7th Symposium on

"Computational Complexities, Innovations & Solutions"

07-08, May 2012

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The department organized an international conference in June 2003. The conference focused on theoretical and computational fluid dynamics. More than 200 renowned scientists from all over the world including 7 International speakers attended this conference and more than 28 talks were delivered. Under continuous series of International Conferences department is gathering eminent scientists from all over the world.

In 2005 the department also organized One day workshop on Computational and Industrial Mathematics chaired by the well-known Prof. Dr. Q.K. Ghori and three scientists from research organizations shared their knowledge.

A series of Two days symposia on "Computational Complexities, Innovations and Solutions (CCIS)" was held in the department of Mathematics, COMSATS Institute of Information Technology, Abbottabad, under the umbrella of TechnoMoot in 2006, 2007, 2008, 2009 , 2010 and 2011.

The primary objective of the current symposium is to bring together computational scientists from all fields of the traditional sciences, i.e., Mathematics, Physics, Chemistry, Biology, Medicine and all branches of Engineering in order to share methods and ideas to regroup original contributions from these fields.

ABSTRACTS

A Cardless Authorization and Charge System

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Abstract:

Credit and charge cards are the backbone of present-day financial transactions. Different banks, stores and companies issue their cards, creating a mess in the wallet. To integrate all services into one card, adding more services on demand, a cardless authorization and charge system is proposed. This system, bring a charge system and not a credit system, conforms to *Islamic Shariah* (juridical rules of Islam), because it is free from interest. This system is sufficient for all services, *e. g.*, travel (ticketing, car rental — client's preferences stored in data-base), banking transactions, cash advance, LIFENET (one phone call connects to family doctor, police, immediate relative/close friend, making available the patient database, containing history, current illnesses, medications and allergies, to the physician — computer system, automatically, tracing the number from where the call is made), message service (call forwarding, fax service on-the-go, express and priority mail forwarding service, courier service), bill-payment service (telephone, utility, house rent, while the client is traveling), telephone card, (optional) photo-identification card (scanned signature, photograph and bar code on card — CITI Visa included photograph and scanned signature following a suggestion, to country manager, by the first author), child-registration (which will help locate the law-enforcing agencies in case of abduction, accidental separation and medical emergencies) and security service for home (while is client is traveling). There is, therefore, no need to carry a bunch of cards. All the above services are accessible through one, easy, toll-free number and there is option to obtain on-screen information using laptop or blackberry. There are enhanced security features by requiring PIN (Personal Identification Number) for all transactions, generated through mathematical codes utilized in cipher technologies. Combined with the stereographic identifications system (employing edge-based moiré fringe topography and edge-based rastersterography), presented the first author in 2008, the cardless system could be used for identification, transactions, travel, security and health services. Mathematical techniques needed to implement this system include graph theory, logic and queuing theory.

Keywords: Services on demand, universal card, identification, security, travel

Uniform Exponential Stability for Discrete Non-Autonomous Systems via Discrete Evolution Semigroups

CONSTANTIN BUS E, AFTAB KHAN, GUL RAHMAT AND AFSHAN TABASSUM

Abstract:

We prove that a discrete evolution family

$$\mathcal{U} = \{U(m,n)\}_{m \geq n \in \mathbb{Z}_+}$$

of bounded linear operators acting on a complex Banach space X is uniformly exponentially stable if and only if it is admissible in respect to the pair $(c_{00}(\mathbb{Z}_+, X), c_{00}(\mathbb{Z}_+, X))$, (i. e. the sequence $n \mapsto \sum_{k=0}^{n} U(n,k) f_k : \mathbb{Z}_+ \to X$ belongs to $c_{00}(\mathbb{Z}_+, X)$ for each $(f_k) \in c_{00}(\mathbb{Z}_+, X)$). The approach is based on the theory of discrete evolution semigroups associated to such families.

Key words and phrases. Non-autonomous discrete problems; discrete evolution families of bounded linear operators, discrete evolution semigroups, spectrum of bounded linear operators.

