued function of a real variable where values are normal, convex, upper semicontinuous and compactly supported fuzzy sets in R^n .

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CONTROL OF PLANAR BAUTIN BIFURCATION

Carmen Roșoreanu and Mihaela Sterpu

On a versal deformation of the Bautin bifurcation it is possible to find dynamical systems that undergo Hopf or nonhyperbolic limit cycle bifurcations.

Our paper concerns a nonlinear control system in the plane whose nominal vector field has a pair of purely imaginary eigenvalues. We find conditions to control the Bautin bifurcation using the symmetric multilinear vector functions that appear in the Taylor development of the vector field around the equilibrium.

The scalar control law designed by us depends on two bifurcation parameters and three control parameters, which establish the stability of the equilibrium point and the orientation and stability of the periodic orbits.

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1. $xe = x$ for every $x \in G$;
2. $x^2 = x \cdot x = e$ for every $x \in G$;
3. $x \cdot zt = t \cdot zx$ for all $x, z, t \in G$;
4. For every $a, b \in G$ there exists a unique point $y \in G$ such that $ya = b$.

Then e is a (2,1)-identity in G .

Theorem 3. Let (G, \cdot) be a multiplicative groupoid, $e \in G$ and the following conditions hold:

1. $xe = x$ for every $x \in G$;
2. $x^2 = x \cdot x = e$ for every $x \in G$;
3. $xy \cdot uv = vy \cdot ux$ for all $x, y, u, v \in G$
4. If $xa = ya$, then $x = y$.

Then G is a paramedial quasigroup with a (2,1)-identity e .

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ALGEBRAS OF CONTINUOUS FUNCTIONS AND COMPACTIFICATIONS OF SPACES

Mitrofan M. Choban and Laurențiu I. Calmuțchi

We introduce the notion of the partial algebra over the field of complex numbers. For any partial algebra A the ideal space $M(A)$ is a compact T_1 -space. For the field K of complex numbers we define the compactification \overline{K} which is a partial algebra. Denote by $C(X)$ the partial algebra of all continuous functions of X into \overline{K} .

A subset A of $C(X)$ is an algebra of functions on X if: if f is a constant function, then $f \in A$; if $f, g \in A$ and $f+g \in C(X)$, then $f+g \in A$; if $f, g \in A$ and $f \cdot g \in C(X)$, then $f \cdot g \in A$; if $f \in A$, then $-f, \lambda f \in A$.

Theorem 1. Let X be a topological space $X_0 = \bigcup \{U: U \text{ is open in } X \text{ and } \text{cl } U \text{ is a compact Hausdorff subspace}\}$ and $L \subseteq C(X)$. Then there exists a unique g -compactification (Y, h) , where h is a continuous mapping of X into a compact space Y and $h(X)$ is dense, of the space X with the next properties:

1. Every function $f \in L$ is continuously extendable on Y , i.e. there exists a unique continuous function $ef \in C(Y)$ such that $f = ef \circ h$.
2. If $y, z \in Y \setminus h(X_0)$ and $y \neq z$, then there exists $f \in L$ such that $ef(y) \neq ef(z)$.
3. If the set U is open in X and $\text{cl } U$ is compact, then $h(U)$ is an open subset of Y and $h|_U$ is a homeomorphism.

Theorem 1 for the Riemannian surfaces and real functions was proved by C.

Constantinescu and A. Cornea, and for any locally compact Hausdorff space - by M. BreLOT.

PSEUDOCOMPACTNESS AND TOTALLY BOUNDEDNESS IN TOPOLOGICAL ALGEBRA

Mitrofan M. Choban and Ina D. Ciobanu

Every space is considered to be a completely regular Hausdorff space.

Let A be a topological E -algebra. The extension B of A is called an a -extension of A if on B can be given a structure of a topological E -algebra such that A is a subalgebra of B . If the a -extension B of A is a compactification of A , then we say that B is an a -compactification of the topological E -algebra A . Let G be a totally bounded topological E -algebra. Then there exists a unique maximal a -compactification abG of G such that for any continuous homomorphism $f: G \rightarrow A$ into a compact E -algebra A there exists a continuous homomorphism $g: abG \rightarrow A$ for which $f = g|_G$.

A topological E -algebra G is called:

- totally bounded if G is a subalgebra of some compact E -algebra;
- an a -pseudocompact algebra if G is totally bounded and G is $G\delta$ -dense in abG ;

the boundary by the external forces initially defined as the negative gradient of a potential function derived from the image itself.

The problems in the behavior of the traditional snake are the poor convergence to concavities, the sensitivity to noise and the fact that the initialization area is restricted to the vicinity of the boundaries.

The Gradient Vector Flow, as external force, appeared like a spectacular solution for the limitations of the original model. It is built as a diffusion process of the gradient vectors of an edge map derived from the image. The recently introduced Vector Field Convolution has similar properties being calculated by convolving a vector field kernel with an edge map derived from the image.

Unfortunately, when we have to deal with highly non-convex shapes, both GVF and VFC field forms an area where the forces point in opposite directions and the snake stops.

In this paper, we present new properties of the GVF and VFC and we show how these will result in the external forces able to drive the snake in such a highly non-convex boundary. Examples for segmentation are presented and both extensions can be immediately used to tracking applications of structures in biomedical images.

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A CRITERION FOR PARAMETRICAL COMPLETENESS IN THE 5-VALUED NON-LINEAR ALGEBRAIC MODEL OF INTUITIONISTIC LOGIC

Mefodie Rață and Ion Cucu

A.V. Kuznetsov [2, p.28] put the problem to find out conditions for parametrical completeness of any system of formulas in the Intuitionistic Propositional Logic. In the present paper we solve a more weak problem. We find out conditions permitting to determine the parametrical completeness in the logic of 5-valued non-linear pseudo-boolean algebra. We give the suitable solution in terms of 11 parametrical pre-complete classes of formulas.

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POWERFUL EXTENTIONS OF THE GRADIENT VECTOR FLOW AND VECTOR FIELD CONVOLUTION SNAKES FOR THE SEGMENTATION OF THE HIGHLY NON-CONVEX STRUCTURES IN BIOMEDICAL IMAGES

Tiberiu Radulescu and Vasile Buzuloiu

Snakes, or active contours, are one of the major paradigms in image segmentation, edge detection, motion tracking and turned out to be a leading tool for the biomedical image processing domain.

