SYMPOSIUM 2026

Department of Mathematics, IIT Palakkad

30–31 January 2026

Title and abstract

Certain Aspects of Dynamics

Prof. Riddhi Shah · Jawaharlal Nehru University

We will introduce dynamical systems with a few examples and provide an overview of distal maps, which were introduced by David Hilbert. We will discuss distal automorphisms on locally compact groups and observe some of their properties and characterise them in terms of their contraction groups and behaviour of their orbits. We will also briefly explore dynamics of expansive maps. Then we will briefly mention the dynamics of billiards, related illumination problem and related work of an inspiring woman mathematician.

Lifting and Interpolation Problems

Prof. Jaydeb Sarkar · Indian Statistical Institute Bangalore

Analytic interpolation is a classical problem that started more than a century ago. Another classical problem, the lifting problem, has its roots in basic algebra. These interconnected problems further link several subjects, including complex analysis, linear algebra, Hilbert function space theory, and even electrical engineering. A part of this talk will review the history of these problems and their development in both one and several variables. We will also report on some of the recent developments.

Limiting Spectral Distribution of (Symmetric) Random Matrices with Independent Entries.

Prof. Arup Bose · Indian Statistical Institute Kolkata

It is well known that the limit eigenvalue distribution of the scaled standard Wigner matrix is the semi-circular distribution whose 2kth moment equals the number of non-crossing pair-partitions of $\{1, 2, \ldots, 2k\}$. There are several specific extensions of this result in the literature, including the sparse case. We discuss a broad extension by relaxing significantly the i.i.d. assumption. The limiting spectral distribution then involve a larger class of partitions. In the process we show how some new sets of partitions gain importance. Several existing and new results for their band and sparse versions, as well as for matrices with continuous and discrete variance profile follow as special cases.

The Interpolation Problem in Algebraic Geometry

Prof. Krishna Hannumanthu · Chennai Mathematical Institute

Mathematicians have studied the interpolation problem for a long time. A well-known version, going back to Euclid himself, asks the following: given a finite set of points in the euclidean plane, is there a polynomial of prescribed degree in two variables having them as roots? A variant which is of interest to us requires the polynomial to vanish at the given points up to a certain "multiplicity". We will first introduce this problem by looking at some examples and then discuss some techniques to study the problem. Later we will talk about connections with interesting recent work in commutative algebra and algebraic geometry, beginning with the famous "Nagata Conjecture".

Large Sample Behaviour of High-Dimensional Kendall's Correlation Matrices with Dependence.

Dr. Priyanka Sen · IIT Palakkad

The limiting spectral distribution (LSD) of Kendall's correlation matrix has been established in the literature under conditions of row dependence. However, the assumptions used in prior works are non-interpretable and difficult to validate, especially in non-Gaussian settings. We establish the same under more interpretable assumptions that are easier to visualize and can be validated in a wider range of non-Gaussian models.
Moreover, we establish the joint convergence of multiple Kendall's correlation matrices and the LSD of polynomials formed from these matrices. This significantly extends the existing results by providing a more general framework for studying spectral properties of correlated data.

On Ordering Properties of Sequential Order Statistics and Generalized Likelihood-Based Robust Inference

Dr. Tanmay Sahoo · IIT Palakkad

In practice, we use different kinds of systems that are structurally equivalent to various well-established systems available in the literature, namely, ordinary coherent systems, ordinary *r*-out-of-*n* systems, sequential *r*-out-of-*n* systems, etc. In most real-life scenarios, the components of a system work in the same environment and share the same load. As a consequence, there may exist two different types of dependencies between the components of a system, namely, interdependency and failure dependency. The sequential order statistics (SOS) and the developed sequential order statistics (DSOS) are two models that are commonly used to describe the failure dependency of a system. There is a one-to-one relationship between order statistics and the lifetimes of systems. Thus, the study of order statistics is the same as the study of the lifetimes of systems. We will discuss various ordering properties of the developed sequential order statistics (DSOS) with the dependency structure described by the Archimedean copula.

Classical inference relies on the usual likelihood function, which underlies sufficiency, completeness, and UMP tests, but it is often sensitive to model misspecification and outliers, motivating more robust generalized likelihood approaches. Since classical sufficiency, based on maximum likelihood estimation, is inadequate for divergence-based methods, generalized sufficiency has been introduced; however, sufficiency alone does not ensure optimality, necessitating a compatible notion of generalized completeness. This work develops such a framework, characterizes families that are complete under the likelihoods of Basu et al. and Jones et al., extends the Lehmann-Scheffe theorem to obtain UMVUEs for power-law families.

Kobayashi Hyperbolicity on Planar Domains

Bharathi T. · IIT Palakkad

In this talk, I will introduce the Kobayashi pseudo-distance on domains in the complex plane and discuss its basic properties. We show that any domain with at least two boundary points is a complete hyperbolic with respect to this distance. As an application, we give the elementary proof of some classical results in complex analysis.

Dual Realizations of Hardy and Bergman Spaces on Convex Domains

Dr. Agniva Chatterjee · IIT Palakkad

The space of analytic functionals on a compact convex subset of $\mathbb{C}^n$ is isomorphic to the space of holomorphic functions on its dual complement, as well as to a space of entire functions of exponential type. These isomorphisms are realized via the Fantappiè transform and the Laplace transform, respectively. The Bergman space and the holomorphic Hardy space of a bounded convex domain D can be viewed as subspaces of the space of analytic functionals on the closure of D. The range of the Fantappiè and Laplace transforms restricted to these subspaces was completely characterized in the planar case by Napalkov Jr–Yulumukhamtov (1995, 2004) and by Lutsenko–Yulumukhamtov (1991). In higher dimensions, a similar characterization was obtained for Hardy spaces on strongly convex domains by Lindholm (2002).

In this talk, we study these transforms on Bergman spaces of certain strongly convex domains in $\mathbb{C}^n$, and on Hardy spaces of some weakly convex Reinhardt domains in $\mathbb{C}^2$. This latter class of domains was previously studied by Barrett–Lanzani (2009) in the context of the Leray transform, which plays a key role in our analysis of the Fantappiè and Laplace transforms on Hardy spaces.

Beyond Traditional FEM: Modern Polytopal Methods for Bulk-Surface Models

Dr. Rekha Khot · IIT Palakkad

Beyond Traditional FEM:
Modern Polytopal Methods for Bulk-Surface Models

Franco Dassi, Rekha Khot, Andres E. Rubiano, Ricardo Ruiz-Baier
e-mail: rekhakhot@iitpkd.ac.in

The finite element method (FEM) has been the most widely used numerical approach for approximating solutions to partial differential equations since the 1970s. Traditionally, the finite element analysis relies on meshes composed of simplicial elements (triangles in 2D and tetrahedra in 3D). Over the past decade, however, substantial progress has been made in the development of discretization techniques that admit polytopal meshes (polygonal in 2D and polyhedra in 3D), motivated by their enhanced flexibility in handling complex geometries, adaptive mesh refinement, and unified framework.

In this talk, I provide a brief overview of the transition from classical FEM to modern polytopal methods and motivate the advantages offered by this paradigm. Several prominent approaches fall within this class, including discontinuous Galerkin, hybridizable discontinuous Galerkin, virtual element, and hybrid high-order methods. I highlight their structural differences and focus in particular on the virtual element method (VEM) applied to a bulk–surface problem.

We present the analysis and numerical discretization of a coupled mixed-dimensional (3D–2D) bulk–surface model describing the interaction between a free fluid and a poroelastic plate. The bulk flow is governed by the Stokes equations, while the surface dynamics follow the Biot–Kirchhoff poroelastic plate model. We discuss the well-posedness of both the continuous and discrete formulations, established via suitable inf–sup conditions, and derive optimal a priori error estimates in the energy norm. These theoretical results are supported by computational experiments confirming the expected convergence rates. Finally, we illustrate the applicability of the model and the proposed VEM discretization in a biomedical setting: the simulation of immune isolation via encapsulation with silicon nanopore membranes. This talk is based on work in [1].

References

[1] F. Dassi, R. Khot, AE. Rubiano and R. Ruiz-Baier, Analysis and virtual element discretisation of a Stokes/Biot–Kirchhoff bulk–surface model, Comput. Methods in Appl. Mech. Engrg., 449 (2025).