COGENT – 2024

November 29 – 30, 2024

1 Gaurav Aggarwal (TIFR Mumbai)

TITLE: Singular matrices on fractals

ABSTRACT: Singular vectors are those for which Dirichlet's Theorem can be improved by arbitrarily small multiplicative constants. Recently, Kleinbock and Weiss showed that the set of singular vectors has measure zero with respect to any friendly measure. However, determining their Hausdorff dimension remains a subtle and challenging problem. Khalil addressed this by proving that the Hausdorff dimension of the set of singular vectors intersecting a self-similar fractal is strictly smaller than the fractal's dimension.

In this talk, I will extend Khalil's result in four key directions. First, we generalize the study from vectors to matrices. Second, we analyze intersections with products of fractals, such as the Cartesian product of the middle-third and middle-fifth Cantor sets. