

Computer Science	1
KINGA MARTON, ISZABELA NAGY AND ALIN SUCIU Visual Inspection of Random Number Sequences with FileSeer	3
ALIN SUCIU, BOGDAN NICOLAE, GABRIEL ANTONIU, ZSOLT ISTVAN AND ISTVAN SZAKATS Gathering Entropy at Large Scale with HAVEGE and BlobSeer	11
ALIN SUCIU, LIDIA ZEGREANU AND CATALIN ZIMA Parallel Generation of Pseudo Random Number Sequences Using Graphics Processing Unit	21
Mathematics	31
HOREA F. ABRUDAN Topological Endomorphism Rings with Minimal Topologies	33
DORIN ANDRICA AND CĂTĂLIN BARBU The Hyperbolic Version of Ceva's Theorem in the Poincaré Disc Model	37
MARIUS BIROU Some Blending Surfaces on Rhombus	47
LUCIA RODICA BLAGA, LIANA LUPŞA AND LUCIANA NEAMŢIU Lexicographical Time-Cost International TSP	57
ADELA CAPĂŢĂ Families of Henig Dilating Cones and Proper Efficiency in Vector Equilibrium Problems	67
ADRIANA CĂTAŞ, ALINA ALB LUPĂŞ AND LOREDANA GALEA Note on Modified Hadamard Product of p -Valent Starlike Functions Involving Multiplier Transformations	77
ADELA CHIŞ-NOVAC Data Dependence of the Solutions to Some Integral Equations	89
DALIA CIMPEAN AND IOAN POP Steady Flow of a Micropolar Fluid in a Sinusoidal Channel	97
BOGDAN GAVREA Switching Events in Rigid-body Time-stepping Schemes	107
IOAN GAVREA On Means Obtained Via P_1 -simple Functionals	113
VIJAY GUPTA, TAEKYUN KIM, JONGSUNG CHOI AND YOUNG-HEE KIM Generating Functions for q -Bernstein, q -Meyer-König-Zeller and q -Beta Basis	119
DANIELA INOAN AND IOAN RAŞA Inequalities for Means in Two Arguments	123
ZOLTÁN MAKÓ Information Matrix Technique with LR-fuzzy Numbers	129
DANA MANGRA Morse Inequalities for Circle-valued Functions	139
VASILE MIHEŞAN The Modified Weibull Approximating Operators	147
OVIDIU T. POP, DAN MICLĂUŞ AND DAN BĂRBOSU The Approximation of Functions by Combining Two Sequences of Operators	153
IOAN RASA Eigenstructure of Differential Operators Arising in Approximation Theory	165
JÚLIA SALAMON Some Regularities for Parametric Operator Equilibrium Problems	171
ALINA SÎNTĂMĂRIAN Some New Sequences that Converge to a Generalization of Ioachimescu's Constant	179
CONSTANTIN COSMIN TODEA Remarks on Definition of Group Cohomology of Finite Groups	193



Visual Inspection of Random Number Sequences with FileSeer

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ABSTRACT: The human visual system is highly trained for detecting patterns in the surrounding world, a valuable feature that can be applied in examining more abstract information as well. Our FileSeer tool is designed to take advantage of the enormous power and subtlety of the human visual perception and employ it for the visual inspection of the quality of random number sequences. To this end FileSeer provides a framework for representing the examined information as black and white, grayscale and color images which enable the spotting of repeated patterns and includes the visualization of certain statistical properties of the random sequence such as its balance, entropy and histogram.

KEY WORDS: randomness, human visual system, pattern recognition

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Gathering Entropy at Large Scale with HAVEGE and BlobSeer

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ABSTRACT: In the context of distributed applications, the random generator plays a crucial role: it needs to achieve a **high entropy**, a **high throughput** and last but not least a **high degree of security**. In this paper we propose a distributed random number generator based on HAVEGE that efficiently addresses the aforementioned issues. We introduce a series of mechanisms to preserve a high entropy and degree of security for the combined output result and implement them on top of BlobSeer, a data storage service specifically designed to offer a high throughput in large-scale deployments even under heavy access concurrency. Large-scale experiments were performed on the G5K testbed and demonstrate substantial benefits for our approach.

