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Characterization of P-Compactly Packed Modules Over Non-Commutative Rings

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Abstract. Let R be a non-commutative ring with 1, and M is a (left) R–module. We introduce the concept of primary submodule over non commutative ring as: A proper submodule N of an R-module M is said to be primary submodule if $N \neq 0$ and $rann(N) = rann(\overline{N})$ for each $\overline{N} \subseteq N$. We list some basic properties of this concept.
We also defined the concept of p-compactly packed submodule over non-commutative ring as: A proper submodule N of an R-module M is said to be p-compactly packed submodule if $N \neq 0$ and for each family $\{N_\alpha\}_{\alpha\in\Lambda}$ of primary submodules of M with $N \subseteq \bigcup_{\alpha\in\Lambda} N_\alpha$ there exist $\beta \in \Lambda$ such that $N \subseteq N_\beta$. We study some various properties of p-compactly packed submodule over non-commutative ring.

Keywords: radical annihilator of an R-module, prime submodule over non commutative ring, primary radical of a submodule over non-commutative ring, p-compactly packed submodule, Bezout module.

Data Compression and Data Classification

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Abstract— Clustering by compression is a powerful tool that uses compression information to classify digital objects and that does not rely on any knowledge or theoretical analysis on the problem domain but only on general-purpose compression techniques. In this paper we review the clustering by compression approach and show some testing results we have obtained.
Keywords—data compression, clustering, classification.

Cache-cache elements preconditioning technique for solving large-scaled nonlinear mechanic problems

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Abstract:
We consider Krylov subspace methods for solving linear systems of equations which stem from large-scaled nonlinear mechanic problems by cache-cache elements method on parallel computer with distributed memory. For speed-up of parallel computation, it is necessary to shorten the communication time among processors. However, in parallelized Krylov subspace methods, global synchronization points for inner products cause increment of communication time. Thus, we created the strategy for reduction of synchronization points of parallel Krylov subspace methods. We transform the computation of a certain parameter to reduce the number of synchronization points of various Krylov subspace methods per one iteration.

In our talks, we apply this strategy to three-term recurrence and propose parallel BiCGMisR method as the effective solver by means of ``cache-cache'' in French (it means ``hide and seek'' in English) elements method suited to parallel computer with distributed memory. Furthermore, through several numerical experiments, we make clear that parallel BiCGMisR method outperforms other methods from the viewpoints of both elapsed time and speed-up on parallel computer with distributed memory.

Outer Approximation of the Set of Hurwitz Polynomials[†]

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Abstract

Let a monic polynomial $p(s) = s^n + a_n s^{n-1} + \ldots + a_2 s + a_1$ be given. This polynomial can be identified with the point $p = (a_1, a_2, \ldots, a_n)^T \in \mathbb{R}^n$. Hurwitz stable polynomial is a polynomial with roots lying in the open left half of the complex plane. A necessary but not sufficient condition for stability is that all of $a_1, a_2, \ldots, a_n$ are positive. It is well known that the set of Hurwitz vectors p is open, unbounded and nonconvex [1, 2].

In this report we approximate the open-left half plane by the half disc $\Omega = \{z : |z| < r \;\; Rez < 0\}$, where r is sufficiently large and consider Ω-stability problem instead of Hurwitz stability [3]. It is shown that the set of Ω-stable vectors $p = (a_1, a_2, \ldots, a_n)^T \in \mathbb{R}^n$ is finite-generated, that is the convex hull of this set is a polytope with known extremal points. This set is an outer approximation of the Hurwitz set. In the report an application of this result to stability problem for continuous-time systems is considered. Namely, consider a family of parametrized n th order monic polynomials $p(s, c)$ with uncertainty parameter $c \in Q \subset \mathbb{R}^l$, where Q is a box and $p(s, c)$ depends on the parameter c linearly [4]. Is there exist c such that the obtained polynomial $p(s, c)$ is stable? Such c is called a stabilising parameter. In the report some condition for the existence such c are obtained. Number of numerical examples are considered.

