Open House - 2016

Department of Mathematics and Statistics

Indian Institute of Technology Kanpur

23 - 24 January, 2016

Speaker	Title
Dr. Kaushik Bal	Inheritance of Symmetry for Semilinear Equations (abstract)
Dr. Subhajit Dutta	On Some 'In-Consistent' Multivariate Distributions (abstract)
Mr. Awanish Kumar Tiwari	A High Order Method for Electromagnetic Wave Scattering from Penetrable Anisotropic Media in Two Dimension (abstract)
Ms. Deepika Baweja	Weighted Spaces of Holomorphic Functions on Banach Spaces and The Approximation Property (abstract)
Mr. Arnab Koley	On Generalized Progressive Hybrid Censoring in Presence of Competing Risks (abstract)
Mr. Rajesh Kumar Singh	A Generalized Interpolation Theorem of Marcinkiewicz Type in Orlicz Spaces (abstract)
Mr. Samir Shukla	Neighborhood Complexes of the Exponential Graphs $K_{n+1}^{K_n}$ (abstract)
Mr. Gopal Priyadarshi	Wavelet Galerkin Method for Fourth Order Multidimensional Partial Differential Equations (abstract)
Mr. Anuj Kumar More	Categories and Algebras of Rough Sets (abstract)
Mr. Anurag Singh	Homotopy Type of Neighborhood Complexes of Kneser Graphs (abstract)
Mr. Ayan Chakraborty	WEB Spline Based Finite Element Analysis of a Class of System of Non Cooperative Elliptic Equations (abstract)
Mr. Abdul Halim	C^0 Interior Penalty Method for Image Denoising (abstract)
Ms. Chitradipa Chakraborty	Multivariate Forward Search Estimators for Location Parameter in Elliptical Model and Associated Tests (abstract)
Ms. Jisha Francis	Some Sufficient Conditions for Relative Ageing of Life Distributions (abstract)
Ms. Meena Pargaei	Maximum Principles in Differential Equations (abstract)
Ms. Poonam Kesarwani	Error Bounds and Multi objective Location Problem (abstract)
Ms. Sheela Verma	Weighted Stekloff Eigenvalue Problem (abstract)
Ms. Tanushree Pandit	An Algorithm for Bi-level Convex Optimization Problem (abstract)
Mr. Samya Kumar Ray	Some Inequalities in Banach Spaces and Applications (abstract)
Ms. Nayana Mukherjee	Effect of Density Dependent Diffusion on Spatio-Temporal Pattern Formation (abstract)

Ms. Shuvashree Mondal	On Progressive Censoring Scheme for Two Samples (abstract)
Ms. Rhythm Grover	On Chirp Signal Model (abstract)

23rd Jan 2016, Session I, From 09.00 a.m. To 11.15 a.m.

Chair: Dr. Shobha Madan

1. **Speaker :** Dr. KAUSHIK BAL

   Title : Inheritance of Symmetry for Semilinear Equations

   Abstract : Harmonic functions has properties like Mean value Property, Harnack inequality, Maximum Principle, Liouville Property to name a few which helps us in our study of Poisson Equation. In this talk we will show that any classical solution to the problem $-\Delta u = f(u)$ in Ω where f is locally lipchitz continuous in $\mathbb{R}^n$ has a very special property that it inherits the geometry of domain for some special domains. In particular for a ball in $\mathbb{R}^n$ we will show that all solutions are radially symmetric and radially decreasing.

2. **Speaker :** Mr. AWANISH KUMAR TIWARI

   Title : A High Order Method for Electromagnetic Wave Scattering from Penetrable Anisotropic Media in Two Dimension

   Abstract : In this talk, I will present a high-order Nyström solver for the time-harmonic electromagnetic wave scattering problem where the bounded material inhomogeneity is anisotropic and penetrable. The high-order convergence of this integral equation based procedure is attained through a combination of changes of parametric variables to resolve the singularities of the Green function and use of specialized weighted Clenshaw-Curtis quadratures to effectively deal with near singular integrals. A brief account of the main algorithmic components of the scheme are presented, together with some numerical results that exemplify its performance.

3. **Speaker :** Mr. GOPAL PRIYADARSHI

   Title : Wavelet Galerkin Method for Fourth Order Multidimensional Partial Differential Equations

   Abstract : We describe wavelet Galerkin method for the numerical solution of elliptic partial differential equations which is based on the use of Daubechies compactly supported wavelets. Since these wavelets are highly oscillatory in nature we apply the approach developed in [3] for the calculation of 2 - term connection coefficients. Linear system of equations arising from discritized equations has been solved using GMRES iterative method. Numerical results are shown for multidimensional PDEs. We observe that as we increase the resolution level J we get higher order accuracy.