They are curves moving through an image under the action of internal forces coming from inside the curve and external forces derived from the image. Both types of forces are defined so that the snakes will evolve to the object boundary by minimizing an energy functional whose minimum is corresponding to this boundary. Internal forces are intended to endow the curve with properties as tension and rigidity; it is attracted toward

- a weakly a-pseudocompact algebra if there exists an a-compactification cG of G such that G is $G\delta$ -dense in cG .

One of the main results is the following.

Theorem 1. Let G be a topological Mal'cev E-algebra. The following assertions are equivalent:

1. G is pseudocompact.
2. G is a-pseudocompact.
3. G is weakly a-pseudocompact.
4. The algebra G is totally bounded and the space G is $G\delta$ -dense in abG .

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ABOUT PERIODS OF THE DEVELOPMENT OF THE GEOMETRICAL SCIENCES: METHODOLOGICAL PROBLEMS

Mitrofan M. Choban and Ion I. Valuța

The development of the geometry is inseparably linked with the history of the development of the mathematics which may be divided into seven periods:

- prehistoric or conceived period (the pre-historic times - until the 4th – 3rd millennium B.C.);
- the period of the practical (algorithmic) mathematics (3rd millennium - the end of the 7th century B.C.);
- the period of the theoretical mathematics (7th century B.C. - 14th century A.D.);
- the period of the origin of the mathematical languages (14th - 17th centuries);
- the period of the variable quantities and of the formation of the calculus (mathematical analysis) (18th century);
- the period of the mathematical structures (19th century - the middle of the 20th century);
- the period of global theories of the complex mathematical structures (the middle of the 20th century - until present).

We link the term period not to the level reached in a certain region, but to the new ideas, the methodological concepts and the mathematical apparatus elaborated during that time. Any of the periods 3 - 6 is divided in subperiods (etaps) and we describe the geometrical concepts elaborated in

the respective time and regions, and its influence to the development of the mathematics and other domains of the Science. We propose some geometrical models of the space-time.

ON THE GOING DOWN OF THE ALGEBRAICITY BY THE UNIVERSALLY OPEN MORPHISMS OF SCHEMES

Adrian Constantinescu

Let k be a field. In this talk we present a proof for the following:

Theorem. Let f be a surjective universally open morphism of reduced k -schemes from X to Y . If X is algebraic over k , then Y is also algebraic over k .

This proof is a variation of the proof of the main result from [1].

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ASUPRA STRUCTURII BUCLELOR MOUFANG

Alexandru V. Covalschi

O mulțime L cu o operație binară \cdot și o operație unară $^{-1}$ se numește Buclă Moufang (în continuare BM) [1], dacă elementele și operațiile ei satisfac următoarele identități:

$$x^{-1} \cdot xy = y = yx \cdot x^{-1},$$

$$(xy \cdot x)z = x(y \cdot xz).$$

Mulțimea $Z(L) = \{a \in L / a \cdot x = x \cdot a, ax \cdot y = a \cdot xy \forall x, y \in L\}$ se numește centrul BM L . Ușor de verificat că centrul $Z(L)$ este o subbuclă asociativă și comutativă, adică grup abelian, normală în BM L .

Șirul de subbuclă normale $\{e\} = Z_0 \subseteq Z_1 \subseteq \dots \subseteq Z_n \subseteq \dots$, unde prin e se notează elementul unitate a BM L , $Z_1 = Z(L), Z_{n+1}/Z_n = Z(L/Z_n)$ pentru $n \geq 2$ se numește șir central ascendent al buclei L . Dacă $Z_n = L$, atunci bucla L se numește central nilpotentă sau simplu nilpotentă; cel mai mic număr natural n cu această proprietate se numește clasa de nilpotență a BM L .

In the current conditions in which teachers must create programs, making CDS, in an interdisciplinary subject areas may be a starting point. Given the above statement, we believe that interdisciplinarity is a principle to be applied, a way of thinking and action, arising from developments in science and social-economic life.

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CLASSIFICATION OF CUBIC DIFFERENTIAL SYSTEMS WITH SIX REAL INVARIANT STRAIGHT LINES ALONG FOUR DIRECTIONS

Vitalie Puțunică and Alexandru Șubă

We consider the cubic differential system $\dot{x} = P(x, y)$, $\dot{y} = Q(x, y)$, where: $P, Q \in \mathbb{R}[x, y]$, $\max\{\deg(P), \deg(Q)\} = 3$ and $\text{GCD}(P, Q) = 1$.

The straight line $ax + by + c = 0$ is said to be invariant for this system if there exists a polynomial $K \in \mathbb{C}[x, y]$ such that $a \cdot P + b \cdot Q \equiv (ax + by + c) \cdot K$ holds. The maximal number of directions (flopes) of these lines is equal to six. The cubic systems with seven and with eight invariant straight lines was investigated by Lyubimova [1], Llibre and Vulpe [2]. An affine classification of cubic systems with exactly six real invariant straight lines along two and three directions was carried out in [3], [4]. In this paper we present similar classification for cubic differential systems with exactly six real invariant straight lines along four directions.

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THE ROUTING ALGORITHM IN CONGESTION CONTROL

Ioan Popoviciu

In this paper we describe a method to securing the steps of routing algorithms, using a public-key infrastructure and cryptographic hashing of messages to achieve security. This method can secure several routing algorithms for networks where a single bad router can affect an entire network.

SIGNIFICANCE OF THE AREA INTERDISCIPLINARY CURRICULUM NATURAL SCIENCES

Elena Pufu and Monica Gruia

In the area of mathematics and natural sciences curriculum, interdisciplinarity is absolutely mandatory, given the direct applicability in practical chemistry, physics, biology and mathematics. Interdisciplinary subject areas in this study and action plan means the content and methodology, which provides knowledge of phenomena in their dynamics, paving the way for synthesis generalizing.

Chemistry, physics and biology have become intensive matematice. De instruments often, theoretical mathematics ahead other sciences, paving roads, building models. Professor of chemistry and physics so mathematics as a tool absolutely mandatory.