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A matrix that generates the point spectral of the Riemann Zeta function

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Abstract

This work presents some meromorphic functions which have the same results as the Riemann zeta function. Matrix representations of these functions are also obtained through which the general form of the point spectral and the trace of the Riemann zeta function were generated. The Riemann Zeta function and its Analytic Continuation function are presented as function with real and imaginary parts. By this The Riemann Zeta function and its Analytic Continuation function are transformed into their Matrices equivalents. We are also able to valuate $\zeta(z)\overline{\zeta(z)} = \varphi^2(t) + \rho^2(t)$. By writing $\zeta(z)\overline{\zeta(z)}$ as a bilinear function, and through the use of Sobolev Space theorem, an optimization problem with a variable coefficient is derived. Some methods of solution are presented.

Keywords: Meromorphic, Riemann Zeta function, Matrix Sobolev Space, Spectral Point, Trace

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Stochastic fractal interpolation function with variable parameter

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The classical methods of real data interpolation can be generalized with fractal interpolation. This paper study the fractal interpolation function in the case when the scaling parameter is a variable parameter. Let the pair $\{X, F\}$ be an Iterated Function System. Also consider a data set (x_i, y_i), with strictly increasing abscissae. Let $I = [x_1, x_n], I_i = [x_i, x_{i+1}]$, for $i \in \mathbb{N}_{n-1} = \{1, 2, ..., n-1\}$ and $L_i : I \to I_i$ be contraction homeomorphisms such that $L_i(x_1) = x_i, \quad L_i(x_n) = x_{i+1}$. Suppose that $0 \leq \omega_i < 1$ for $i \in \mathbb{N}_{n-1}$ and consider continuous maps $F_i : I \times \mathbb{R} \to \mathbb{R}$ satisfying

$$F_i(x_1, y_1) = y_i, \quad F_i(x_n, y_n) = y_{i+1},$$

$$|F_i(x, y) - F_i(x, Y)| \leq \omega_i |y - Y|, \; x \in I, y, Y \in \mathbb{R}.$$

The IFS used in the study of fractal interpolation functions starts form the following maps: $L_i(x) = a_i x + b_i, \quad F_i(x, y) = \alpha_i y + q_i(x)$, where $\alpha_i, i \in \mathbb{N}_{n-1}$ is a variable parameter with the values in the interval (-1,1). In this case we will study the existence of the stochastic fractal interpolation function.

Keywords: Iterated function system, Fractal function, Fractal interpolation, Stochastic fractal function.

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On Stabilization of Discrete Time Systems[†]

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Abstract

Given a monic polynomial $p(s) = s^n + a_n s^{n-1} + a_{n-1} s^{n-2} + \ldots + a_2 s + a_1$ which corresponds to n-dimensional vector $p = (a_1, a_2, \ldots, a_n)^T$. The polynomial $p(s)$ is called Schur stable if all roots of the polynomial $p(s)$ lie in the open unit disc of the complex plane. Schur stability plays an important role in the stability of discrete time systems [1]. It is well known that the set of Schur stable vectors p is a finite-generated set in the n-dimensional space, that is its convex hull is a polytope with known extreme points [2].

We consider the application of this property for stabilization of a discrete-time single-input single-output system. Consider a transfer function $G(z) = \dfrac{g(z)}{f(z)}$, and a controller $C(z) = \dfrac{q(z,c)}{p(z,c)}$ where $c = (c_1, c_2, \ldots, c_l)^T \in \mathbb{R}^l$ is the uncertainty vector which enters linearly in the numerator and denominator. The corresponding closed loop system has characteristic polynomial $a(z,c) = f(z)p(z,c) + g(z)q(z,c)$. The problem is determination the values of the parameters c such that the polynomial $a(z,c)$ is Schur stable. This c is called a stabilising vector. This problem has been considered in the works [3, 4].

In this report we consider this problem from the convex analysis point of view. Conditions for the existence of a stabilising vector are obtained. By using linear programming the minimal box of the uncertainty vectors is determined. Number of examples are considered.