KEY WORDS: random number generation, large scale, high throughput, high entropy, Blobseer, HAVEGE

RECEIVED: October 31, 2010



Parallel Generation of Pseudo Random Number Sequences Using Graphics Processing Unit

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ABSTRACT: Generating high quality pseudo random numbers sequences is a key operation in a variety of disciplines like cryptography, computer graphics, simulations and many others. Nonetheless, the high execution times of algorithms that produce high quality number sequences are often a bottleneck for the systems that require them. Our research in the domain of algorithm parallelization using the Graphics Processing Unit parallel architecture led us to very promising results. Taking advantage of the extremely flexible programmable processors, which provide both precision and high processing power, we were able to obtain a great speed up for a set of PRNGs like EICG, CEICG, MD5 and others. The used implementation technologies are High Level Shading Language (HLSL) and NVIDIA CUDA, which also allowed us to provide a comparison between two GPGPU computing trends: graphics APIs and dedicated GPU computing languages.

KEY WORDS: random number generation, graphical processing unit, CUDA, HLSL

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Topological Endomorphism Rings with Minimal Topologies

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ABSTRACT: The notion of a minimal topological space was introduced by A. S. Parhomenko in 1939 when he proved that compact Hausdorff spaces are minimal. Recall that a Hausdorff topological space (X, \mathcal{T}) is said to be *minimal* provided there is no Hausdorff topology on X coarser than \mathcal{T} . We study the following question: Let M_R be a right unitary module over a ring R . Under which conditions on M_R the ring $\text{End}(M_R)$ furnished with the finite topology is a minimal topological ring? A positive answer is given for free modules over finite rings.

KEY WORDS: minimal topology, free module, finite topology, endomorphism ring

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The Hyperbolic Version of Ceva's Theorem in the Poincaré Disc Model

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ABSTRACT: In this note, we present the hyperbolic version of Ceva's theorem in the Poincaré disc model.

KEY WORDS: hyperbolic geometry, hyperbolic triangle, gyrovector

MSC 2010: 30F45, 20N99, 51B10, 51M10

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Some Blending Surfaces on Rhombus

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ABSTRACT: In this paper we construct some blending surfaces on domain bounded by a rhombus using the univariate Bernstein operator. The surfaces stay on the rhombus and have a fixed height in the point $(0, 0)$. We study the monotonicity and give conditions to obtain concave surfaces. Also, we show that the surfaces are of parabolic type.

KEY WORDS: Bernstein operator, surfaces, monotonicity, concavity, convexity, parabolic points

MSC 2010: 65D17, 41A36, 41A63

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Lexicographical Time-Cost International TSP

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ABSTRACT: Starting from an application in the health economics, a multi-criteria international travel salesman problem is studied. A method for solving such a problem is given.

KEY WORDS: international travel salesman problem, lexicographic multi-criteria problem, medico - economics problems

MSC 2010: 90C10, 90C29

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Families of Henig Dilating Cones and Proper Efficiency in Vector Equilibrium Problems

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ABSTRACT: This paper deals with an extended form of the scalar equilibrium problem, called the strong vector equilibrium problem. New existence results for Henig proper efficient solutions of this problem are presented, using a well-known separation theorem in infinite dimensional spaces. Furthermore, it is showed that a net of Henig proper efficient solutions admits a convergent subnet to an efficient solution of the studied vector equilibrium problem.

KEY WORDS: Henig efficient solution, C -upper semicontinuity, subconvexlike bifunction.

