Technical University of Cluj-Napoca
The Faculty of Automation and Computer Science

Automation Computers Applied Mathematics

Volume 22, Number 1, 2013
ISSN 1221-437X

CONTENTS

Automat. Comput. Appl. Math.
Volume 22 (2013), Number 1

Automation **1**

Claudiu Adrian Todoruţ

Object detection using Connected Components Labeling 3

Mathematics **13**

Dan Bărbosu and Naokant Deo

Some Bernstein-Kantorovich operators 15

Alina Bărbulescu and Andreea-Oana Petac

Statistical assessement of precipitation evolution. Case study 23

Marius Mihai Birou

Some polynomial operators of Bernstein type 33

Cristina Blaga

Circular time-like geodesics around a charged spherically symmetric dilaton black hole . . 41

Paul A. Blaga

Barycentric and trilinear coordinates in the hyperbolic plane 49

Sorin Budişan and Adrian Viorel

Existence results for nonlocal Cauchy problems 59

Vasile Bulgărean

The group $Iso_{d_p}(\mathbb{R}^n)$ with $p \neq 2$ 69

Jorge Bustamante and Victor M. Méndez-Salinas

A discrete operator for approximation of continuous periodic functions 75

Iulia Costin and Gheorghe Toader

Invariance of a weighted Lehmer mean in the family of weighted Gini means 89

Iulia Costin and Gheorghe Toader

Some optimal evaluations of the logarithmic mean 103

Ioana Crăciun and Daniela Inoan

On generalized golden ratio 113

Cristina-Ioana Fătu and Ion Mihoc

Some characteristic properties of the Fisher information for some special distributions . . 119

Bogdan Gavrea and Mircea Rus

On an l_1-minimization problem from optical flow 127

Adrian Holhoş

The rate of convergence of some Riemann-Stieltjes sums 137

Vasile Horea Ile

Logic type functions in deformable body mechanics 147

Detlef Mache and Ioan Rasa

Relations between polynomial operators 157

Vasile Miheşan
General Gamma approximating operators 165
Alexandru I. Mitrea
On the companion interpolatory product quadratures 173
Viorica Mureşan
On a Volterra integral equation with linear modifications of the arguments 181
Vasile Pop
Relations between the homomorphisms of $(k+1)$-groups and the homomorphisms of their $(n+1)$-retracts 189
Vasile Revnic
Discrete Morse-Smale characteristic of a simplicial complex 195
Constantin-Cosmin Todea
On parabolic subalgebras of inverse-symmetric algebras 203

Automation
Computers
Applied Mathematics
ISSN 1221–437X
Vol. 22 (2013) no. 1
pp. 3–11

Object detection using Connected Components Labeling

Claudiu Adrian Toduruţ

Claudiu Adrian Toduruţ: Department of Automation,
Technical University of Cluj-Napoca,
Memorandumului 28, Romania

todorutclaudiu@yahoo.com

Abstract: In this paper an implementation is presented for object detection using Connected Components Labeling algorithm which is superior to other methods. By implementing this algorithm it is detected objects of various forms: circles, rectangles and triangles.

Key Words: Pattern recognition, classification, object detection, connected components labeling

Received: January 25, 2013

Automation
Computers
Applied Mathematics
ISSN 1221–437X
Vol. 22 (2013) no. 1
pp. 15–21

Some Bernstein-Kantorovich operators

Dan Bărbosu and Naokant Deo

Dan Bărbosu: Department of Mathematics and Computer Science, Faculty of Sciences North University Center at Baia Mare, Technical University of Cluj-Napoca, Victoriei 76, 430122 Baia Mare, Romania

barbosudan@yahoo

Naokant Deo: Department of Applied Mathematics, Delhi Technological University, (Formerly Delhi College of Engineering), Bawana Road, Delhi 110042, India

dr_naokant_deo@yahoo.com

Abstract: Starting with the Bernstein's operators $\overline{B}_n : C\left[0, \frac{n}{n+1}\right] \to C\left[0, \frac{n}{n+1}\right]$, we construct the associated Kantorovich operators $\overline{K}_n : L_1\left[0, \frac{n}{n+1}\right] \to C\left[0, \frac{n}{n+1}\right]$ and we study some of their approximation properties.

Key Words: Bernstein operators, Kantorovich operator, modulus of continuity, Shisha-Mond theorem

MSC 2000: 41A25, 41A36

Received: Oct 16, 2013

Automation
Computers
Applied Mathematics
ISSN 1221–437X
Vol. 22 (2013) no. 1
pp. 23–31

Statistical assessement of precipitation evolution. Case study

Alina Bărbulescu and Andreea-Oana Petac

Alina Bărbulescu: Doctoral School of Civil Engineering,
Technical University of Civil Engineering, Bucharest
alinadumitriu@yahoo.com
Andreea-Oana Petac: Université de Bretagne Occidentale
andreea.petac@gmail.com

Abstract: Since the water supply by precipitation is of big importance in the water management resources, especially in regions with high drought, this article has two purposes. We start by performing the statistical analysis of precipitation series, in order to detect their characteristics. Then, we build the trend evolution for each individual series, using the wavelets approch. Finally, the model for the regional evolution of precipitation is detected, using the ensemble of data series. The data base is formed by 41 series collected at the secondary hydrological stations from Dobrogea region, Romania.

Key Words: Autocorrelation, break point, trend, wavelets

MSC 2000: 62P12

Received: September 1, 2013

Automation
Computers
Applied Mathematics
ISSN 1221–437X
Vol. 22 (2013) no. 1
pp. 33–40

Some polynomial operators of Bernstein type

Marius Mihai Birou

Marius Mihai Birou: Technical University of Cluj-Napoca, Memorandumului str. 28-30, Cluj-Napoca, Romania

Marius.Birou@math.utcluj.ro

Abstract: In this article we present some polynomial operators of Bernstein type. We study the shape preserving properties and the convergence of these operators. Also, some comparisons with the classical Bernstein operator are given.

Key Words: Bernstein operator, shape preserving, convergence, order of approximation, error of approximation

MSC 2000: 41A36, 41A25

Received: November 1, 2013

Automation
Computers
Applied Mathematics
ISSN 1221–437X
Vol. 22 (2013) no. 1
pp. 41–48

Circular time-like geodesics around a charged spherically symmetric dilaton black hole

Cristina Blaga

Cristina Blaga: Faculty of Mathematics and Computer Sciences,
Babeş-Bolyai University of Cluj-Napoca, 1 Kogălniceanu Street,
400084 Cluj-Napoca, Romania

cpblaga@math.ubbcluj.ro

Abstract: In this note we examine the circular time-like geodesics near a spherically symmetric dilaton black hole, described using the exact solution for a static charged black hole found by Gibbons and Maeda and, independently, by Garfinkle, Horowitz and Strominger. The existence and stability of the circular orbits are analysed using the effective potential of a free material test particle moving on time-like geodesic near this black hole. We determine the radius of the innermost stable circular orbit, the radius of the shortest circular orbit and compare our results with those obtained by other authors for specific values of the parameters involved in our analysis.

Key Words: circular time-like geodesics, dilaton black holes, effective potential

MSC 2000: 83C10, 83C20, 83C57

Received: November 1, 2013

Automation
Computers
Applied Mathematics
ISSN 1221–437X
Vol. 22 (2013) no. 1
pp. 49–57

Barycentric and trilinear coordinates in the hyperbolic plane

Paul A. Blaga

Paul A. Blaga: "Babeş-Bolyai" University,
Faculty of Mathematics and Computer Sciences
1, Kogălniceanu Street,
400084 Cluj-Napoca,
Romania

pablaga@cs.ubbcluj.ro

Abstract: In this paper, we show that, in the projective model of the hyperbolic plane, we can adapt the classical trilinear and barycentric coordinates to the hyperbolic plane. We mention that these coordinates were invented by Sommerville in the early thirties, but he resumed to the discussion of the elliptic case. We use the method of polarities to write down the equation of the Absolute, both in point and line coordinates and provide the basic formulae for computation of of angles and distances. At the end, we find the coordinates of the incenter and those of the centroid of the reference triangle and show that they are unit points for the trilinear and barycentric coordinate system, respectively.

Key Words: trilinear coordinates, barycentric coordinates, hyperbolic plane

MSC 2000: 51M09, 51M10

Received: Oct 7, 2013

Automation
Computers
Applied Mathematics
ISSN 1221–437X
Vol. 22 (2013) no. 1
pp. 59–68

Existence results for nonlocal Cauchy problems

Sorin Budişan and Adrian Viorel

Adrian Viorel: Department of Mathematics,
Technical University of Cluj-Napoca,
Str. Memorandumului Nr. 28, 400114 Cluj-Napoca Romania

Adrian.Viorel@math.utcluj.ro

Sorin Budişan: Department of Mathematics,
Babesş-Bolyai University Cluj-Napoca,
Str. Mihail Kogalniceanu Nr. 1, 400084 Cluj-Napoca, Romania

sorinbudisan@yahoo.com

Abstract: In this paper, we study semilinear evolution equations subject to nonlocal initial conditions in Banach spaces. The existence of nontrivial solutions is shown by means of compression-expansion theorems for problems involving superlinear nonlinear terms.

Key Words: Senilinear evolution equation, nonlocal initial condition, completely continuous operator

MSC 2000: 34G10, 47D06

Received: Nov 1, 2013

Automation
Computers
Applied Mathematics
ISSN 1221–437X
Vol. 22 (2013) no. 1
pp. 69–74

The group $Iso_{d_p}(\mathbb{R}^n)$ with $p \neq 2$

Vasile Bulgărean

Vasile Bulgărean: Babeş-Bolyai University, Faculty of Mathematics and Computer Science, Cluj-Napoca, Romania

vasilebulgarean@yahoo.com

Received: October 31, 3013

Automation
Computers
Applied Mathematics
ISSN 1221–437X
Vol. 22 (2013) no. 1
pp. 75–87

A discrete operator for approximation of continuous periodic functions

Jorge Bustamante and Victor M. Méndez-Salinas

Jorge Bustamante: Facultad de Ciencias Físico Matemáticas,
Benemérita Universidad Autónoma de Puebla,
Avenida San Claudio y 18 Sur, Colonia San Manuel
Puebla, Pue. C.P. 72570, México.

jbusta@fcfm.buap.mx

Victor M. Méndez-Salinas: Facultad de Ciencias
Físico Matemáticas,
Benemérita Universidad Autónoma de Puebla,
Avenida San Claudio y 18 Sur, Colonia San Manuel
Puebla, Pue. C.P. 72570, México.

vm-mendez@hotmail.com

Abstract: In this paper, approximation of continuous 2π-periodic functions is realized by discrete two-terms linear combinations of Jackson kernels. The rate of convergence is given.

Key Words: Discrete operators, rate of convergence, linear combinations of positive linear operators, approximation of periodic functions.

MSC 2000: 41A10, 41A17, 41A25

Received: April 6, 2013

Automation
Computers
Applied Mathematics
ISSN 1221–437X
Vol. 22 (2013) no. 1
pp. 89–101

Invariance of a weighted Lehmer mean in the family of weighted Gini means

Iulia Costin and Gheorghe Toader

Iulia Costin: Department of Computer Sciences, Technical University of Cluj-Napoca, Romania

Iulia.Costin@cs.utcluj.ro

Gheorghe Toader: Department of Mathematics, Technical University of Cluj-Napoca, Romania

Gheorghe.Toader@math.utcluj.ro

Abstract: Given two means M and N, the mean P is called $(M, N)-$invariant if $P(M, N) = P$. At the same time the mean N is called complementary to M with respect to P. We use the method of series expansion of means to determine the complementary with respect to a weighted Lehmer mean. The invariance of a weighted Lehmer mean in the family of weighted Gini means is also studied. We use the computer algebra Maple for solving some complicated systems of equations.

Key Words: weighted Gini mean, weighted Lehmer mean, complementary mean, invariance in a class of means

MSC 2000: 26E60

Received: March 5, 2013

Automation
Computers
Applied Mathematics
ISSN 1221–437X
Vol. 22 (2013) no. 1
pp. 103–112

Some optimal evaluations of the logarithmic mean

Iulia Costin and Gheorghe Toader

Iulia Costin: Dept. of Computer Science,
Technical University Cluj-Napoca, Romania

Iulia.Costin@cs.utcluj.ro

Gheorghe Toader: Dept. of Mathematics,
Technical University Cluj-Napoca, Romania

Gheorghe.Toader@math.utcluj.ro

Abstract: We compare some optimal evaluations of the logarithmic mean by families of means which depend on one parameter. We consider the families of power means, that of Lehmer means, another special family of Gini means, the family of Heron means, a special family of Muirhead means, and other more complicated families of means obtained by composition.

Key Words: power means; logarithmic mean; Lehmer means; Heron means; Muirhead means; inequalities of means

MSC 2000: 26E60

Received: November 11, 2013

Automation
Computers
Applied Mathematics
ISSN 1221–437X
Vol. 22 (2013) no. 1
pp. 113–118

On generalized golden ratio

Ioana Crăciun and Daniela Inoan

Ioana Crăciun: Technical University of Cluj-Napoca, Romania
ioana.craciun@omt.utcluj.ro
Daniela Inoan: Technical University of Cluj-Napoca, Romania
Daniela.Inoan@math.utcluj.ro

Abstract: The Golden Ratio has been associated with the ideas of harmony and beauty in art and nature. Many mathematical properties connected with it and its generalizations were studied along time. We propose in this work a study of some generalized versions of the Golden Ratio defined by means. For some particular means we obtain an explicit formula of the generalized ratio.

Key Words: Golden Ratio, homogeneous mean

Received: Nov 6, 2013

Automation
Computers
Applied Mathematics
ISSN 1221–437X
Vol. 22 (2013) no. 1
pp. 119–126

Some characteristic properties of the Fisher information for some special distributions

Cristina-Ioana Fătu and Ion Mihoc

Cristina-Ioana Fătu: Faculty of Economics, Christian University "Dimitrie Cantemir", Cluj-Napoca, Str. T. Mihali 56, Romania

cristina.fatu@cantemircluj.ro

Ion Mihoc: Faculty of Mathematics and Computer Science, "Babes-Bolyai" University of Cluj-Napoca, Str. Kogalniceanu 1, Romania

imihoc@math.ubbcluj.ro

Abstract: Fisher information is a fundamental concept of statistical theory and plays an important role in many areas of statistical analysis. Importance of Fisher information as a measure of the information in a distribution is well known. In this article, under certain regularity conditions, we analyze some properties of the score functions and of the Fisher informations in the case of the continuous random variables as well as for some sums of continuous random variables. A similar study was made by Barron and Johnson in the papers [1] and [2].

Key Words: Statistical estimation, score function, Fisher information, Cauchy-Schwarz inequality, local parameter, convolution

MSC 2000: 62B10, 94A17, 62H20

Received: October 10, 2013

Automation
Computers
Applied Mathematics
ISSN 1221–437X
Vol. 22 (2013) no. 1
pp. 127–136

On an l_1-minimization problem from optical flow

Bogdan Gavrea and Mircea Rus

Bogdan Gavrea: Department of Mathematics,
Technical University of Cluj-Napoca,
Str. Memorandumului nr. 28, 400114 Cluj-Napoca, Romania

Bogdan.Gavrea@math.utcluj.ro

Mircea Rus: Department of Mathematics,
Technical University of Cluj-Napoca,
Str. Memorandumului nr. 28, 400114 Cluj-Napoca, Romania

rus.mircea@math.utcluj.ro

Abstract: We present a study of some linear programming formulations used in the estimation of optical flow. We focus on a version of the Horn-Schunck model with the l_1 norm in place of the classical l_2 norm. We analyze two linear programming reformulations of the l_1 minimization problem and adress issues related to the linear structure induced by the optical flow problem in the context of primal-dual interior point methods. Some of the linear algebra structures may be exploited by parallel algorithms.