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The mixed Dirichlet-Robin problem for the lid-driven cavity flow problem

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Abstract

The purpose of this work is the mathematical analysis of the mixed Dirichlet-Robin boundary value problem for the nonlinear generalized Darcy-Brinkman system in a bounded Lipschitz domain, when the boundary data belong to some L^2-based Sobolev spaces, and the application of the corresponding results to the study of a well-known model, i.e., the lid-lid driven flow problem of an incompressible viscous fluid located in a two-dimensional square cavity filled with a porous medium. First we obtain a well-posedness result for the linear Brinkman system with Dirichlet-Robin boundary conditions, when the boundary data belong to L^2-based Sobolev spaces. Further, we consider a special nonlinear Darcy-Brinkman boundary value problem of Dirichlet and Robin type, obtained by adding to the Brinkman equation the nonlinear term $\mathbf{u} \cdot \nabla \mathbf{u}$ of the Navier-Stokes equation. Next, we analyze from the numerical point of view a special Dirichlet-Robin boundary value problem for the generalized Darcy-Brinkman system, i.e., the lid-driven problem associated with such a nonlinear system. We obtain the streamlines of the fluid flow for different Reynolds and Darcy numbers. Moreover, we study the behavior of the flow with respect to an additional sliding parameter imposed on the moving wall.

Keywords: Generalized Darcy-Brinkman system, Lipschitz domains, layer potential operators, existence and uniqueness results, lid-driven problem

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Linear Programming Technique and Goal Optimization- A Case Study of Ice Cream Manufacturing Unit

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Abstract
Most of the non-profit organisations generally follow non standardised costing mechanism. No specific method constitutes the basis for determination of their cost structure. Development of standardised cost structure based on scientific method is highly essential for any organisation irrespective of the nature and scope.
Linear Programming helps in optimal utilization of various existing factors of production such as installed capacity, labour availability, supply of raw materials, and such other factors. Linear programming as an optimisation tool has been in use over centuries in the supply chain operations in manufacturing organisations. Supply chain planning, to a large extent, starts with forecasting. Matching supply and demand is an important goal for most of the firms and is at the heart of operational planning.
In this context, the current study focuses on formulating a scientific cost structure pertaining to ice cream producing units, applying linear programming technique. The designed cost structure thus can be used as a standardised measure in all ice cream manufacturing units of small and medium firms, for optimising the goals.

Keywords: Linear, cost, demand forecasting, constraints, Scientific, Supply chain.

Geodesics on the Sierpinski Gasket with respect to the intrinsic metric: An algorithm to calculate the distance

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Abstract

The Sierpinski Gasket (also known as the Sierpinski Triangle) is one of the most important fractals. In the literature there exist some works to compute the shortest distance between any two points of the discrete Sierpinski Gasket (see [3] and [4]). We explicitly define the intrinsic metric on the Sierpinski Gasket by which we determine the geodesics on SG. In order to describe the points on the Sierpinski Gasket there is a particular way so-called code space. We classify its geodesics due to this code space representation of the Sierpinski Gasket. In this work, we also present a source code of an algorithm, written by using the mathematical software Maple 18, which gives the distances between any two points of the Sierpinski Gasket with respect to the intrinsic metric. We then easily determine the geodesic classification of points on the Sierpinski Gasket by this algorithm.

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Graph-Directed Affine Fractal Interpolation Functions

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Abstract

It is known that there exists a function interpolating a given data set such that the graph of the function is the attractor of an iterated function system which is called fractal interpolation function [1]. These functions have been widely used in various fields such as approximation theory, image compression, modeling of signals and in many other scientific areas [4],[6]. We generalize the notion of fractal interpolation function to the graph-directed case and prove that for a finite number of data sets there exist interpolation functions each of which interpolates corresponding data set in $\mathbb{R}^2$ such that the graphs of the interpolation functions are attractors of a graph-directed iterated function system.

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