A NEWTON-TYPE LEVEL-SET METHOD FOR MINIMIZATION OF THE PIECEWISE CONSTANT MUMFORD-SHAH FUNCTIONAL FOR X-RAY TOMOGRAPHY

KUNWAR M. A. MERAJ† AND W. RING*

ABSTRACT. In this work the classical two-dimensional X-ray tomography problem modeled by the Radon transform is discussed. The problem of incomplete data or the adjustments to the concrete scanning geometry which are necessary in real world situations have not been accounted for in this work. The problem of simultaneously inverting the Radon transform and segmenting the density distribution into homogeneous regions directly from the sinogram data have been focused upon. Mumford-Shah like model for piece-wise constant densities has been used. The segmenting curves are described by a suitable level-set function and the problem of optimal adjustment of the curves to the actual contours of objects in the density distribution is achieved combining shape sensitivity techniques with level-set based transport of geometrical object. The novel contribution of this work is the use of second order shape sensitivity analysis to construct a Newton-type descend direction for the solution of the resulting shape optimization problem.

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A numerical assessment of convection diffusion type parabolic partial differential equations using Haar and Legendre wavelets

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Abstract

In this paper we present two new numerically stable methods based on Haar and Legendre wavelets for one-dimensional parabolic partial differential equations (PPDEs). This work is the extension of the studies [14, 27, 28]. Two generic numerical algorithms are being proposed in two phases. In the first stage a numerical algorithm is derived by using Haar wavelets and then in the second stage Haar wavelets are replaced by Legendre wavelets in quest for better accuracy. In the proposed methods the time derivative is approximated using first order forward difference operator and space derivatives are approximated using Haar (or Legendre) wavelets. Performance of the Haar wavelets collocation method (HWCM) and Legendre wavelets collocation method (LWCM) are compared with the most recent methods reported in the literature. Improved accuracy is obtained in the form of wavelets decomposition. The solution in this process is first obtained on a coarse grid and then refined towards higher accuracy in high resolution space. Accuracy wise performance of the LWCM is better than HWCM for problems having smooth initial data or having no shock phenomena in the initial conditions. A distinctive feature of the proposed methods is its simple applicability for a variety of boundary conditions.

Keywords

Haar wavelets, Legendre wavelets, Parabolic partial differential equations, Convection-diffusion problem, Numerical methods, Collocation methods.

On classification of Commuting Graphs of Semi Groups

Ajmal Ali

Abstract:

Let S be a finite non-commutative semi group. The commuting graph of S, denoted by G(S), is the graph whose vertices are the non-central elements of S and whose edges are the sets {a, b} of vertices such that a ≠b and ab = ba.It is an open problem how can one classify the commuting graphs of semi groups. We give a partially answer of it by finding

some semi groups of bipartite graph, sunflower like graph, polygonal chain graph and almost complete graph.
Moreover, we find **left path** in the commuting graph of complete bipartite graph and found that the maximum length of this path is 2m-2 for some even positive number n.

Monotone Surface Data Visualization

Danish Zaidi

Abstract:

A rational cubic function has been extended to the rational bi-cubic partially blended function to preserve the shape of monotone data in view of the monotone surfaces. Simple data dependent constraints are derived on free parameters in the description of rational bi-cubic partially blended function to preserve the shape of monotone regular surface data. The developed scheme not only preserves the shape of data but it also provides freedom to refine it.

Keywords: Rational Function, rational bi-cubic partially blended function, free parameters, monotone surfaces.

Quartic non polynomial Spline Solution of third order singularly perturbed boundary value Problem

Imran Talib

Abstract:

In this paper, the third order self-adjoint singularly perturbed boundary value problems are treated. A generic numerical approach based on non-polynomial spline is presented to solve such boundary value problems. The end conditions are derived in terms of not only first derivative but second derivative as well. The present method shows less computational difficulties and yields better approximated results as compared to other approximation methods. Convergence analysis of the non-polynomial spline solution is discussed, and the method preserves second-order convergence. Two examples are considered to support the theoretical results of the presented method. The order of the method is improved using the improved end conditions and it is observed that the method preserves the fourth order convergence.