Key Words: optical flow, l_1 minimization, linear programming, sparse matrices, parallel algorithms

MSC 2000: 90C05, 65F50

Received: October 1, 2013

Automation
Computers
Applied Mathematics
ISSN 1221–437X
Vol. 22 (2013) no. 1
pp. 137–145

The rate of convergence of some Riemann-Stieltjes sums

Adrian Holhoş

Adrian Holhoş: Department of Mathematics,
Technical University of Cluj-Napoca,
Str. Memorandumului nr. 28, 400114 Cluj-Napoca, Romania
adrian.holhos@math.utcluj.ro

Abstract: We give the rate of convergence of some optimal lower Riemann-Stieltjes sums toward the integral.

Key Words: Riemann-Stieltjes integral, Riemann sum, rate of convergence

MSC 2000: 26A42, 41A25

Received: Oct 15, 2013

Automation
Computers
Applied Mathematics
ISSN 1221–437X
Vol. 22 (2013) no. 1
pp. 147–155

Logic type functions in deformable body mechanics

Vasile Horea Ile

Vasile Horea Ile: Technical University of Cluj-Napoca, Memorandumului str. 28-30, Cluj-Napoca, Romania

vasile-horea.ile@math.utcluj.ro

Abstract: Using the logic type functions in the forming of the equations of some plane domains boundaries, it is formulated mathematically the solution of the partial derivative equation with boundary conditions. The possibility of the analytical expression of the complex form boundaries, suggests also large perspectives to use this method in many technical problems

Key Words: Logic type functions

Received: October 29, 2013

Automation
Computers
Applied Mathematics
ISSN 1221–437X
Vol. 22 (2013) no. 1
pp. 157–163

Relations between polynomial operators

Detlef Mache and Ioan Rasa

Detlef H. Mache: University of Applied Sciences TFH Bochum
WB 3 - Applied Mathematics (Constructive Approximation)
Herner Str. 45, D-44787 Bochum, Germany

mache@tfh-bochum.de

Technical University of Dortmund
Department of Mathematics
Vogelpothsweg 87, D - 44221 Dortmund, Germany

Detlef.Mache@math.tu-dortmund.de

Ioan Rasa: Technical University of Cluj-Napoca,
Department of Mathematics,
G. Baritiu Street, 25, Cluj-Napoca, Romania

ioan.rasa@math.utcluj.ro

Abstract: A sequence of positive linear operators (P_n), representing a link between Bernstein polynomials and Durrmeyer polynomials with Jacobi weights, was introduced by the first author in [3] and studied in [4]-[5]. In this paper we associate to the sequence (P_n) a simpler sequence (V_n), representing a link between Bernstein polynomials and certain Stancu polynomials. We investigate the properties of these sequences and the relationship between them.

Key Words: Positive linear operators, asymptotic formulae

MSC 2000: 41A36

Received: Oct 25, 2013

Automation
Computers
Applied Mathematics
ISSN 1221–437X
Vol. 22 (2013) no. 1
pp. 165–171

General Gamma approximating operators

Vasile Miheşan

Vasile Miheşan: Technical University of Cluj-Napoca, Department of Mathematics, 400020 Cluj-Napoca, Romania

Vasile.Mihesan@math.utcluj.ro

Abstract: By using the generalized gamma distribution we shall define a general linear gamma transform $\Gamma^{(a)}_{\alpha,\beta,\gamma}$, $a \in \mathbb{R}$ from which we obtain as special cases the generalized first kind transform. For different value of α, β, γ and a we obtain generalization of several gamma type operators studied in literature.

Key Words: Generalized Euler's gamma distribution, generalized gamma transform, positive linear operator

MSC 2000: 41A36

Received: November 1, 2013

Automation
Computers
Applied Mathematics
ISSN 1221–437X
Vol. 22 (2013) no. 1
pp. 173–179

On the companion interpolatory product quadratures

Alexandru I. Mitrea

Alexandru I. Mitrea: Technical University of Cluj-Napoca,
Department of Mathematics,
Str. Memorandumului nr. 28, 400114 Cluj-Napoca, Romania
alexandru.ioan.mitrea@math.utcluj.ro

Abstract: The main result of this paper highlights the phenomenon of double condensation of singularities, meaning unbounded divergence on large subsets of C and L^1 (in topological sense), for companion interpolatory product quadratures generated by a family of projection operators whose Lebesgue constants are unbounded.

