CHAPTER 28

MATHEMATICAL SCIENCES
MATHEMATICS

Doctoral Theses

01. BANSAL (Ashish)
Heisenberg Inequality and Uncertainty Principles on Locally Compact Groups.
Supervisor : Prof. Ajay Kumar
Th 23048

Abstract
(Not Verified)

The various mathematical aspects of the uncertainty principle include Heisenberg inequality, qualitative uncertainty principle (QUP), Hardy's theorem, etc. The Fourier transform is commonly used for analyzing the frequency properties of a given signal. After transforming a signal using Fourier transform, the information about time is lost and it is hard to tell where a certain frequency occurs. So there is a necessity of a joint time-frequency analysis. In recent times, Gabor transform is one of the tools that have established themselves in this direction. In this thesis we study Heisenberg inequality and other uncertainty principles such as QUP and Hardy's theorem for Fourier transform and Gabor transform on a variety of locally compact groups. In Chapter 1, some basic notations and terminology related to the representation theory of locally compact groups are given. Heisenberg inequality for Fourier transform on locally compact groups such as $R^n \times K$, Euclidean motion group, $K \ltimes R^n$ and several classes of nilpotent Lie groups is established in Chapter 2. In the next chapter, the Heisenberg inequality for Gabor transform on classes of groups of the form $K \ltimes R^n$ is proved. The chapter 4 includes a necessary and sufficient condition for a second countable, locally compact, abelian group to have QUP for Gabor transform. We also prove the QUP for Gabor transform on certain group extensions. A weaker version of QUP for Gabor transform in case of compact groups has also been discussed. In the last chapter, we prove analogue of Hardy's theorem for Gabor transform on locally compact abelian group, Euclidean motion group and several general classes of nilpotent Lie groups. Lastly, there is an appendix containing visualizations of Gabor transform and verifications of Heisenberg uncertainty inequality for certain well-known functions using software Wolfram MATHEMATICA

Contents

02. BATRA (Rakesh)
Coincidences and Fixed point Theorems on Metric Spces.
Supervisor : Dr. Sachin Vashistha
Th 22767

Abstract
(Verified)

A point $x \in X$ is called a coincidence point of mappings $T:X \to X$ and $g:X \to X$ if $Tx=gx$ and if $Tx=x$ then x is called a fixed point of T. A point $(x,y) \in X \times X$ is said to be a coupled coincidence point of mappings $F:X \times X \to X$ and $g:X \to X$ if $F(x,y)=gx$ and $F(y,x)=gy$ and if $F(x,y)=x$ and $F(y,x)=y$ then (x,y) is called a

coupled fixed point of F. $F : X\times X\to X$ is said to follow mixed g-monotone property if for any $x,y\in X$, $x_1, x_2\in X$, $gx_1\leq gx_2 \Rightarrow F(x_1, y) \leq F(x_2, y)$ and, respectively, $y_1, y_2\in X$, $gy_1\leq gy_2 \Rightarrow F(x, y_1)\geq F(x, y_2)$. Coupled coincidence point theorems under c-distance in cone metric space X for functions $F:X\times X\to X$ and $g:X\to X$ under mixed g-monotonicity both for weak contractions with constant coefficients as well as with variable coefficients are proved. Work is further generalized for a cone metric space having an (F,g)-invariant subset. Later, the concept of an F-contraction is generalized to an F_w-contraction and a fixed point theorem for an F_w-contraction on a complete metric space equipped with a w-distance is proved. Fixed point theorems under discontinuous control functions are proved and applications of the theory to coupled coincidences and integral equations are provided. The theory is developed for an F-G-contraction on a metric space endowed with a graph G and thereafter the work is extended by introducing the concept of a (p,F,G)-contraction which is a w-distance version of an F-G-contraction.