MSC 2010: 49J52

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Note on Modified Hadamard Product of p-Valent Starlike Functions Involving Multiplier Transformations

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ABSTRACT: We consider in this paper a p-valent analytic functions class denoted by $\mathcal{T}_{\lambda,l}^m(n,p,\alpha,\gamma)$, $0 \leq \alpha < p$, $0 \leq \gamma \leq 1$, $m \in \mathbb{N}_0$, $l \geq 0$, $\lambda \geq 0$, $p \in \mathbb{N}$. The new results are obtained by means of a multiplier transformation, namely $I_p(\delta,\lambda,l)f(z) := z^p + \sum_{k=p+n}^{\infty} \left[\frac{p + \lambda(k-p) + l}{p+l} \right]^{\delta} a_k z^k$ where $f \in \mathcal{A}(p,n)$, $\delta, \lambda \in \mathbb{R}$, $\lambda \geq 0$, $\delta \geq 0$, $l \geq 0$ and $\mathcal{A}(p,n)$ denote the class of normalized analytic functions $f(z)$ in the open unit disc $f(z) = z^p + \sum_{k=p+n}^{\infty} a_k z^k$, ($p, n \in \mathbb{N} := \{1, 2, 3, \dots\}$). Related to the above mentioned class, by making use of the familiar concept of modified Hadamard product of p-valent analytic functions, the authors prove the new results. There are also established various integral properties. Relevant connections of some of the results obtained in this paper with those in earlier works are provided.

KEY WORDS: analytic function, multiplier transformations, integral operator, modified Hadamard product

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Data Dependence of the Solutions to Some Integral Equations

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ABSTRACT: We study the data dependence of the solutions to some Fredholm and Volterra integral equations in a locally convex space.

KEY WORDS: Picard operator, data dependence, Fredholm integral equation, Volterra integral equation, continuation principle.

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Steady Flow of a Micropolar Fluid in a Sinusoidal Channel

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ABSTRACT: An applied problem for a steady micropolar flow in a two-dimensional sinusoidal channel, is studied in the present paper. The governing equations of the flow and the boundary conditions involved in the problem are presented. The problem is reduced to a system of ordinary differential equations which is solved numerically using the NAG Fortran Routine D02HBF. Representative results for the velocity profiles into the channel are presented and plotted for different parameters and the shear stress to the walls is discussed.

KEY WORDS: flow, mixed convection, porous medium

MSC 2010: 35Q35, 76D99, 76M55

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Switching Events in Rigid-body Time-stepping Schemes

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ABSTRACT: We discuss the detection of switching events in rigid-body time-stepping schemes. The integration step is formulated as a linear complementarity problem (LCP) and the detection schemes are based on analyzing the basis used to obtain the LCP solution.

KEY WORDS: linear complementarity problems, switching events, rigid body simulation

MSC 2010: 65K10, 90C33

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On Means Obtained Via P_1 -simple Functionals

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ABSTRACT: In this paper we define means using P_1 -simple functionals. This means generalize the means defined in [1]. As in classical case, we show monotonicity property of new means.

KEY WORDS: P_n -simple functionals, log-convexity, divided differences

MSC 2010: 26D15, 26D20, 26D95

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Generating Functions for q -Bernstein, q -Meyer-König-Zeller and q -Beta Basis

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ABSTRACT: The present paper deals with the q -analogues of Bernstein, Meyer-König-Zeller and Beta operators. Here we estimate the generating functions for q -Bernstein, q -Meyer-König-Zeller and q -Beta basis functions.

KEY WORDS: q -integers, q -binomial coefficient, q -exponential, q -Bernstein basis, q -Meyer-König-Zeller basis and q -Beta basis function

MSC 2010: 41A25, 41A35

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Inequalities for Means in Two Arguments

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ABSTRACT: We extend the definition of a mean introduced by J. Sándor and establish some inequalities between this extended mean and other classical means. In particular, we obtain improvements of some known results.

KEY WORDS: Means in two arguments, inequalities.

MSC 2010: 26D15, 26D20

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Information Matrix Technique with LR-fuzzy Numbers

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ABSTRACT: In the paper [8] Huang and Moraga suggested a new method to extract fuzzy if-then rules from training data, based on information matrix technique with Gaussian membership function. In this paper, we extend this method to LR-fuzzy numbers of Archimedean t-normed space.

KEY WORDS: fuzzy rule, information matrix, additive fuzzy system, LR-fuzzy number, triangular norm.