Lema 1. Fie L o BM, $k \geq 2$ – număr natural, $a, b \in Z_k$ și $x, y, z \in L$. Atunci:

$$[a, x, y \cdot z] \equiv [a, x, y][a, x, z] \pmod{Z_{k-2}},$$

$$[a \cdot b, x, y] \equiv [a, x][b, y] \pmod{Z_{k-2}},$$

$$[a \cdot b, x] \equiv [a, x][b, x][a, b, x]^{-3} \pmod{Z_{k-2}}.$$

Teorema 1. Fie L o buclă Moufang. Dacă pentru un care-va număr natural $k \geq 1$ bucla-factor Z_{k-1}/Z_{k-2} are exponentul finit ε_{k-1} atunci factor-bucla Z_k/Z_{k-1} are exponentul finit ε_k și ε_k este un divizor a lui ε_{k-1} . Mai mult pentru orice $k \geq 1$ factor-buclele Z_k/Z_{k-1} și $[Z_k, L]/Z_{k-2}$ au acelaș exponent.

Conform unor proprietăți ale șirului descendent D_i , $i=0,1,\dots$, obținute în [2], se deduc și următoarele două afirmații.

Corolar 1. Dacă BM L/Z_1 are exponentul finit, atunci și grupul abelian $D_1(L)/D_2(L)$ are exponentul finit și este un divizor al exponentului L/Z_1 .

Corolar 2. Dacă L este o BM nilpotentă de clasa 2, atunci $D_1(L) = [L, L]$ și L/Z_1 au acelaș exponent.

Teorema 2. Pentru orice BM local nilpotentă L sunt echivalente următoarele afirmații:

- 1) L - BM finit generată;
- 2) BM L verifică condiția maximalității pentru subbucle;
- 3) BM L verifică condiția maximalității pentru subbucle normale;
- 4) BM L posedă o serie centrală, factorii căreia sunt grupuri ciclice de ordin prim sau infinit.

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THE SECOND AXIALLY-SYMMETRIC PROBLEM OF THE MICROPOLAR ELASTODYNAMICS

Ion Crăciun

The linear theory of the micropolar elastodynamics of an isotropic, homogeneous, and centro-symmetric elastic body occupying the three dimensional region Ω is considered. In the case of the cylindrical coordinate system (r, θ, z) , and under the assumption of axially symmetry (causes and effects do not depend of the variable θ), from vector equations in displacement and rotation of this theory, in the cartesian product of Ω with an infinite time interval, we obtain a system of three partial differential equations of the second order, whose unknowns are the second component of the displacement vector u , the first, and the last component of the rotation vector φ , all depending both of the variables r, z in Ω , for each θ , and the time t . The aim of this paper is the study of such obtained system. Thus, we discuss the generalized Lamb problem, the stress equations of motion problem, and the fundamental solutions for stresses. By using the superposition method, we analyze the initial-boundary value problem of the second axially-symmetric problem of the micropolar elastodynamics. The fundamental solutions in the presence of a distortion field are obtained. Finally, the method of potentials, and the potentials of Galerkin type are considered.

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As an alternative, we consider that the set of all available iris-codes is so sparse and scattered within the iris-code population that the matching between the bits of any two different irides happens only by chance. This is the first major hypothesis in our approach to iris recognition. It was initially formulated by Daugman in the early 90s but never fully exploited ever since. Present paper shows that accepting and following this hypothesis leads to theoretical and experimental iris recognition results agreeing each other. In this scenario we will give here some examples and counter-examples showing that masking the so called "fragile bits" don't necessary improve the iris recognition performance. By changing the point of view, it can be said that the proposed iris encoding methodology doesn't produce "fragile bits".

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SEARCHING FOR ‘FRAGILE BITS’ IN IRIS-CODES GENERATED WITH GABOR ANALYTIC IRIS TEXTURE BINARY ENCODER

Nicolaie Popescu-Bodorin

This paper presents a new methodology for generating iris binary codes (Circular Fuzzy Iris Segmentation, Gabor Analytic Iris Texture Binary Encoder) and tests the concept of "fragile bits" in this new context.

From the early stages of our PhD study we found that an open problem in iris recognition is the fact that we can't say for sure if a given iris database is or isn't a representative sample. To be more precise, if the length of the iris binary code is assumed to be 1024, then the numerical space representing the iris population counts more than $1.7E+308$ elements. Now, let's imagine a huge iris database containing, let's say, $1E+12$ images on which extraordinary iris recognition results have been proved. We shall use some sampling techniques enabling us to extrapolate these results to entire iris-code population (and to other similar databases), despite the fact that representativity rate of our hypothetical database is nearly null ($1E-296$). Unfortunately, such techniques doesn't exist and consequently, in these circumstances, explaining the differences between theoretical and experimental results could prove to be difficult and misleading. A possible example is the concept of "fragile bits" introduced to explain the difference between experimentally determined False Reject Rates and the theoretically predicted values.

SET-NORM CONTINUITY OF SET MULTIFUNCTIONS

Anca Croitoru

In this talk we present different types of set-norm continuous set multifunctions (such as uniformly autocontinuous or autocontinuous from above), their relationships with non-additive set multifunctions and also some properties of (pseudo)atoms for null-null-additive set multifunctions.

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SPECIFIC MODALITIES OF USING THE SOLVING PROBLEMS ACTIVITIES IN THE TEACHING-LEARNING OF GEOMETRY IN THE UNDERGRADUATE EDUCATION

Neculae Dinuță

The article presents the way of approaching of the problem solving process in the teaching-learning of the elements of geometry as well as the characteristic aspects of using the problem solving activities in the undergraduate education. After the presentation of the specific modalities close related to the methodology of using the guidance techniques for the thinking orientation, a few examples of the solving problems activities are offered; these examples highlight the practical aspects of solving the geometry problems.

Key words: solving problems process, solving problems activity, thinking orientation.

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DARBOUX INTEGRABILITY AND CENTRES IN CUBIC DIFFERENTIAL SYSTEMS WITH TWO INVARIANT STRAIGHT LINES AND ONE INVARIANT CONIC

Dumitru Cozma

We consider the cubic system of differential equations

$$\begin{aligned}\dot{x} &= y + ax^2 + cxy + fy^2 + kx^3 + mx^2y + pxy^2 + ry^3, \\ \dot{y} &= -(x + gx^2 + dxy + by^2 + sx^3 + qx^2y + nxy^2 + ly^3),\end{aligned}\quad (1)$$

where coefficients and variables are assumed to be real. The origin $O(0,0)$ is a singular point with purely imaginary eigenvalues (a weak focus) for (1). The system (1) is said to be Darboux integrable if it has a first integral or an integrating factor of the form $f_1^{\alpha_1} f_2^{\alpha_2} \dots f_m^{\alpha_m}$, where $f_j(x, y) = 0$ are invariant algebraic curves and $\alpha_j \in \mathbb{C}$. The cubic systems (1) which are Darboux integrable have a centre at $O(0, 0)$. The problem of Darboux integrability for (1) with two parallel invariant straight lines and one invariant conic was studied in [1], with a bundle of two invariant straight lines and one invariant conic in [2].