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03. CHHABRA (Anu)
Newer Families of Optional Unrelated Question RRT Models
Supervisor : Prof. B. K. Dass and Prof. Sat Gupta
Th 22769

Abstract
(Verified)

The thesis is devoted to the study of Optional Unrelated Question RRT models. In optional models, there are two parameters of interest, the underlying sensitivity level (the proportion of respondents who consider the research question sensitive), and the proportion of respondents who possess the sensitive characteristic for binary case and the mean of sensitive variable for quantitative case. To estimate these two parameters, Gupta et al. (2013) uses the split-sample approach, where in each sample the respondent reports the true answer if they feel the research question is not sensitive to be answered directly in face-to-face survey otherwise, they can give the scrambled response using Greenberg et al. (1969) model for binary response and Greenberg et al. (1971) model for quantitative response. Different scrambling devices are used in the two sub-samples. The main motivation for this work is to avoid the split-sample approach when dealing with optional RRT models. The split-sample approach requires unnecessarily larger total sample size.

Contents

04. DATT (Gopal)
Normal Familie in One and Several Complex Variables: Looking Through Zalcman's Lemma.
Supervisor : Dr. Sanjay Kumar
Th 22768

Abstract
(Not Verified)

This thesis work carries out a systematic study of the notion of normal family in complex analysis of one and several variables. Normality is a concept lying at the very heart of the subject, weaving a line of thought through Picards's theorem, Schottky's theorem, and the Riemann mapping theorem, to many

modern results on meromorphic functions via Bloch principle. Moreover, it features in the study of holomorphic (iterative) dynamical system in one or more complex variables. The key point of our research is that the families F that arise in our work can be viewed as families of meromorphic maps taking values in N-dimensional complex projective space ℂP^{N}, N≥1, which is not hyperbolic. Our approach to normality is via techniques of shared values or functions in plane domains, and by shared moving hypersurfaces in several complex variables. The Zalcman Lemma is one of the main ingredients in the proofs of several results proven by us. While the best-known criteria for normality of families of holomorphic maps are easy to state, they can be hard to check in many situations. The Zalcman Lemma and its various generalizations to higher dimensions represent, as sufficient conditions for normality, perhaps the best trade-off between being restrictive and being checkable. There is, therefore, interest in determining when a complex manifold X, with dimension at least 2, admits a Zalcman-type criterion for families of X-valued holomorphic maps.

Contents

05. DUBEY (Shivani)
Boundary Value Problems for the Kohn-Laplacian on the Heisenberg Group Hn
Supervisors : Prof. Ajay Kumar and Ass. Prof. Mukund Madhav Mishra
Th 22770

Abstract
(Not Verified)

A boundary value problem (BVP, for short) consists of a deferential equation Lu = f with boundary conditions of the form Bu = h. The pair (f; h) is known collectively as the data for the problem, and u is the response to be determined. The boundary value problems have much broader utility in other streams of sciences, especially in branches like electromagnetics, thermodynamics and fluid mechanics of physics. A boundary condition which specifies the value of the function itself is a Dirichlet boundary condition, or first-type boundary condition and a boundary condition which specifies the value of the normal derivative of the function is a Neumann boundary condition, or second-type boundary condition. The Heisenberg group Hn is one of the simplest examples of a non commutative Lie group and the Heisenberg sub-Laplacian also known as the Kohn-Laplacian can be viewed as a generalization of the Laplace-Beltrami operator. The rich geometric structure of the Heisenberg group allows us to construct explicit examples of domains to perform the study of boundary value problems there. In the present thesis, we have made some contributions to boundary value problems in the Heisenberg group Hn. We determine the explicit expression of Green's function and Poisson kernel for certain bounded and unbounded domains by using infinitely many reflections technique which was introduced by Courant and Hilbert for annulus in C. We have obtained a necessary and suffcient condition for the solvability of the Neumann problem for the Kohn-Laplacian on the Heisenberg group Hn. Neumann function for the Koranyi ball is given for circular functions only in order to solve the inhomogeneous Neumann problem. We have discussed the solvability of polyharmonic Neumann problem and polyharmonic mixed boundary problems by reduction method.

Contents

06. GAUTAM (Pragati)
Quasi-partial b# Metric Spaces and Fixed Point Theorems.
Supervisor : Dr. Anuradha Gupta
Th 23175

Abstract
(Verified)

Fixed point theory is a highly rich, interesting and an applied branch of Mathematics. The results related to the existence and uniqueness of fixed points are known as fixed point theorems. Banach contraction principle marked the beginning of metric fixed point theory and became a popular tool in solving existence problem in mathematical analysis. In history, the origin of fixed point theorem is attributed to the work on differential equations by the French Mathematicians Poincare and Picard. Various generalizations of this theorem were proved by Hadamard and Brouwer. A range of generalizations of metric spaces and Banach contraction Principle followed thereafter. Bakhtin introduced b-metric spaces and proved fixed point results. Matthews gave the notion of partial-metric spaces. Later Shukla generalized both the concepts of b-metric and partial-metric spaces and thus introduced partial b-metric spaces. The concept of a quasi-partial-metric space was given by Karapinar et al. Motivated by these researches, the present work introduces the notion of quasi-partial b-metric spaces and studies fixed point results on it. The topological properties of the quasi-partial b-metric space have been studied thoroughly. Coupled and tripled fixed point theorems on quasi-partial b-metric spaces have also been studied and even when the space is generalized from one to two.The first chapter provides the basics, definitions, notations and terminologies which have been used throughout. Chapter two focuses on the topological structure of the quasi-partial b-metric spaces and fixed point theorems on them. Chapter three deals with the results which are further verified for coupled fixed point theorems. The concept of quasi-partial b-metric spaces has further been generalized to two quasi-partial b-metric spaces in Chapter four and tripled fixed point theorem is proved with illustrative examples.

Contents

07. GUPTA (Ankit)
Generalized Structures Concerning Regularity, Normality and Function Space Tropology.
Supervisor : Dr. Ratan Dev Sarma
Th 23049

Abstract
(Verified)

The thesis deals with the study of generalized structures concerning regularity, normality and function space topology. It consists of seven chapters. Chapter two to Chapter four deal with the generalized form of open sets and we study generalized notions of regularity and normality as well. Chapter five to Chapter seven deal with generalized structures on function space topologies. The chapter-wise organization of the thesis is as follows: Chapter One is an introductory chapter contains notations and terminologies related to normality and function space topologies. Chapter Two deals with a new generalized form of regular open sets called PS-regular sets. Chapter Three includes investigations on new types of separation axioms which are obtained from the notion of PS-regular sets and are called PS-regularity and PS-normality respectively. Decomposition of normality and PS-regularity are discussed with the help of PS-normality. In Chapter Four, a unified theory regarding normality for GTS are provided. The two most important results on normality - Urysohn's lemma and Tietze extension theorem also hold good for (λ,μ)-normality. After this, Chapter Five introduces function space topologies for the class of (μ,ν)-continuous mappings on generalized topological spaces. Various topologies, such as (μ,ν)-topology, point-open topologies etc. are defined and studied. Chapter Six deals with topologies on the class of continuous multifunctions. The theory of net of sets for the continuous convergence of multifunctions are developed. We further continue our work for the class of equi-continuous mappings from a topology to a uniform space. The last chapter, Chapter Seven deals with this type of topologies. Admissibility and splittingness for such spaces are defined characterized. We have also introduced the concept of dual pair for $C_M(Y,Z)$ and EC(Y,Z) and establish the relationships between the space and its dual.

Contents

1. Introduction 2. PS- Regular sets in topology and generalized topology 3. PS-Regularity and ps-normality in topology 4. A uniform approach normality for topological spaces 5. Function space topologies for generalized topological spaces 6. Function space topologies for multifunctions 7. Topologies for equi-continuous mappings. References. List of symbols. Index.

08. GUPTA (Chavi)
Intuitionistic Fuzzy Linear Programming Problems and Sensitivity Analysis.
Supervisor : Dr. Shashi Aggarwal
Th 23176

Abstract
(Not Verified)

The purpose of this thesis is to study various kinds of intuitionistic fuzzy optimization problems. This thesis comprises of five chapters that are summarized as under. Chapter 1 is introductory in nature and devoted to various mathematical preliminaries, which are used in subsequent chapters of the thesis.Chapter 2 focuses on Generalized Trapezoidal Intuitionistic Fuzzy Numbers (GTrIFN), Symmetrical IFNs and introduces p-norm GTrIFN. In literature, there are various methods to rank different kinds of triangular or trapezoidal IFNs, but with several restrictions imposed on them. In contrast to this, we have proposed new ranking methods without any such restrictions on them. Chapter 3 revolves around the applications of the ranking methods proposed in the previous chapter of this thesis to develop algorithms for solving intuitionistic fuzzy linear programming problems. Further, each of the algorithms is followed by a numerical example to illustrate the proposed approach and the efficiency of the proposed method over existing methods in the literature. Chapter 4 focuses on sensitivity analysis. It presents sensitivity analysis for Intuitionistic Fuzzy Linear Programming Problem (IFLPP) and Intuitionistic Fuzzy Solid Transportation Problem (IFSTP). Two major research problems considered in this chapter are:(1) Sensitivity analysis for IFLPP: The concept of sensitivity analysis is generalized in IFLPP. Numerical examples are solved to illustrate the proposed approach. In literature, there is no tool for performing sensitivity analysis for such kind of problem.(2) Type II sensitivity analysis range for IFSTP/STP: Here, Type II sensitivity analysis ranges for cost coefficients and R.H.S. parameters of the constraints of IFSTP/STP are computed. Chapter 5 deals bi-level linear programming problem with multiple objectives at each level in intuitionistic fuzzy environment. In this problem, technological coefficients and resources are characterized by intuitionistic fuzzy numbers having linear membership and non-membership function.

Contents

1. Introduction 2. Ranking of intuitionistic fuzzy numbers 3. Applications of proposed ranking methods 4. Sensitivity analysis 5. Bi-level multi-objective linear programming under intuitionistic fuzzy environment. Appendix. Biography.

09. JASPREET KAUR
Free S^1 and S^3 Actions on Certain Spaces and Uniform Version of Z_2 - index
Supervisor : Prof. Tej. B. Singh
Th 23050

Abstract
(Not Verified)

The thesis contains some new results on certain topics in Algebraic Topology, mainly in the area of cohomological aspects of topological transformation groups. An action of a topological group G on a space X is said to be free if each non-identity element of G moves every point of the space X. The question of classifying the orbit spaces of free actions of finite cyclic groups on spheres was first raised by Hopf in 1925-26. Hopf's problem has been studied extensively by Livesay, Rice, Ritter and many others. The structure of the orbit spaces of free actions on spaces other than spheres have also been

studied by several authors. For instance, Tao has determined the orbit spaces of free involutions on $S^1 \times S^2$, Dotzel, et al. have investigated the cohomology structure of orbit spaces of free Z_p and S^1-actions on the product of two spheres. Recently, the cohomology algebras of the orbit spaces of free Z_2-actions on projective spaces and the product of two projective spaces has been determined. Continuing with this thread of research, we have undertaken the study of the orbit spaces of free actions of S^1 and S^3 on the product of two projective spaces, the product of a projective space and a 3-sphere. For a compact Lie group G acting on a space X, there is Leray-Serre spectral sequence associated to the Borel- fibration $X \rightarrow X_G \rightarrow B_G$. The E_2-term of this spectral sequence is given by $E_2^{k,l} \equiv H^k(B_G; H^l(X,R))$. The Volovikov index of G-space X is s if $E_2^{*,0} = \ldots\ldots E_s^{*,0} \neq E_{s+1}^{*,0}$, otherwise it is taken to be infinity. We have computed Volovikov's index for some transformation groups and used it to obtain information about the existence of equivariant maps. Lastly, the uniform versions of Yang's B-index have also been studied.

Contents

10. KAPOOR (Malti) Nee Malti Chawla
Approximation Methods and Generalized Convexity in Vector Optimization Over Cones.
Supervisor : Associate Prof. Sunila Sharma
Th 22771

Abstract
(Verified)

This research work presents various approximation methods and generalized convexity notions pertainin g to a vector optimization problem over arbitrary cones. The thesis is divided into four chapters. Chapter 1 is introductory. In Chapter 2 we develop approximation methods for solving a nonsmooth vector optimization problem over cones (NVOP).In Chapter 3, we introduce various generalized convex functions and establish optimality and duality results for vector optimization problem. Chapter 4 mainly deals with second-order optimality conditions for the vector optimization problem over cones in which the involved functions are first-order differentiable but may fail to possess a second order derivative. Secondorder optimality and Mond-Weir type duality results are derived for a vector optimization problem over cones (VOP) using the introduced classes of functions. Next, we develop a second-order approximation method to explore weakly efficient solutions of (VOP) wherein the involved functions are not necessarily secondorder differentiable.

Contents

11. POUMAI (Khole Timothy)
Nonlinear Approximations and Frames in Banach Spaces.
Supervisor : Associate Prof. Shiv Kumar Kaushik
Th 22772

Contents

12. LOUHAN (Pooja)
Optimality and Duality for Some Vector Optimization Problems Over Cones.
Supervisors : Dr. S. K. Suneja and Dr. C. S. Lalitha
Th 22773

Abstract
(Verified)

The main objective of this thesis is to develop the theoretical aspects of vector optimization over cones. Chapter 1 contains basic notations and definitions and ends with summary of the thesis. Chapter 2 comprises optimality and duality results for vector optimization problems over cones involving differentiable functions. In Section 2.1 higher-order sufficient optimality conditions for a vector optimization problem have been established. In this section higher-order dual problems are associated to the primal problem and various duality results are proved. Next Section 2.2 studies two types of symmetric vector dual problems. We have established the weak, strong and converse duality results for both of these duals. Chapter 3 presents the study of nonsmooth vector optimization problem over cones. Section 3.1 deals with a vector optimization problem over cones which contains support functions of compact convex sets. Necessary and sufficient optimality conditions for the given problem are proved. A unified dual has been associated with the considered primal problem and weak, strong and converse duality results have been established. In Section 3.2, a fractional vector optimization problem has been considered. Necessary and sufficient optimality conditions have been established by applying the parametric approach. The Mond-Weir type and Schaible type duals have been associated to the primal problem and duality results have been established. Chapter 4 deals with a composite vector optimization problem over cones. Section 4.1 establishes optimality conditions using conjugate functions. Then a vector dual is associated to the primal problem and weak and strong duality results are proved. Lastly, Section 4.2 studies the composite vector optimization problem by assuming the concerned functions to be locally Lipschitz. The necessary optimality conditions are established in terms of subdifferentials. Next we associate the Wolfe type and Mond-Weir type dual to the given problem and prove weak and strong duality results.

Contents

13. MAMTANI (Karuna)
Weyl-Type Theorems and Their Variants for Unbounded Linear Operators.
Supervisor : Dr. Anuradha Gupta
Th 22765

Abstract
(Verified)

In 1909, Hermann Weyl proved that for bounded self-adjoint operators, the complement of the Weyl's spectrum in the spectrum consists of those points which are isolated eigenvalues of finite multiplicity. This theorem was later termed as the `Weyl's Theorem'. We intend to extend the study of Weyl-type theorems and their variants to classes of unbounded linear operators on Hilbert spaces. Further, equivalences between several variants of Weyl's theorem for different classes of operators have been discussed. Chapter 1 gives the necessary notations and terminologies used throughout the thesis. In Chapter 2 some preliminary results about the spectrum of unbounded normal operators and equivalences between several variants of the Weyl's theorem have been established. In Chapter 3, Weyl theory for classes of unbounded non-normal operators is discussed. We introduce the class of unbounded posinormal operators and consider the known class of unbounded hyponormal operators. In Chapter 4, we study the adjoints of those unbounded operators T which share the common property that ascent $p(T - \lambda I) = 0$ or 1 for every complex number λ. We have shown that the spectrum of the adjoint of such an operators can be partitioned into the Weyl spectrum and the set of isolated spectral points of finite multiplicity. Generalization of this result in terms of the B-Weyl spectrum has also been studied. Chapter 5 is devoted to the study of Weyl-type theorems for direct sums and

restrictions of closed linear operators. T is assumed to be an operator with compact resolvent and sufficient conditions are given for S which ensure that their direct sum satisfies Weyl's theorem, a-Weyl's theorem and Browder's theorem. Further, it is shown that several Weyl-type theorems and properties hold for T if and only if a restriction of T satisfies the respective Weyl-type theorem.