4. **Speaker :** Ms. MEENA PARGAEI

   Title : Maximum Principles in Differential Equations

Abstract : In this talk I will discuss about the maximum principle for ODE's and PDE's. I will give a brief introduction of maximum principle for Elliptic PDE then I will talk about the Parabolic PDE in detail and will give some of it's applications.

23rd Jan 2016, Session II, From 11.45 a.m. To 01.15 p.m.

Chair: Dr. Subhra Shankar Dhar

1. **Speaker :** Ms. SHUVASHREE MONDAL

   Title : On Progressive Censoring Scheme for Two Samples

   Abstract : Comparative lifetime experiment is of great importance when experimenters need to deduce the relative merit of two competing products in terms of their reliability. In this talk we will establish a new progressive censoring scheme implemented on two samples drawn from two exponential populations. We then derive the maximum likelihood estimator (MLE) of the mean lifetime of two populations, as well as the exact distribution of MLEs.The exact confidence interval of the mean lifetimes have been derived and a montecarlo simulation has been conducted to construct bootstrap confidence interval.

2. **Speaker :** Mr. ARNAB KOLEY

   Title : On Generalized Progressive Hybrid Censoring in Presence of Competing Risks

   Abstract : We analyse generalized progressive censored data in presence of competing risks. For brevity we have considered only two competing causes of failures, and it is assumed that the life time of the competing causes follow one parameter exponential distributions with different scale parameters. Maximum likelihood estimators of the unknown parameters are obtained and we provide their exact distributions. Based on the exact distributions of the maximum likelihood estimators exact confidence intervals can be obtained. Asymptotic and bootstrap confidence intervals are also provided for comparison purposes. We further consider the Bayesian analysis of the unknown parameters under a very flexible Beta-Gamma prior. Bayes estimates and the associated credible intervals of the unknown parameters are provided based on the above priors. Extensive simulations are done to see the effectiveness of the proposed method and finally one real data set is analysed for illustrative purpose.

3. **Speaker :** Ms. CHITRADIPA CHAKRABORTY

   Title : Multivariate Forward Search Estimators for Location Parameter in Elliptical Model and Associated Tests

   Abstract : The idea of forward search method for univariate data is well-known concept in statistics for a long time. However, this methodology and related properties with applications for multivariate data have not yet been fully explored. In this talk, we study the asymptotic properties of the multivariate forward search estimator for the location parameter when data follow elliptical distribution. The robustness properties of the estimator has also been investigated. Further, we develop a test for multivariate location parameter based on this estimator for a specified scatter

matrix and study the asymptotic power of the test under contiguous alternatives along with that of some other tests based on more classical estimators. Moreover, the performances of the estimator as well as the test have been carried out for different simulated and real data, and compared the performances with more classical ones.

23rd Jan 2016, Session III, From 02.30 p.m. To 04.30 p.m.

Chair: Dr. Sasmita Patnaik

1. **Speaker :** Ms. POONAM KESARWANI
   Title : Error Bounds and Multi objective Location Problem
   Abstract : We consider the well known facility location problem, which we pose as a strongly convex multi objective problem. We derive an error bound for the problem and use it choose a solution of better quality. The idea is to first focus on a general strongly convex vector optimization problem, develop a gap function and use it to develop an error bound. The location problem will be solved using NSGA-II an evolutionary algorithm.

2. **Speaker :** Ms. TANUSHREE PANDIT
   Title : An Algorithm for Bi-level Convex Optimization Problem
   Abstract : We consider the problem of minimizing a non-smooth convex function over the constrained minimizers of another non-smooth convex function.

   $$\min\{f(x) \mid x \in argmin\{g(y) : y \in C\}\}$$

   where f and g are non-smooth convex functions and $c \subseteq \mathbb{R}^n$ is a convex, compact set. The main objective here is to provide an algorithm for this kind of simple bi-level problem specially where the functions in both the levels are non-smooth which has been taken care of by the sub-differentials of the functions. The algorithm consists of a main loop wherein a sequence of one-level, strongly convex optimization problems are solved that involve the penalization method and a combination of proximal and Tikhonov regularization to handle the lower-level Optimization problem.

