INVITED TALKS: TITLE AND ABSTRACTS

Day 1: June 3, 2024

Rajeev Bhaskaran: June 3, 2024 (9:00 - 9:45 AM IST)

Title: Stochastic Partial Differential Equations and Finite Dimensional Diffusion Processes: A Progress Report

Abstract: In this talk we will present recent results obtained (jointly with collaborators) on the connection between S' - valued i.e. tempered distribution valued processes and finite dimensional processes. These results include a geometric basis for 'translation invariance' (with S. Tappe), existence and uniqueness for the 'adjoint equation' (with S. Bhar and A.K. Nath), continuity of solutions of SPDEs with respect to initial conditions and coefficients with an application to SPDEs driven by an infinite dimensional Brownian motion (with B. Sarkar). We will also present results on the Donsker delta function using our approach. Time permitting, we will discuss some open problems.

Shashi Jain: June 3, 2024 (9:50 - 10:35 AM IST)

Title: Managing risk and returns using options portfolio

Abstract: Ahn et al. (1999) provide an analytical solution to the risk management problem where an institution manages the risk in an asset position by minimizing Value-at-Risk (VaR) using options. They find that, under their assumptions, a single put option optimally achieves this goal. Building on this seminal work, we propose a more comprehensive optimization problem that includes a constraint on the target return for investors. Additionally, we focus on minimizing Conditional Value-at-Risk (CVaR) instead of VaR, offering a more robust risk measure by considering the tail end of the loss distribution. This leads to a non-linear optimization problem. To address this, we develop an efficient numerical scheme for determining the optimal options portfolio. Our approach provides a flexible hedging strategy that balances risk minimization with return objectives.

Sourish Das: June 3, 2024 (10:50 - 11:35 AM IST)

Title: Bayesian Portfolio Optimisation for Portfolio Writers.

Abstract: An option writer is required to comply with margin requirements which compels the writer to keep additional securities/money as collateral. The writer in this scenario is concerned about the movement of underlying(s) (and in turn, the overall portfolio value) to assess the risk and returns of his portfolio against the margin requirements set by the counterparty (usually, the exchange).

Here, we discuss our algorithm and the methodology to calculate, for a given amount of premium receivable, the optimal portfolio that minimizes the margin requirements keeping the minimum portfolio risk (and thereby, minimising the probability of a margin call) along with maximising the returns.

Stefan Tappe: June 3, 2024 (11:40 AM - 12:25 PM IST)

Title: Stochastic partial differential equations and invariant manifolds in embedded Hilbert spaces

Abstract: In this presentation we provide necessary and sufficient conditions for stochastic invariance of finite dimensional submanifolds for solutions of stochastic partial differential equations (SPDEs) in continuously embedded Hilbert spaces with non-smooth coefficients. Furthermore, we establish a link between invariance of submanifolds for such SPDEs in Hermite Sobolev spaces and invariance of submanifolds for finite dimensional SDEs. This provides a new method for analyzing stochastic invariance of submanifolds for finite dimensional Itô diffusions.

This presentation is based on joint work with Rajeev Bhaskaran (IISER Thiruvanantapuram, India).

Rama Cont: June 3, 2024 (2:00 - 2:45 PM IST)

Title: TBA

Abstract: TBA

Manil T Mohan: June 3, 2024 (2:50 - 3:35 PM IST)

Title: Existence and uniqueness of weak solutions for the generalized stochastic Navier-Stokes-Voigt equations

Abstract: In this talk, we consider the incompressible generalized Navier-Stokes-Voigt equations in a bounded domain $\mathcal{O} \subset \mathbb{R}^d$, $d \geq 2$, driven by a multiplicative Gaussian noise. The considered momentum equation is given by:

$$\mathrm{d}\left(\boldsymbol{u} - \kappa\Delta\boldsymbol{u}\right) = \left[\boldsymbol{f} + \operatorname{div}\left(-\pi\mathbf{I} + \nu|\mathbf{D}(\boldsymbol{u})|^{p-2}\mathbf{D}(\boldsymbol{u}) - \boldsymbol{u}\otimes\boldsymbol{u}\right)\right]\mathrm{d}t + \Phi(\boldsymbol{u})\mathrm{dW}(t).$$

In the case of $d = 2, 3$, $\boldsymbol{u}$ accounts for the velocity field, π is the pressure, $\boldsymbol{f}$ is a body force and the final term stay for the stochastic forces. Here, κ and ν are given positive constants that account for the kinematic viscosity and relaxation time, and the power-law index p is another constant (assumed $p > 1$) that characterizes the flow. We use the usual notation $\mathbf{I}$ for the unit tensor and $\mathbf{D}(\boldsymbol{u}) := \frac{1}{2}\left(\nabla\boldsymbol{u} + (\nabla\boldsymbol{u})^\top\right)$ for the symmetric part of velocity gradient. For $p \in \left(\frac{2d}{d+2}, \infty\right)$, we first prove the existence of a *martingale solution*. Then we show the *pathwise uniqueness of solutions*. We employ the classical *Yamada-Watanabe theorem* to ensure the existence of a unique *probabilistic strong solution*. This is a joint work with Mr. Ankit Kumar and Dr. H. B. de Oliveira.