Contents

14. NAMITA

MDS and Perfect Codes in Poset Block Spaces

Supervisors : Prof. B. K. Dass and Assi. Prof. Rashmi Verma

Th 23051

Abstract
(Verified)

In this thesis, we have studied perfect and MDS codes with respect to poset block metric. We first propose a correction in the characterization of poset block structures that turn the extended binary Hamming code and extended binary Golay code into 1-perfect poset block codes by Alves, Firer and Panek (2008). We have obtained the characterization of poset block structures that turn a code into 1-perfect poset block code in terms of the blocks of weight 1. Further, we have characterized an r-perfect code in poset block space. Given the weight enumerator of the code with respect to Hamming metric, we describe the construction of a poset block structure which turns a code into r-perfect poset block code. We modify the algorithm for construction of new perfect poset codes from a given poset code (refer, Lee (2004)) and present its generalization to the case of poset block metric. We derive Singleton bound for a poset block code and define an MDS poset block code. Further, we extend the concept of I-perfect codes to the case of poset block metric and establish the duality result for the same. We present the relation between an MDS poset block code and I-perfect code. We further obtain the weight distribution of an MDS poset block code for the case when all the blocks have the same dimension. Moreover, we obtain the packing radius of a poset block code by taking minimum over the packing radii of all codewords.

Contents

15. NISHAD (Chandrashekhar)

Similarity Solutions for Convective Heat Transfer Non-Newtonian Flows in Porous Medium Saturated with Nanofluids

Supervisor : Prof. Shobha Bagai

Th 22766

Abstract
(Not Verified)

The present thesis investigates similarity solutions for free convective heat transfer across bodies immersed in a porous medium saturated with non-Newtonian nanofluids. The governing equations takes into account the presence of internal heat generation source term.The Ostwald de Waele Model is used in this study to represent the relationship between shear stress and shear rate. In this study we follow the approach of Buongiorno, who proposed a model that incorporated the effects of Brownian diffusion and thermophoresis. Each of these gives rise to cross-diffusion terms that are analogous to Soret and

Dufour terms. The continuity equation remains unchanged but the equations of conservation of momentum, heat and nanoparticle volume fractions are modified. Chapter 1 is a brief survey of basic concepts and results related to the thesis. Chapter 2 we study the effect of variable viscosity of the base fluid. The viscosity varies with the temperature for free convective heat transfer over an axisymmetric body embedded in a fluid saturated porous medium. We consider that the surface temperature of the body changed with the distance. Chapter 3 extends the study in the previous chapters by also incorporateing the effect of variations in permeability of the porous medium along with the variations in viscosity of the base fluid. The geometry in this chapter is a vertical cone. Chapter 4 is the study of the horizontal plate configuration, the direction of the gravity is normal to the immersed body. As a result the order of differential equations increases and more boundary conditions are needed. In the appendix we present additional problems that can be taken up as extensions of the problems worked out in this thesis.

Contents

16. RAJESH KUMAR

Coincidence and Fixed Point Theorems in Metric, Cone Metric and Vector Metric Spaces.

Supervisor : Dr. Sachin Vashistha

Th 22774

Abstract
(Not Verified)

In this thesis, we have worked on coupled coincidence point results for weak contractions with variable coefficients using c-distance and without using mixed monotonicity in cone metric space and generalized the similar work done for coincidences of mixed g-monotonic function. Later we prove coincidence point theorems on metric spaces for generalized contractions that uses a function F given by Darius Wardowski and further we present w-distance version of these results. Next, we prove w-distance version of fixed point results proved by Jachymski on metric spaces that are endowed with a graph . Finally, we present fixed point theorems for (G,Φ)-contractions on vector metric spaces. Chapter 1 of the thesis gives an introduction about the fixed point theory and various terminologies required to understand rest of the thesis. This is followed by a brief description of some recent related work which forms a basis for our work In Chapter 2, we use the notion of an (F,g)-invariant subset for some functions $F:X\times X\to X$ and $g:X\to X$ and describe coupled coincidence point theory under c-distance in cone metric spaces for weak contractions with variable coefficients. In Chapter 3, we prove coincidence point theorems on metric spaces for generalized contractions that use a function F given by Darius Wardowski.Thereafter we present a coincidence point result for an F_w-g-contraction on a metric space equipped with a w-distance. In Chapter 4, we introduce contractions on metric spaces involving p as a w-distance and endowed with a directed graph G. We prove a few results dealing with fixed points for such contractions. In Chapter 5, we prove fixed point theorems for (G,Φ)-contractions on vector metric spaces endowed with a directed graph G and apply it to integral equations.