Key Words: Product quadratures, projection operators, superdense set

MSC 2000: 41A10, 41A55

Received: Oct 30, 2013

Automation
Computers
Applied Mathematics
ISSN 1221–437X
Vol. 22 (2013) no. 1
pp. 181–187

On a Volterra integral equation with linear modifications of the arguments

Viorica Mureşan

Viorica Mureşan: Department of Mathematics
Technical University of Cluj-Napoca 28 Memorandumului Street
400114 Cluj-Napoca ROMANIA

vmuresan@math.utcluj.ro

Abstract: In this paper we consider a Volterra integral equation with linear modifications of the arguments. By using Picard operators' technique we obtain existence, uniqueness and data dependence results for the solution.

Key Words: Fixed point, Picard operator, functional-integral equation

MSC 2000: 34K05, 34K15, 47H10

Received: Nov 3, 2013

Automation
Computers
Applied Mathematics
ISSN 1221–437X
Vol. 22 (2013) no. 1
pp. 189–194

Relations between the homomorphisms of $(k+1)$-groups and the homomorphisms of their $(n+1)$-retracts

Vasile Pop

Vasile Pop: Universitatea Tehnică Cluj-Napoca, Str. Memorandumului 28, 400114 Cluj-Napoca, Romania

vasile.pop@math.utcluj.ro

Abstract: Let n and k be natural numbers. If k is a multiple of n, Dudek and Micholski [2] emphasized a functor from $(k+1)$-group category to the $(n+1)$-group category, by which to a $(k+1)$-group is associated a $(n+1)$-group called its retract. A part of relations between the morphisms of the two polyadic groups were previously studied by I. Corovei, I. Purdea, V. Pop [4], [5]. In this paper we complete these results, especially, by establishing the conditions under which a morphism between two retracts is also a morphism between the groups from which they derive.

Key Words: n-groups, morphisms, reduced group, retract group

MSC 2000: 20N15

Received: October 12, 2013

Automation
Computers
Applied Mathematics
ISSN 1221–437X
Vol. 22 (2013) no. 1
pp. 195–202

Discrete Morse-Smale characteristic of a simplicial complex

Vasile Revnic

Vasile Revnic: Babeş-Bolyai University,
Faculty of Mathematics and Informatics, Cluj-Napoca, Romania
revnicvasile1@yahoo.com

Abstract: In this paper, we quickly review some basic facts from discrete Morse theory, we introduce the Morse-Smale characteristic for a finite simplicial complex and we give examples of exact discrete Morse functions on torus with two holes and Dunce hat.

Key Words: finite simplicial complex, discrete Morse function, exact discrete Morse function, discrete Morse-Smale characteristic, torus of genus 2, Dunce hat

MSC 2000: 57Q99, 57R70, 58E05

Received: October 31, 2013

Automation
Computers
Applied Mathematics
ISSN 1221–437X
Vol. 22 (2013) no. 1
pp. 203–206

On parabolic subalgebras of inverse-symmetric algebras

Constantin-Cosmin Todea

Constantin-Cosmin Todea: Technical University of Cluj-Napoca
Department of Mathematics,
Str. G. Bariţiu, nr.25, 400027, Cluj-Napoca, Romania

Constantin.Todea@math.utcluj.ro

Abstract: In this short paper we prove a theorem which gives conditions to construct parabolic subalgebras of a class of symmetric algebras, called inverse-symmetric algebras. This class was defined and analyzed by the author in a recent article. An example of parabolic subalgebra is also given.

Key Words: symmetric algebra, inverse semigroup, parabolic subalgebra

MSC 2000: 16E40, 20J06, 20C05

Received: June 30, 2013