3. **Speaker :** Mr. AYAN CHAKRABORTY
   Title : WEB Spline Based Finite Element Analysis of a Class of System of Non Cooperative Elliptic Equations
   Abstract : In this study we establish the existence and uniqueness of the solution of a coupled system of general elliptic equations with anisotropic diffusion, non-uniform advection and variably influencing reaction terms on Lipschitz continuous domain $\Omega \subset \mathbb{R}^m$ (m≥1) with a Dirichlet boundary. Later we consider the finite element (FE) approximation of the coupled equations in a meshless framework based on weighted extended B-Spine functions (WEBS).The a priori error estimates corresponding to the finite element analysis are derived to establish the convergence of the corresponding FE scheme and the numerical methodology has been tested on few examples.

4. **Speaker :** Mr. ABDUL HALIM

   Title : C^0 Interior Penalty Method for Image Denoising

   Abstract : In this talk I will introduce the C^0 interior penalty finite element method for noise removal of digital images.

23rd Jan 2016, Session IV, From 05.00 p.m. To 06.30 p.m.

Chair: Dr. Parasar Mohanty

1. **Speaker :** Ms. DEEPIKA BAWEJA

   Title : Weighted Spaces of Holomorphic Functions on Banach Spaces and The Approximation Property

   Abstract : We study the linearization theorem for the weighted space $H_w(U, F)$ of holomorphic functions defined on an open subset U of a Banach space E with values in a Banach space F. After having introduced a locally convex topology $\tau_\mathcal{M}$ on the space $H_w(U, F)$, we show that $(H_w(U, F), \tau_\mathcal{M})$ is topologically isomorphic to $(\mathcal{L}(\mathcal{G}_w(U), F), \tau_c)$ where $\mathcal{G}_w(U)$ is the predual of $\mathcal{H}_w(U)$ consisting of linear functionals whose restrictions to the closed unit ball of $\mathcal{H}_w(U)$ are continuous for the compact open topology τ_0. Finally, these results have been used in characterizing the approximation property for the space $\mathcal{H}_w(U)$ and its predual for suitably restricted weight w.

2. **Speaker :** Mr. RAJESH KUMAR SINGH

   Title : A Generalized Interpolation Theorem of Marcinkiewicz Type in Orlicz Spaces

   Abstract : We establish a sharp extension of the Marcinkiewicz interpolation theorem in the framework of Orlicz spaces for more general class of operators. Namely, the class $W(p, r; \infty, \mu, \nu)$ of quasilinear operators T such that

   $$T : L_{p,r}(X, \mu) \to L_{p,\infty}(Y, \nu) \qquad \text{and} \qquad T : L_\infty(X, \mu) \to L_\infty(Y, \nu).$$

   We will see the necessary and sufficient conditions on Young's functions Φ_1, Φ_2 such that for every $T \in W(p, r; \infty, \mu, \nu)$

   $$T : L_{\Phi_2}(X, \mu) \to L_{\Phi_1}(Y, \nu).$$

3. **Speaker :** Mr. SAMYA KUMAR RAY

   Title : Some Inequalities in Banach Spaces and Applications

   Abstract : In this talk, we are going discuss on some important inequalities in Banach spaces and their applications to various fields. The main inequalities we shall talk about are Grothendieck inequality, Khintchine inequality and Von Neumann inequality. These are the inequalities of great importance. They often interact but still have significant differences. We shall try to explore their different generalizations in different set ups which has deep impact in different areas of mathematics such as Functional Analysis, Harmonic Analysis, Operator Theory and Computer Science.

5

24th Jan 2016, Session V, From 09.00 a.m. To 11.00 a.m.

Chair: Dr. Sharmistha Mitra

1. **Speaker :** Dr. SUBHAJIT DUTTA

   Title : On Some 'In-Consistent' Multivariate Distributions

   Abstract : In the literature, we have non-Gaussian bivariate distributions that have marginal distributions to be Gaussian. We generalize this result to construct a p-dimensional distribution for which any proper subset of its components has the Gaussian distribution, but the joint p-dimensional distribution is not. A similar construction is also proposed for multivariate discrete distributions.(based on joint works with Marc G. Genton and Sugata Ghosh)

2. **Speaker :** Ms. JISHA FRANCIS

   Title : Some Sufficient Conditions for Relative Ageing of Life Distributions

   Abstract : In reliability theory, Cox's proportional hazard model is quite popular and widely used. In many situations, it is observed that failure rates under consideration are not proportional, rather they cross each other. In such situations, an alternative to Cox's proportional hazard model may be monotone hazard ratio model (provided the ratio exists). The notion of relative ageing describes the rate at which one component/system is ageing relative to the other. Various partial orders describing relative ageing of two life distributions have been introduced in the literature based on various notions of ageing such as failure rate, reversed failure rate and mean residual life. In this talk I will present some sufficient conditions under which a life distribution ages faster than the other with respect to notions of relative ageing described above. These sufficient conditions are easy to verify and can be used in practical applications where one is interested in studying relative ageing of two life distributions.