Contents

17. SAROHE (Poonam)
Generalizations of Prime and Primary Ideals in Commutative Semirings.
Supervisors : Dr. Pratibha Kumar and Manish Kant Dubey
Th 23177

Abstract
(Not Verified)

Our main aim of the thesis: Study and generalize the concepts of prime and primary ideals in commutative semiring. The thesis presents various generalizations of prime and primary ideals in commutative semiring. It also includes a refinement of the Prime Avoidance Theorem of semirings which is sometimes in some situation extremely useful. All the chapters are the embodiment of our study in the present thesis entitled Generalizations of prime and primary ideals in commutative semirings. The thesis contains five chapters namely Introduction and Preliminaries: In this chapter, we give a brief introduction of semirings and a brief exposition of basic definitions, results of semirings etc., which lays foundation for the subsequent chapters of the thesis. prime ideals: In this chapter, the notion of prime ideals of a commutative semiring is introduced and obtain some related results about these ideals. weakly prime ideals: In this chapter, the concept of weakly prime ideals in commutative semirings is introduced which is an extension of weakly prime ideals. prime and primary ideals: In this chapter, the concept of prime ideals in a commutative semiring is developed. We prove and characterize several results about these kind of ideals. 2 -absorbing and weakly 2 -absorbing primary ideals: In this chapter, we introduce the notion of 2 -absorbing primary ideals in commutative semirings with some suitable examples. We also investigate several propertiesof 2 -absorbing primary ideals of semiring parallel to ring theory. List of relevant references are provided at end of the thesis . Throughout the thesis, S will denote commutative semiring with unity. Keywords: Semirings, ideals, weakly prime ideals, prime,primary ideals, 2 –absorbing primary ideals, 2 –absorbing weakly primary ideals.

Contents

18. SUSHIL KUMAR
Coefficient Estimates and Subordination for Univalent Functions
Supervisor : Prof. V. Ravichandran
Th 22775

Abstract
(Verified)

The main objective of this thesis is to discuss geometric properties of certain subclasses of univalent functions defined in the open unit disk. In this thesis, necessary and sufficient coefficient conditions are obtained for a normalized analytic rational function to be in the class of Janowski starlike functions. For such functions, growth, covering and distortion theorems are also proved. In addition, a sufficient coefficient condition is also obtained for such functions to be Janowski convex. Analogous results are proved for meromorphic rational functions defined in the punctured open unit disk. We determine the bounds for coefficients of the functions in certain classes of starlike functions. We obtain radius estimates for certain classes of univalent functions. We give some sufficient conditions for normalized analytic function to belong to some well known classes of starlike functions using first order differential subordination. Further, we consider two subclasses of Ma-Minda type univalent functions with some constraints and determine the sharp lower and upper bound of the initial coefficients of the functions.We also determined sharp radius of alpha-convexity and univalence for the normalized analytic function with prescribed bounds on Taylor coefficients.

Contents

1. Introduction 2. Coefficient inequalities for janowski starlike functions 3. Coefficient and radius estimates for starlike functions 4. Subordination for starlike functions 5. Starlike functions with real coefficients 6. Functions defined by coefficient inequalities. References. Index.

19. UPMANYU (MUDITA)
Imprecise Multi Objective Set Covering and Fuzzy Fixed Charge Problems.
Supervisor : Dr. Ratnesh R. Saxena
Th 22777

Abstract
(Verified)

The class of 0-1 integer programming problems arise in practically every area of application of mathematical programming. A special problem in this class is the NP-complete set covering problem that serves as a model for many important applications including assembly line balancing, facility location and vehicle routing. Another problem in the class of 0-1 mixed integer programming problems is the fixed charge problem wherein a charge is associated with performing an activity at a nonzero level which does not depend on the level of the activity. The existence of these fixed charges associated with the activities in the objective function produce a nonlinear programming problem. The fixed charge problem has been widely applied in many decision-making and optimization problems such as the warehouse or plant location decisions, wherein there is a charge associated with opening the facility; and also in transportation problems - called the fixed charge transportation problem - where there are fixed charges for transporting goods between supply points and demand points. While formulating real world problems, the parameters in the objective functions are supplied according to the decision makers' requirements. More often than not, the decision maker is unable to provide this precise information and to deal with this imprecision the parameters are formulated as fuzzy numbers. In other words the objective function is fuzzified and a leverage is provided to the decision maker. This imprecision can arise due to problems of observing the parameters themselves or to the fact that their values depend on factors such as nature, decisions of other agents, etc. In the present thesis, we have investigated both these optimization problems having linear and nonlinear multiple objectives where the parameters in the objective functions are fuzzy numbers. We have also studied the fixed charge transportation in the fuzzy environment.