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Morse Inequalities for Circle-valued Functions

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ABSTRACT: It is natural to consider circle - valued Morse functions, that are functions $f : M \rightarrow S^1$ having only non-degenerate critical points (details can be found in the monographs [6], [9] and in our earlier articles [3], [4]). The Novikov complex is a generalization to the circle - valued case of the Morse complex and it is in the center of this construction.

In this paper we present the universal coefficient version of the Novikov complex and the Morse-Novikov inequalities for circle-valued functions.

We begin with an introductory part about Morse functions, we proceed to circle - valued Morse functions and the Novikov complex, Novikov ring and the Morse-Novikov inequalities. In the last section we get new bounds to the number of critical points circle-valued maps.

KEY WORDS: Morse inequalities, circle-valued Morse functions, Novikov complex, Morse-Novikov inequalities

MSC 2010: 58K05, 58E05, 57R70

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The Modified Weibull Approximating Operators

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ABSTRACT: By using the Weibull distribution we shall define the modified Weibull transform $W_{\beta,\gamma}^{(a)}f$, $a \in \mathbb{R}$, from which we obtain as special cases both the modified Weibull operators of the first and second kind. We obtain a several positive linear operators, as a special case of this Weibull operator.

KEY WORDS: Weibull distribution, modified Weibull transform, positive linear operator

MSC 2010: 41A36

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The Approximation of Functions by Combining Two Sequences of Operators

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ABSTRACT: The present paper continues earlier research by authors concerning the convergence and approximation theorems for linear and positive operators. For these operators we construct a general class of study. The main goal is to construct a new general class of operators and also to establish a convergence theorem and the degree of approximation for this class of operators, obtained by combining of two sequences of operators.

KEY WORDS: linear and positive operators, modulus of continuity, convergence theorem, degree of approximation.

MSC 2010: 41A10, 41A25, 41A36.

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Eigenstructure of Differential Operators Arising in Approximation Theory

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ABSTRACT: We consider some differential operators A on $C[0, 1]$ which generate strongly continuous semigroups $(T(t))_{t \geq 0}$. We obtain some information about the eigenstructure of A , which can be used in order to investigate the rates of convergence of $T(t)$ when $t \rightarrow 0$ and $t \rightarrow \infty$.

MSC 2010: 41A36, 47D06

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Some Regularities for Parametric Operator Equilibrium Problems

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ABSTRACT: In this paper we introduce a new definition of vector topological pseudomonotonicity to study the parametric operator equilibrium problems. The main result gives sufficient conditions for closedness of the solution map defined on the set of parameters. The Hadamard well-posedness of the problem is also studied.

KEY WORDS: parametric operator equilibrium problem, vector topological pseudomonotonicity, generalized Hadamard well-posedness

MSC 2010: 49N60, 90C31

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Some New Sequences that Converge to a Generalization of Ioachimescu's Constant

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ABSTRACT: The purpose of the paper is to give some sequences that converge quickly to a generalization of Ioachimescu's constant, i.e. the limit of the sequence

$$\left(\frac{1}{\sqrt{a}} + \frac{1}{\sqrt{a+1}} + \cdots + \frac{1}{\sqrt{a+n-1}} - 2(\sqrt{a+n-1} - \sqrt{a}) \right)_{n \in \mathbb{N}},$$

where $a \in (0, +\infty)$.

KEY WORDS: Sequence, convergence, approximation, Ioachimescu's constant, Bernoulli number.

MSC 2010: 11Y60, 11B68, 40A05.

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Remarks on Definition of Group Cohomology of Finite Groups

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ABSTRACT: For G a finite group, we define a left exact functor denoted F_G isomorphic with the Hom functor, which allow us to construct the right derived functor of F_G . We obtain an isomorphism between the ordinary group cohomology defined using "Cartan-Eilenberg stable elements method" and the cohomology obtained using our functor F_G .

KEY WORDS: group cohomology, stable elements, right derived functor

MSC 2010: 16E40, 20J06, 20C05

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