In this paper we study the problem of Darboux integrability assuming that (1) has two invariant straight lines and one irreducible conic curve. It was found the coefficient conditions for the existence of two invariant straight lines

$f_j \equiv a_j x + b_j y + 1 = 0, j = 1, 2, a_1 b_2 - a_2 b_1 \neq 0$ (real or complex) and one invariant conic curve

$$f_3 \equiv a_{20} x^2 + a_{11} xy + a_{02} y^2 + a_{10} x + a_{01} y + 1 = 0.$$

In each of these cases we show that (1) has an integrating factor of the form $\mu = f_1^{\alpha_1} f_2^{\alpha_2} f_3^{\alpha_3}$ with $\alpha_j \in \mathbb{C}$ and hence the origin is a centre for (1).

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KACZMARZ EXTENDED VERSUS AUGMENTED SYSTEM SOLUTION IN IMAGE RECONSTRUCTION

Aurelian Nicola and Constantin Popa

In this paper we make a comparative analysis of two projection based iterative algorithms for systems of linear equations arising from image reconstruction in computerized tomography. The first one - Kaczmarz's iterations - is used for solving the (consistent) augmented system, whereas the second - Kaczmarz extended algorithm - is used for solving the original (inconsistent) system. We obtain bounds for the generalized spectral condition numbers for both augmented and original system, which give us information about the theoretical behaviour of the two iterative methods. Numerical experiments are made on a phantom used in the image reconstruction literature.

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NEW ANALYTICAL MODELS OF CAVITATION EROSION PREDICTION

Constantin Pătrășcoiu

Cavitation erosion prediction for the hydraulic machines is very important in the hydraulics research because that cavitation erosion is a source of failure of pumps water turbine blade, pipelines and other hydraulic devices. In these paper new kinds of theoretical volume loss rate curve of erosion cavitation progress is proposed. The analytical models describing this new kind of erosion curves give a new vision of the volume loss rate curve and produce a good concordance between the experimental and theoretical data if there is a good choice of theoretical model. Instead of using a unique analytical (universal) model for all materials, we give the possibility of a good choice between the proposed models. There may also appear some open problem such as optimally correlating this analytical cavitation erosion models with the properties of the implied materials.

Keywords: Cavitation erosion, Mathematical model, Bessel's equations

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SEMIOTIC FLEXIBILITY VERSUS MATHEMATICAL PRECISION IN E-WORLD

Ioan Dzitac and Simona Dzitac

In e-World can be used two main computational paradigms: word-based paradigm (soft computing) or number-based paradigm (hard computing). First paradigm is exploit semiotic flexibility (tolerant of imprecision, uncertainty, partial truth, and approximation), unlike second paradigm, which is oriented on mathematical precision. Problems where solution strong requires soft computing include medical applications (diagnosis, interpretation of medical images and biomedical signals), perception (e.g. recognition of signals, phoneme recognition, olfactory signals), computer vision problems (e.g. face recognition), hand-written character recognition, control in robotics and nonlinear complex systems), playing complex games (like go or strategic war games), natural language analysis problems (understanding of meaning of sentences). In this paper we have describes a comparative scheme of main aspects of soft computing versus hard computing used in e-World: Fuzzy-defined situation (quality, imprecision, uncertainty) vs. Well-defined problem (quantity, precision, certainty); Software entity: AGENT (process devised as interactant) vs. Software entity: PROGRAM (object devised as tool); “Computing as Interaction” paradigm (agent-oriented, always parallel vs. “Client-Server” paradigm (object-oriented, mostly sequential); Nondeterministic environment (open, dynamic, unknown) vs. Deterministic environment (closed, static, known); Managing “Just In Time” situations (descriptive, flexible, robust) vs. Solving exactly problems (imperative, firm, reliable); Antropocentric design (user-friendly, simple interface) vs. Technocentric design (accurate, complex functionality); Suboptimal solving (answer, temporary, non-algorithmic, revisable, local) vs. Optimal solving (solution, lasting, algorithmic, apodictic, general).

Keywords: soft computing, hard computing, intelligent systems, intelligent agents, Zadeh- word- oriented paradigm, Kelvin – number- oriented paradigm.

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NUMERICAL ALGORITHM TO LOCATE FIXED POINTS

Raluca Efrem

To determine the location and the stability type of the limit sets is the first step in analyzing a dynamical system. The most common method is the manual search for limit sets. When a researcher looks for new behavior in a system, he typically use a simulation program that display trajectories or orbits. He changes the parameters or the initial condition, and he lets the system run until it reaches the steady state. When the approximate location of an interesting limit set has been found, he applies more sophisticated methods to calculate its precise position.

Some sophisticated algorithms transform the problem of locating a limit set into the task of calculating the zeros of a system of nonlinear equations, and here the numerical analysis provide us a lot of zero-finding algorithms. The main advantages of this approach are the rapid rate of

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„CURBA LUI GAUSS” ȘI ÎNVĂȚAREA DEPLINĂ

Valerian Oprișor and Mariana Vladu

Imaginea grafică obținută, consultând notele din catalogul unei clase, va fi o curbă în formă de clopot, așa-zisa „curbă a lui Gauss”, care reprezintă distribuția (numită normală) în jurul unei valori medii, a tuturor valorilor ce se pot da capacității de învățare a elevilor. Conform „curvei a lui Gauss” aceasta ar duce în final la ideea clasificării elevilor. Deși faptul poate părea firesc, lucrurile sunt departe de a sta așa.

MATHEMATICAL MODELS FOR CHAOTIC ECONOMICAL SYSTEMS

Constantin Pătrășcoiu

Chaotic models have been applied to a variety of dynamic phenomena in the areas of fluid dynamics, meteorology, biology and so on. In this paper we investigate some chaotic phenomena in macroeconomic systems. The dynamical systems with chaotic behavior, modeling the various actual economical situations are discussed.

Keywords: Economic dynamical system, Bifurcation, Stability, Chaotic solutions.