3. **Speaker :** Ms. RHYTHM GROVER

   Title : On Chirp Signal Model

   Abstract : Chirp signals are very common in many natural and man-made systems like audio signals, sonar, radar etc. Estimation of the unknown parameters is a fundamental problem in statistical signal processing. Recently, Kundu and Nandi (2008) estimated the parameters of a simple chirp signal model using least squares method under the assumption of stationary noise and proved that the estimators obtained are strongly consistent and asymptotically normally distributed. Under the same assumption, we estimate the parameters of the model by approximate least squares method and study their asymptotic properties. It is observed that the ALSEs are strongly consistent and asymptotically equivalent to the LSEs.

4. **Speaker :** Ms. NAYANA MUKHERJEE

   Title : Effect of Density Dependent Diffusion on Spatio-Temporal Pattern Formation

   Abstract : Spatio-temporal pattern formation is commonly observed in various physical, chemical and biological processes. The basic modeling approach is based on nonlinear parabolic partial differential equation(s) with given initial and boundary conditions. These type of systems generate

various types of patterns like spots, stripes, traveling waves, etc. The study of the stationary nature of the patterns and relevant bifurcations are challenging issues. significant progress in these directions have been made on models based on self-diffusion terms. Consideration of the cross-diffusion terms can have significant implications in the context of pattern formation. The talk will discuss different methods that are used to study stationary patterns and their extension to the models with cross-diffusion terms.

24th Jan 2016, Session VI, From 11.30 a.m. To 01.30 p.m.

Chair: Dr. B.V. Rathish Kumar

1. **Speaker :** Mr. ANUJ KUMAR MORE

   Title : Categories and Algebras of Rough Sets

   Abstract : Rough set theory has been studied from various directions including algebraic and category theoretic aspects. We have tried to establish theory of Rough sets from the viewpoint of topos theory. Two categories $ROUGH$ and RSC of rough sets and a subcategory $\xi - RSC$ are focussed upon. It is shown that $ROUGH$ and RSC are equivalent. Generalizations $RSC(\mathscr{C})$ and $\xi - RSC(\mathscr{C})$ are proposed over an arbitrary topos $\mathscr{C}$. $RSC(\mathscr{C})$ is shown to be a quasitopos. Next, the algebra of strong subobjects of an object in RSC is studied using the notion of relative rough complementation. A class of contrapositionally complemented '$c. \vee c.$' lattices is obtained as a result, from the object class of RSC.

2. **Speaker :** Mr. ANURAG SINGH

   Title : Homotopy Type of Neighborhood Complexes of Kneser Graphs

   Abstract : A. Schrijver identified a family of vertex critical subgraphs of Kneser graphs called the stable Kneser graphs $SG_{n,k}$. A. Björner and M. de Longueville proved that the neighborhood complex of the stable Kneser graph $SG_{n,k}$ is homotopy equivalent to a k-sphere. It is also known that the neighborhood complex of $KG_{n,k}$ is homotopy equivalent to the wedge sum of k-spheres. The main objective here is to give the exact number for $KG_{2,k}$ i.e. to show that the homotopy type of the neighborhood complex of $KG_{2,k}$ is a wedge sum of $(k+4)(k+1)+1$ spheres of dimension k. Further we will construct a subgraph $S_{2,k}$ of $KG_{2,k}$ whose neighborhood complex deformation retracts onto the neighborhood complex of $SG_{2,k}$.

3. **Speaker :** Mr. SAMIR SHUKLA

   Title : Neighborhood Complexes of the Exponential Graphs $K_{n+1}^{K_n}$

   Abstract : In this talk, we consider the bipartite graphs $K_2 \times K_n$. We first show that the connectedness of $\mathcal{N}(K_{n+1}^{K_n}) = 0$. Further, we show that $\text{Hom}(K_2 \times K_n, K_m)$ is homotopic to S^{m-2}, if $2 \leq m < n$.

4. **Speaker :** Ms. SHEELA VERMA

   Title : Weighted Stekloff Eigenvalue Problem

Abstract : In this talk I will introduce the Stekloff problem in weighted domain and then talk about the upper bound of it's first eigenvalue.