Contents

20. VINAY KUMAR
Numerical Study of the Phase Space Structure of Nonlinear Dynamical Systems based on Wavelets.
Supervisor : Dr. Beena R. Gupta
Th 23178

Abstract
(Not Verified)

Nonlinear dynamical systems are widely observed in many branches of physics ranging from Celestial Mechanics to Chemistry. We investigate the phase space structure of these systems which is a combination of periodic, quasi-periodic, and chaotic trajectories. Several methods (such as Smaller Alignment Index Method (SALI), Correlation Dimension (CD), Largest Lyapunov Characteristic Exponent (LLCE), etc.) have been introduced to study the phase space structure of these systems. But for higher dimensional systems, these methods involve complex computational work. Also, these quantities do not provide relevant information (such as resonance trapping, transitions, etc.) about the phase space structure of these systems. These infinite-time quantities are not sufficient for many purposes: rather than knowing a trajectory is chaotic, it is often preferred to say when, where, and to what degree an orbit is chaotic. Further, many scholars tried to resolve these problems by using the method of Fourier

Transform (FT) and Short-Time Fourier Transform (STFT). Fourier transform provides only frequency representation and hence not suitable for the analysis of chaotic trajectories (that is the trajectories having the variation of frequency with respect to time). Also, STFT was able to analyze either high-frequency components using narrow windows or low frequency components using wide windows, but not both. But, with the introduction of wavelet transform having the capability of adaptive windows, time-frequency analysis (TFA) based on wavelets resolved all those problems mentioned earlier. This method produces a sound localization in time and frequency. The objective of the thesis is to apply the method of TFA based on wavelets to examine and classify the phase space structure of different nonlinear dynamical models in the field of Space Dynamics and Celestial Mechanics. In addition to that, the comparison of TFA based on wavelets with different chaos indicators is also an important part of the work.

Contents

21. VIRMANI (Garima)
Well-posedness in Variational Inequalities.
Supervisor : Dr. Manjari Srivastava
Th 22776

Abstract
(Not Verified)

The purpose of this thesis is to study different aspects of well-posedness invarious generalized variational inequalities.Chapter 1 provides the pre-requisites related to this research.Chapter 2 deals with the two types of well-posedness studied through thepresent research work, viz. Tykhonov well-posedness and Levitin–Polyak (LP)well-posedness of (generalized) variational inequalities.Section 2.1 investigates the parametric mixed vector quasivariational-like in-equality using bifunctions for its Tykhonov and L-well-posedness.Section 2.2 deals with the LP well-posedness of variational-hemivariational in-equalities and perturbed bilevel mixed equilibrium problem in two subsections.Chapter 3 deals with a special general variational inequality, viz. the inversequasivariational inequality which is known to have applications in market equilib-rium problem and transportation system operation.In Section 3.1, a perturbed inverse quasivariational inequality has been investi-gated for its LP well-posedness.Section 3.2 deals with the constrained inverse quasivariational inequality prob-lem and its LP well-posedness.Chapter 4 is the application of variational inequality problems, viz. the re-lationship of the solutions of the problem with the solutions of the optimizationproblem. Many problems like the complementarity problem, fixed point problemcan be modelled into a variational inequality problem. The literature being vastfor finding the solutions to the optimization problems, hence to study this appli-cation is necessary.In Section 4.1, we have considered a generalized Minty vector variational-likeinequality problem and a nonsmooth vector optimization problem which uses theClarke's generalized directional derivative. The relationships amongst the solu-tions of these problems have been established assuming the function to be α-univex.The weak formulations of these problems have been considered in Section 4.2and similar relationships have been established using appropriate assumptions.

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