DEVELOPING TOOLS FOR COLLECTION LANGUAGE RESOURCES AND BUILDING NEW VOICE WEB APPLICATION

Nicolae Objelean

We proposed to build systems for rapidly creation of language resources and rapidly building new application, which need to resolve two problems of current speech recognition and speech synthesis of natural language. We deal with the problem adaptation of automatic speech recognition systems for new vocabulary. For that aims we proposed building tools for collection language knowledge to rapidly creation new application. The ended goal of this research is to design the speech recognition and synthesis systems that can be rapidly configured for any vocabulary adaptation to new task. We used Voice XML for building spoken applications for speech interface to the information on the Web

Keywords: Language modeling, Speech Recognition, linguistics knowledge.

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ABOUT SOME EPIDEMIC MODEL IN SPACE WITH PERTURBATED METRIC

Ion-Marian Olaru

In this paper we shall present a fixed point result in space with perturbated metric. We obtain this result by using comparison function technique. Next we apply the above result in the study of the following integral equation,

$$x(t) = \prod_{i=1}^2 g_i(t) + \int_a^t K_i(t, s, x(s)) ds, t \in [a, b],$$

whichs is related to some epidemic models.

convergence and the ability to locate stable, nonstable and unstable limit sets.

In this paper we will present an algorithm that help us to locate fixed points, we build his Maple code, and implement him on an example.

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THE EXCITATION OF TWO INDIVIDUAL ATOMS IN THE RYDBERG BLOCKADE

Nickolae Enaki and Marcela Cerbu

In this work it was obtained the Hamiltonian of two atoms with two levels with monomod cavity eld, considering the dipole interaction. We researched the quantum nutation of these two atoms, which interact with the cavity eld.

VARIATIONAL CALCULUS APPLICATIONS IN IMAGE PROCESSING

Cristina Gherghina and Elena-Alexandra Fr ncu

Image processing, a very complex and interdisciplinary domain, requires a very good mathematical modeling for efficient use of electronic computer.

The paper presents a modern method of segmentation, active contours model, based on variational calculus techniques. The mathematics fundamentals of active contour model involve the merging between elements of geometry (regarding the shape of the objects), physics (which define the constraints of variations in time and space) and approximation theory (which offers the mechanisms for fitting the model on the object shape).

In the presented model an initial contour is applied upon an image in order to obtain the edges of an object from the image. Through an iterative process it identifies the targeted object by minimizing the contour energy, depending on its parameters.

A development of this model is the Snake Demo in MATLAB software, which is used to illustrate the evolution of active contours.

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SOME REMARKS ABOUT FROBENIUS THEOREM

Cristina Flaut

Starting from Frobenius theorem, in abstract algebra, which characterizes the finite-dimensional real division algebras, we give some example of division algebras of dimension 2^t , $t \in \mathbb{N}$, over a suitable field.

ON THE NUMERICAL APPROCH OF THE NONLINEAR KURAMOTO-SIVASHINSKY EQUATION

Ana-Maria Moșneagu

In this paper the following nonlinear equation is considered:

$$u_t = -(1/2)(u^2)_x - u_{xx} - u_{xxxx} \quad x \in [-L, L], t \in (0, T],$$

with periodic boundary conditions $u(t, -L) = u(t, L)$ $t \in (0, T]$,

and initial condition $u(0, x) = u_0(x)$ $x \in [-L, L]$, where $L, T > 0$ and u_0 is a given function. The finite difference method and the standard spectral method (discrete Fourier transform) were used for numerical approximation. The both schemes were constructed in such a way that the linear part is treated implicitly and the nonlinear part explicitly. Some numerical experiments have been made in order to compare the two numerical methods.

Keywords: Kuramoto-Sivashinsky equation, spectral methods, finite difference methods.

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THE WIND DRIVEN CIRCULATION ON THE CENTRAL REGION OF ROMANIAN BLACK SEA SHORE

Angela Muntean

The wind driven circulation is a very important element of marine water circulation. This circulation of water on the Romanian Black Sea coast is not very well known. Some theoretical calculi regarding the Ekman currents on the ocean regions with finite depths are presented. Those results are applied for Romanian Black Sea shore, especially for Constanta and Eforie regions. They are compared with the results obtained from the data set for Constanta and Eforie regions.

AN INVERSE PROBLEM IN THE PHASE-FIELD TRANSITION SYSTEM. THE 2D CASE

Constantin Moroşanu

The inverse problem (P) in 2D space dimension governed by the nonlinear parabolic system (the phase-field transition system), introduced by Caginalp, is considered. For every $\varepsilon > 0$, we associate to the nonlinear system an approximating scheme of fractional steps type; corresponding, we consider for (P) the approximating boundary optimal control problem (P^ε) . On the basis of the convergence of the associated problem (P^ε) to problem (P), the necessary optimality conditions are established for (P^ε) and a conceptual algorithm of gradient type is elaborated in order to compute the sub(optimal) boundary control. The advantage of such approach is that the new method simplifies the numerical computations due to its decoupling feature. The finite element method (fem) is used to deduce the discrete equations and numerical results regarding the stability and accuracy of the fractional steps method, as well as the physical aspects (separating zone of solid and liquid states, supercooling, superheating), are reported.

Keywords: boundary value problems for nonlinear parabolic PDE, optimal control, free boundary problem, fractional steps method, finite element method, computer science.

AMS 2000 Classification: 35K60, 49, 65, 68, 93.

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NEW PROPERTIES FOR A CLASS OF MULTIVARIATE OPERATORS

Loredana-Florentina Galea

In this paper we are concerned with a class of multivariate operators. Based on the results of the weakly Picard operator's theory our aim is to study the good and special weakly Picard properties for these operators.

2000 AMS: 47H10, 41A10.

Keywords and phrases: Picard operators, weakly Picard operators, good Picard operators, special Picard operators.

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BASINS OF ATTRACTION IN A DISCRETE-TIME ECONOMIC MODEL

George-Valentin Cîrlig and Adelina Georgescu

An economic model described by a two-dimensional noninvertible map is considered. The global behavior of the map is investigated and the property of multistability is proved (using the method of critical curves). In particular, the shape of basins of attraction of the coexisting attractors and the qualitative changes in their structure (as the parameters are varied) is analyzed.

STUDY OF THE LYAPUNOV STABILITY IN A BIOLOGICAL MODEL

Raluca-Mihaela Georgescu

A mathematical model from biology is analyzed. Numerically it is found that the only candidates for the Lyapunov asymptotically stable or unstable sets governing the phase portrait are the equilibrium points, so that their type was investigated. The corresponding global dynamic bifurcation diagram is carried out.

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THE ROLE OF CORRELATION IN ENGINEERING PROBLEMS

Mihaela Ghelmez (Dumitru), Florentina Iorga, Ciprian Cojocarasu and Bogdan Dumitru

Last years, a new faculty was created in Politehnica University of Bucharest, namely the Applied Sciences Faculty, having as sections "Mathematical Engineering" and "Physical Engineering". 2009 is the year of the first graduated students from this faculty. At the student Scientific Session in May, many presented works were awarded and selected as continuation as diploma work.

In this paper we present the program of such a session and one of the works, dealing with some conditions of existence and unicity of a solution for equations of the form $x=g(x)$ where $g:X\rightarrow X$ is a contraction of a complete metric space X .

We used the principle of contraction, as well as the formula of one step iteration. As an example, Maple software was the most appropriate. Some examples in physics were indicated, too.

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NUMERICAL SOLUTION OF TWO-DIMENSIONAL ADVECTION-DIFFUSION EQUATION USING SIMULTANEOUSLY TEMPORAL AND SPATIAL WEIGHTED PARAMETERS

**Abolfazl Mohammadi, Mehrdad Manteghian, Ali Mohammadi, and
Seyed Mojtaba Hoseini Nasab**

Several numerical techniques have been developed and compared for solving the two-dimensional advection-diffusion equation with constant coefficients. These techniques are based on the finite difference methods (FDM). By changing the values of temporal and spatial weighted parameters, solutions are obtained for both explicit and implicit techniques such as FTCS, FTBSCS, BTCS, BTBSCS and Crank–Nicholson schemes. Numerical solution is given for a special case which has been dealt with in the literature and for which an analytical solution has been provided. Comparison of the results has confirmed that the Crank–Nicholson numerical approach matches successfully with the analytical solution while the other techniques result in some levels of discrepancy.

Keywords: finite difference methods; advection–diffusion equation; spatial weight; temporal weight; explicit and implicit techniques.

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A GENERAL MOUNTAIN-PASS THEOREM FOR LOCALLY LIPSCHITZ FUNCTIONS

Georgiana Goga

In the paper we present a new proof of a general mountain-pass theorem for locally Lipschitz functions established in [3], giving information about the location of critical points for these kinds of functions. Unlike the method of localization used in [3], which replaced the Ghoussoub–Preiss techniques [4] by Ekeland’s variational principle, our proof is based on the Borwein–Preiss variational principle [1] and a lemma of Choulli, Deville and Rhandi [2].

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SOME RESULTS ON SIMULTANEOUS ALGEBRAIC TECHNIQUES IN IMAGE RECONSTRUCTION FROM PROJECTIONS

Lăcrămioara Grecu and Aurelian Nicola

In this paper we make a comparative analysis of two projection based iterative algorithms for systems of linear equations arising from image reconstruction in computerized tomography: Kaczmarz’s successive projection iteration (1937) and Simultaneous Algebraic Reconstruction Technique (SART; 1984). We start a theoretical analysis of the SART algorithm, which gives us the possibility to consider its extended and constrained versions. Systematic numerical experiments and comparisons are made on two phantoms widely used in image reconstruction literature, with the classical, extended and constrained versions of both Kaczmarz and SART methods.

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EXPERIMENTAL ASPECTS OF TEMPERATURES, IN THE BREAK SYSTEM OF IAR-99 LANDING GEAR

Grigore Ion

The paper presents aspects of the thermal field on the block braking of IAR 99 aircraft during after landing. Experimental aspects are presented.

Keywords: break system, temperature

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GENERALIZED PRIORITY MODELS WITH “LOOK AHEAD” STRATEGY: NUMERICAL ALGORITHMS FOR BUSY PERIODS

Gheorghe Mishkoy and Olga Benderschi

By the Generalized Priority Models (GPM), we call the mathematical models of queueing system, in which the switching of the service process from a class of requests (messages) to another one is non-zero. Such switching between the priority classes is considered a random variable with arbitrary distribution function. The GPM is defined by setting four identifiers: “priority type”, ”strategy in free state”, “discipline of service” and “discipline of switching”. As is shown in [1] and in some recent publications (see, for example [2,3]), GPM have a number of important distinguished features, compared with classical priority models. One of these distinguished features consists in the fact that mathematical formalization of switchover times leads to appearance of various new priority laws enables to considerate more flexible real time processes, such as, absolute, semi-absolute, relative, etc., priority disciplines. Another import feature of GPM consist in the fact that they are enable to consider the strategy in the free states. In this communication will be discussed and presented some analytical results concerning busy period distributions for $M_2/G_2/1$ generalized queueing systems with semi-Markov switching and so called “look ahead” strategy. Will be shown that presented analytical results can be viewed as a 2- dimensional analogs of well known in queueing theory the Kendall-Takacs functional equation. For solving the mentioned analogs was used the technique elaborated in [4]. Numerical algorithms and modeling examples for busy periods will be presented.

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familiarizarea cu aceste inegalitati si aprofundarea teoriei functiilor convexe si a aplicabilitatii acestora in diversele domenii de activitate.

EFFICIENT COMPUTER ASSISTED NUMERICAL CALCULUS THROUGH NUMERICAL ENGINEERING SOFTWARE

**Romulus Militaru, Liviu-Adrian Călin, George-Cristian Călugăru and
Adrian Georgescu**

Numerical Engineering Software is a newly developed software solution for the efficient processing of numerical calculus. The development started from a pilot-project which engulfed a few numerical methods and graphic profile visualizations for them. Through this prototype the developers intended to set the guidelines of the graphic interface which we intended to make as accessible as possible. The development continued and in the current stage of development the application consists of five chapters: Matrix Algebra, Polynomial Approximations, Roots of Equations, Numerical Integration and Cauchy Problems. The project members customized the methods included in the program in order to give optimum results with respect to an imposed accuracy, with a low computational cost and using minimal memory storage.

The most customized chapter is the Cauchy Problems chapter which now contains embedded methods for the solving of ordinary differential equations, higher order differential equations, systems of differential equations, Sturm-Liouville problems.

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MODELING HEAT TRANSFER IN BRAKING SYSTEM OF IAR-99 PLANE, DURING PHASES OF BRAKES

Grigore Ion and Amado Stefan

The paper presents aspects of the thermal field on the block braking of IAR 99 aircraft during landing and thereafter. The thermal field was conducted with the finite elements method.