Tulasi Ram Reddy: June 3, 2024 (4:00 - 4:30 PM IST)

Title: Computing VaR and some issues

Abstract: Value at Risk (VaR) is a crucial risk metric widely used by firms and mandated by regulators to monitor risk. In this presentation, we will discuss some common issues encountered in estimating the VaR metric under weak assumptions. Additionally, we will propose potential solutions to address these problems.

Day 2: June 4, 2024

Sandeep Juneja: June 4, 2024 (9:00 - 9:45 AM IST)

Title: Flipping coins to win!

Abstract: Consider multiple coins with differing biases that can be flipped. While it is difficult to predict the output from a single coin flip, we can, over a longer horizon, figure out which horse to bet on, that is, the coin with the largest favorable bias. But how to learn this quickly to maximize our winnings? Even such simple problems can have a complex and yet delightfully elegant solution. In this talk we outline the underlying ideas. These involve skillful use of information theory, optimization theory and probabilistic ideas including intricate concentration inequalities. As a bonus, we are able to go much beyond Bernoulli coin flips to general probability distributions. We also discuss related and more general problems and a myriad of applications based on these ideas.

Donghan Kim: June 4, 2024 (9:50 - 10:35 AM IST)

Title: Variation index, Hölder exponent, and Schauder coefficients.

Abstract: We study a concept of p-th variation of a continuous function along a general class of refining sequence of partitions. We show that the finiteness of the p-th variation of a given function is closely related to the finiteness of ℓ^p norm of the coefficients along a Schauder basis, similar to the fact that Hölder coefficient of the function is connected to ℓ^∞ norm of the Schauder coefficients. This result provides an isomorphism between the space of α-Hölder continuous functions with finite p-th variation and a subclass of infinite-dimensional matrix equipped with appropriate norms, in the spirit of Ciesielski.

Atul Shekhar: June 4, 2024 (10:50 - 11:35 AM IST)

Title: Large deviation for complex solutions for Bessel SDE.

Abstract: Complex solution to Bessel SDE appears naturally in relation to Schramm-Loewner-Evolutions. Motivated by works of Y. Wang on Loewner chains driven by finite energy functions, we prove a large deviation principle for complex Bessel solutions as the dimension parameter goes to minus infinity. This is a variant of a result of DonatiMartin-Rouault-Yor-Zani which applies for dimension going to plus infinity. This talk is based on a joint work with Arnab Chowdhury.

Siddhartha Pratim Chakrabarty: June 4, 2024 (11:40 AM - 12:25 PM IST)

Title: Single Event Transition Risk (SETR): Carbon-transition Premium to Carbon-transition Risk

Abstract: The genesis of this study is the quantification of the magnitude of carbon risk exposures for portfolios. Existing literature mostly focus on simple measures like emissions per unit revenue or profit, Environmental, Social and Governance (ESG) score etc. Accordingly, we present an alternative risk measure, contingent on the awareness about the future transition risk. We call this measure for carbon risk exposure as Single Event Transition Risk (SETR), adopting an approach

which is analogous to a "default" in credit risk. The basis for this formulation is that the cumulative earnings from the carbon premia exactly offsets the transition risk. The SETR framework assumes that for a probability density function for the arrival of climate driven transition, the value of the transition risk equals the cumulative expected earnings. Therefore, based on the information about the emissions by the firm and the expected arrival time of the carbon transition, one can estimate the carbon risk exposure for the firm. Finally, we consider several probability density functions for the arrival time of climate transition policy and study how the risk measure changes in response.

(The talk is based on joint work with Suryadeepto Nag and Sankarshan Basu)

Suprio Bhar: June 4, 2024 (2:00 - 2:45 PM IST)

Title: Stochastic PDEs involving a bilaplacian operator

Abstract: In this talk, we discuss the existence and uniqueness problem for linear Stochastic PDEs involving a bilaplacian operator. Our results on the existence and uniqueness are obtained through an application of a Monotonicity inequality, which we also prove here. As an application of these results, we also obtain a probabilistic representation of the solution for a linear PDE involving the bilaplacian operator. This is based on a joint work with Barun Sarkar.