Optimal Balls In Hölder Spaces For Schauder Fixed-Point Theorem In The Plane

Dr. Muhammad Sajid Iqbal

Abstract:

The article deals with the existence of solutions of the boundary value problems for non-linear elliptic partial differential equations in the closure of domains in the plane with sufficiently smooth boundaries. Schauder fixed-point theorem is the key method to show the existence of solutions in the Banach space of Hölder continuously differential functions. Schauder estimates and maximum principles are applied to estimate the solution of linear elliptic differential equations. To get a-priori estimates the balls (closed and convex subset) in the Banach space are considered. Further the article covers the optimization to get the best results such as the minimum restriction on the boundary values. Important stage is the relative compactness of the fixed-point operator.

Keywords: Elliptic partial differential equations, optimization, relative compact operator

Gravitational Collapse in Higher Dimensional Charged-Vaidya Spacetime

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Abstract:

In this paper, the gravitational collapse in higher dimensional charged-Vaidya spacetime is investigated. The nature of the singularity is determined by considering the behavior of non-spacelike geodesics originating at the singularity. The effects of charge on the collapse are discussed.

Commuting Graph of Dihedral Type Groups

Dr. Zahid Raza, Shahzad Faizi

Status: Recently accepted in WAS (World Applied Sciences journal of scientific research) but not published yet.

Abstract:

For a non-abelian group G and a subset X of G, we define the commuting graph, denoted $\Gamma(X)=C(G,X)$, to be the graph whose vertex set is X with two distinct vertices $x,y \in X$

joined by an edge if and only if xy=yx. In this paper, certain properties of commuting graphs constructed on the dihedral type groups D_2n with respect to some specific subsets are discussed. More precisely, the chromatic number and clique number of these commuting graphs is obtained.

Dynamics Of Viscous Dissipative Plane Symmetric Gravitational Collapse

M. Sharif and Zakia Rehmat

Abstract:

Dynamical description of gravitational collapse in view of Misner and Sharp's formalism is presented. Matter under consideration is a complicated fluid consistent with plane symmetry which we assume to undergo dissipation in the form of heat flow, radiation, shear and bulk viscosity. Junction conditions are studied for a general spacetime in the interior and Vaidya spacetime in the exterior regions. Dynamical equations are obtained and coupled with causal transport equations derived in context of Muller Israel Stewart theory. The role of dissipative quantities over collapse is investigated.

Key words: Gravitational collapse; Dissipation; Junction conditions; Dynamical equations; Transport equations.

Stagnation Point Flow Of Burgers' Fluid Over A Stretching Surface

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Abstract:

The steady flow of an incompressible Burger fluid near a stagnation-point over a linearly stretching surface is investigated. The two-dimensional flow equations are modelled and then simplified by employing boundary layer analysis. The solution to the arising nonlinear problem is computed in the whole spatial domain ($0 \leq \eta < \infty$). Interpretation of various emerging parameters is given through graphs for velocity and temperature fields. Furthermore tables are constructed in order to make a comparative study with the previous published results. Comparison shows an excellent agreement with the previous limiting investigations in the field

Approximate analytic solution for magneto-hydrodynamic flow of a non-newtonian fluid over a vertical stretching sheet

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Abstract:

In this article a rigorous mathematical analysis is given for a magnetohydrodynamic flow and heat transfer of a power law fluid over a vertically stretching surface. Flow phenomenon is model in a coupled partial differential equations, which are transformed to a system of ordinary differential equation by similarity transformation. The analytic solutions of the resulting non-linear ordinary differential equations are found through HAM. The effects of the thermal radiation and other significant parameters on the velocity and temperature profiles are examine in detail, local skin friction coefficient and Nusselt number are provided in tabular form.

Numerical Solution Of Linear And Nonlinear Integro-Differential Equations Based On Haar Wavelaets

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Abstract:

Based on Haar wavelets two new algorithms are proposed for the numerical solution of Fredholm and Volterra integro-differential equations. The proposed methods are generic and are applicable to all types of both linear and nonlinear Fredholm as well as Volterra integro-differential equations of second kind. These methods are designed to exploit the special characteristics of Haar wavelets both in one- and two-dimensions. Contrary to other numerical methods, the advantage of our method is that it does not involve any intermediate numerical technique for evaluation of integral present in integro-differential equations. The methods are validated on test problems and numerical results are compared with existing methods in the literature. The numerical results indicate that the accuracy of the obtained solutions is quite high even when the number of collocation points is small.