Keywords: break system, temperature, fem

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QUEUING SYSTEM WITH SEMI-MARKOV BATCH FLOW

Iulia Griza

Stochastic approximation in queuing system is already well known and established approach. The main reason is that such systems are very large and so it is difficult and often impossible to handle them by usual methods of Markov and semi-Markov processes. The specific our queuing system (QS) is that the series scheme is considered with phase merging procedure. The usual batch claims are transformed into continuous drift of limit process, mean while the large batch claims are developed as a jump of limit Poisson process. The large batch claim arises under exponential distribution with intensity Λ . That is the large batch claim is not predictable in stochastic QS considered on increasing time intervals.

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STATIC AND DYNAMIC PRIORITIES IN THE QUEUEING SYSTEM MODELS

Gh.Misoi and O.Groza

Queueing system models have found applications in various domains such as medicine, transport, commerce, etc. The study of queueing systems, and especially of priority queueing systems, is necessary in order to provide one with a better level of quality of service. Static priorities are not always the most optimal in the context of real time functioning of the system. For that reason we consider more advantageous priority schemes where priorities change over time (dynamic priorities) in contrast with static priorities. We present two service strategies within dynamic priority schemes: oldest-first (OF) and earliest-deadline-first (ED) and also some results related to waiting time.

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(iii) partially unimodal if $a_0 \leq a_1 \leq \dots \leq a_i$ & $a_j \geq a_{j+1} \geq \dots \geq a_n$, for some $1 \leq i \leq j \leq n$.

In this paper we consider some families of graphs whose independence polynomials are palindromic and partially unimodal. We conjecture that all these polynomials are unimodal.

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INEGALITATI INTEGRALE SI APLICATII

Marcela V. Mihai

In aceasta lucrare am abordat cateva din inegalitatile clasice integrale relative la functiile convexe sau nu, insotite de demonstratiile corespunzatoare si multiple aplicatii. Unele dintre ele si aplicatiile lor pot fi lucrate cu elevii dotati, la cercurile de matematica. Tinta lucrarii este

symmetry [1,2]. If the "indexes" r_i and r_j , ascribed to the points which belong to distinct fundamental domains, are supplementary transformed, in general, by different permutations p_i and p_j of group P , then the transformation $\tilde{g} = wg$ is exactly a transformation of W_q -symmetry [3,4].

The groups of W_q -symmetry are subgroups of the crossed standard Cartesian wreath product of initial group P with generating group G . The general theory of \bar{P} -symmetry groups and basic assumptions of the general theory of W_q -symmetry, inclusive the methods of deriving the groups of different tips of W_q -symmetry from given groups P and G was elaborated and developed by Zamorzaev's geometrical school from Chisinau.

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SOME PROPERTIES OF PALINDROMIC INDEPENDENCE POLYNOMIALS

Vadim E. Levit and Eugen Mandrescu

An independent set in a graph G is a set of pairwise non-adjacent vertices and $\alpha(G)$ is the size of a maximum independent set in G . The independence polynomial of G is defined by:

$$I(G; x) = s_0 + s_1x + s_2x^2 + \dots + s_\alpha x^\alpha \quad \alpha = \alpha(G),$$

where s_k equals the number of independent sets of cardinality k (I. Gutman and F. Harary, 1983).

A polynomial $P_n = a_0 + a_1x + a_2x^2 + \dots + a_nx^n$ of degree n , is called:

- (i) palindromic if $a_k = a_{n-k}$, $k = 0, 1, \dots, \lfloor n/2 \rfloor$;
- (ii) unimodal if $a_0 \leq a_1 \leq \dots \leq a_k \geq a_{k+1} \geq \dots \geq a_n$, for some $k \in \{0, 1, 2, \dots, n\}$;

THE EMPLOYMENT OF HARD LIMITER CONTROL FOR THE MODIFICATION OF REGIMES IN THE DYNAMICS OF ZHANG'S MODEL

Adriana-Daniela Gurgui

Starting from the initial figures of the function that describes the economic model, there are introduced thresholds of superior, inferior and mixed limiter. It is shown by graphic and numeric representations either how the state of chaos turns into a cyclic regime or, how a cyclic regime can turn into another cyclic regime of smaller periods. The bifurcation diagrams can give an outlook and at the same time they can offer a comparative image over the dynamic system under control.

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LYAPUNOV METHODS IN THE STABILITY AND BIFURCATION STUDY OF A CERTAIN DELAY DIFFERENTIAL EQUATION

Anca-Veronica Ion

A delay differential equation modeling the evolution of cells in leukemia is considered. A comprehensive study of the stability of the equilibrium solutions is performed, by using either the first approximation Lyapunov method or the method of Lyapunov functionals. The Hopf bifurcation points are detected and the orbital stability of the emerged periodic solutions is established by computing the first Lyapunov coefficient in the bifurcation point of the restriction of the problem to some two-dimensional center manifold (and thus the normal form of the restricted equation is constructed). Also Bautin-type bifurcation points are detected, and the orbital stability of the emerged periodic solutions is established, by computing the second Lyapunov coefficient and thus finding the normal form of the reduced to the center manifold equation in this case also.

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COMPUTATIONAL MODELS FOR GENERALIZED NAVIER-STOKES FLUID FLOW IN MICROCHANNELS

Stelian Ion

A numerical algorithm for computing a class of non-Newtonian fluid flow is presented. The flow is modelled by the generalized incompressible Navier-Stokes equations with viscosity depending on the strain rate. The algorithm is based on the finite volume method for space discretization and a semi-implicit backward differentiation formula for time integration. The primitive variables are the velocity field and pressure field and are discretized on the primal mesh and the dual mesh respectively. The space derivative operators of the velocity field are discretized on the dual mesh and the gradient operator of the pressure field is discretized on the primal mesh. This approach allows the discretization of the strain rate tensor and stress tensor as piecewise constant functions on the dual mesh. A numerical example concerning the flow in the T-shape microchannels is also presented.

COMPUTATIONAL APPROACH OF MIXING BEHAVIOR IN EXCITABLE MEDIA: CASE ANALYSIS FOR THE VORTIC FLOW

Adela Ionescu

Between the most mature interdisciplinary areas, computational fluid dynamics (CFD) comes recently into focus. In the same time, it becomes more and more difficult to contribute fundamental research to it. The growing availability of CFD software may seem to be a threat for CFD research. However, how CFD develops remain unpredictable, and it is part of what makes it an exciting and attractive discipline.

This paper aims to exhibit a part of some new recent works in CFD. It concerns the qualitative approach of the mixing behavior in excitable media. In [1,2] it has been realized a large analysis of 3D mixing flow behavior, in agreement with technological experiments associated [5].

BRANCHING EQUATION IN THE ROOT SUBSPACE FOR EQUATIONS NONRESOLVED WITH RESPECT TO DERIVATIVE AND STABILITY OF BIFURCATING SOLUTIONS

Loginov B.V., Konopleva I.V. and Rousak Yu.B.

For implicitly given stationary and dynamical bifurcating problems with sufficiently smooth nonlinear operator branching equations in the root subspaces are introduced and investigated. On this base new results about stability of bifurcating solutions by A.M. Lyapounov are obtained. Branching equations in the root subspaces under group invariance conditions allow to give the results about orbital stability of bifurcating solutions. Separately results are obtained in variational case.

THE SYMMETRY OF GEOMETRIC SPACE WELL-BALANCED BY "PHYSICAL" ORIENTATED LOAD

Alexandru Lungu

Let the "indexes" r_i from the set $N = 1, 2, \dots, m$ be omogene oriented magnitudes (vectors, tensors). On fix a certain transitive group P of permutations over N . Let us have discrete group of symmetry G of geometric space S of constant curvature. Ascribe to each interior point M_i of fundamental domain S_i from decomposition of space S within respect to the group G the same "indexes" r_1, r_2, \dots, r_k , from the set N , where k is a divisor of $m = |N|$. We obtain one regular decomposition of geometric space well-balanced by summary "physical" orientated load N .

The mixed transformation \tilde{g} of the obtained regular decomposition of "indexed" geometric space, which maps the "indexed" point, is composed also of two components: $\tilde{g} = wg$. The transformation of classical symmetry g which operates both on points of initial geometric space S and on "indexes", attributed to the points, by a given rule independently of points, while w is certain supplementary complex rule which describes the transformation of these "indexes".

If the rule w is the same for every "indexed" point of well-balanced space, then the mixed transformation \tilde{g} is exactly a transformation of \bar{P} -

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STRICTLY INCREASING MARKOV CHAINS AS WEAR PROCESSES

Mario Lefebvre

To model the wear $X(t)$ of a machine at time t , Rishel (1991) proposed to use a degenerate two-dimensional diffusion process defined by the system of stochastic differential equations

$$\begin{aligned} dX(t) &= \rho[X(t), Y(t)] dt, \\ dY(t) &= f[X(t), Y(t)] dt + \sigma[X(t), Y(t)] dB(t), \end{aligned}$$

where ρ and σ are positive in the domain of interest. In this model, $Y(t)$ is a variable that directly influences the wear. Notice that $X(t)$ is strictly increasing with time, as should be.

In discrete time, we can define a strictly increasing one-dimensional Markov chain $\{X_n, n = 0, 1, \dots\}$. Here, we assume that the state space of the chain is the set $\{x_0, x_0 + \delta, \dots, x_0 + (k+1)\delta\}$, where x_0 is the initial wear, and we define its transition probabilities as follows:

$$p_{i,j} = p \quad \text{if } j = i + \delta$$

and

$$p_{i,j} = 1-p \quad \text{if } j = i + 2\delta.$$

We compute, in particular, the mean number of transitions required for the process to take on a value greater than or equal to $x_0 + k\delta$, with $k = 1, 2, \dots$. We also consider a continuous-time version of this Markov chain, by conditioning a Brownian motion process to always move from its current state x to either $x + \delta$ or $x + 2\delta$ after ε time units. Again the expected value of the time it takes the process to cross the boundary at $x_0 + k\delta$ is computed explicitly. This model is an improvement over the one proposed by Tseng and Peng (2007).

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It was established that all the parameters have a sensitive influence on the behavior, moreover, this kind of model belongs to the far from equilibrium model class, widespread in excitable media.

The vortical (unsteady) flow is studied here [3], from computational standpoint. Using recent appliances of MAPLE11 soft [6], there are searching some special behavior features of this flow, in order to establish specific relationships between this flow and the general mixing flow.

Key words: turbulent mixing, rare event, vortical flow, Maple Assistant

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THE IMPLICATIVE-GROUP - A TERM EQUIVALENT DEFINITION OF THE GROUP COMING FROM ALGEBRAS OF LOGIC

Afrodita Iorgulescu

We introduce the implicative-group (the partially-ordered (lattice-ordered) implicative-group) as a term equivalent definition of the group (the partially-ordered (lattice-ordered) group, respectively).

The partially-ordered implicative-group is the great piece which missed of the puzzle showing the connections between partially-ordered groups and some algebras of logic.

We establish connections between the group level and the algebras of logic level. We discuss about the filters (ideals) and the deductive systems of the involved notions.

NUMERICAL SIMULATION OF COMPRESSIBLE MAGNETOHYDRODYNAMIC PLASMA FLOW IN A CIRCUIT BREAKER

**Rolf Jeltsch, Ralf Hiptmair, Patrick Huguenot, Harish Kumar,
Christoph Schwab, Manuel Torrilhon and
Vincent Wheatley**

The main function of a circuit breaker is to switch off the electric current safely, in case of fault current. A mechanical force separates the contacts, and an arc starts to burn between the two contacts. This plasma is described by the resistive Magnetohydrodynamics (MHD) equations. The emphasis is on very high currents (10kA-200kA) and relatively high conductivity. Radiation is incorporated by adding a Stefan's radiation. To simulate the plasma in the arc the Nektar code developed by Brown University is adapted and extended. It is based on the Discontinuous Galerkin(DG) methods allowing for triangular or quadrilateral meshes in 2d and hexagonal or tetrahedral meshes in 3d.

GID is used for mesh generation. The code is extended to include Runge-Kutta time stepping, various accurate Riemann solvers for MHD, slope limiters and SF₆ gas data. It operates on both serial and parallel computers with arbitrary number of processors. The suitability of this Runge-Kutta Discontinuous Galerkin (RKDG) methods is analysed.

In particular different numerical fluxes, different Riemann solvers and limiters, low and high order approximations on smooth and non-smooth solutions are investigated. Numerical results are given. This work has been performed by Patrick Huguenot and Harish Kumar in their Ph.D. Thesis and by Vincent Wheatley.

SOLVABILITY OF HAMMERSTEIN EQUATIONS WITH ANGLE-BOUNDED KERNEL

Irina A. Leca

The Browder-Gupta splitting of angle-bounded operators is interplayed with the elliptic super-regularization imbedding to study the solvability of Hammerstein operator equations.

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