Rajat Subhra Hazra: June 4, 2024 (2:50 - 3:35 PM IST)

Title: Gradient of discrete Gaussian free fields and scaling limits.

Abstract: Physicists and mathematicians have for decades been interested in the Abelian sandpile model (ASM), a simple dynamical system that exhibits self-organized criticality. In the present work we asked us the question: what function of a Gaussian field produces the same scaling limit of its joint moments as the height-one field of the ASM? The squared norm of the gradient of the discrete Gaussian free field (GFF) almost does the job, with a subtle yet important difference.We will describe the properties and scaling limits of this model. Also discuss some recent developments which resolve this subtle difference. This is based on a joint work with A. Cipriani (University College, London), A. Rapoport (University of Utrecht) and W. Ruszel (University of Utrecht).

Nacira Agram: June 4, 2024 (4:35 - 5:20 PM IST)

Title: TBA

Abstract: TBA

Day 3: June 5, 2024

Purba Das: June 5, 2024 (9:00 - 9:45 AM IST)

Title: p-th variation and roughness

Abstract: We study the concept of p-th variation of a continuous path along a sequence of partitions and its dependence with respect to the choice of the partition sequence. To start with we introduce the concept of quadratic roughness of a path along a partition sequence and show that for Hölder-continuous paths satisfying this roughness condition, the quadratic variation is invariant with respect to the choice of the partition sequence. Finally, we introduce a notion called Horizontally rough which provides an invariance notion for p-th variation.

K. Suresh Kumar: June 5, 2024 (9:50 - 10:35 AM IST)

Title: Ergodic control problems: a small noise limit approach

Abstract: Using small noise limit approach, we study degenerate stochastic ergodic control problems and as a byproduct obtain error bounds for the approximate optimal controls. We also establish tunneling for a special ergodic control problem and give a representation of the ergodic value using the tunneled Markov chain.

Akash Ashirbad Panda: June 5, 2024 (10:50 - 11:35 AM IST)

Title: Higher order time discretization for the stochastic semilinear wave equation with multiplicative noise.

Abstract: In this talk, I will propose a higher order time-discretization scheme, where the iterates approximate the solution of the stochastic semilinear wave equation driven by multiplicative noise with general drift and diffusion. The variational method for its error analysis is employed and an improved convergence order of 3/2 for the approximates of the solution is proved. The core of the analysis is Hölder continuity in time and moment bounds for the solutions of the continuous and the discrete problem. Computational experiments are also presented.

Mathew Joseph: June 5, 2024 (11:40 AM - 12:25 PM IST)

Title: A random string among random obstacles.

Abstract: We consider a random string on R^d modelled by a vector valued stochastic heat equation driven by additive space time white noise. The obstacles are given by balls of a fixed radius centered around points of a Poisson process. The string dies when any part of the string touches any of the obstacles. We give asymptotic bounds on the probability of survival of the string up to a large time T. The talk is based on joint work with Siva Athreya and Carl Mueller.

Tapan Kar: June 5, 2024 ((2:00 - 2:45 PM IST)

Title: Re-visiting Unit Root Testing Strategy when Presence of Deterministic Time Trend is Uncertain

Abstract: We propose a new testing strategy to test the unit root hypothesis when the linear deterministic time trend is uncertain. Our strategy is obtained by combining the union-based rejection rule and the M-estimation method considering Johnson-SU as a reference density. Simulation results demonstrate that our method exhibits good finite sample performance in terms of power and maintains the test size correctly regardless of the time trend's presence. The proposed method outperforms other strategies in the case of heavy-tailed error processes. We employ the strategy on India's nominal monthly interest rate and observe superior performance compared to existing methods.

Alexander Kalinin: June 5, 2024 (2:50 - 3:35 PM IST)

Title: Mild to classical solutions for XVA equations under stochastic volatility

Abstract: We extend the valuation of contingent claims in the presence of default, collateral, and funding to a random functional setting and characterise pre-default value processes by martingales. Pre-default value semimartingales can also be described by BSDEs with random path-dependent coefficients and martingales as drivers. Moreover, under stochastic volatility, we characterise pre-default value processes via mild solutions to parabolic semilinear PDEs and give sufficient conditions for mild solutions to exist uniquely and to be classical.

Chiraz Trabelsi: June 5, 2024 (4:35 - 5:20 PM IST)

Title: Ergodicity properties of affine term structure models.

Abstract: In this talk, we present some affine term structure models. First we prove the Harris recurrence and strong ergodicity of the CIR model. In the second part, we give two extensions of this model, the so-called BAJB and JCIR models, and we prove the exponential ergodicity in total variation.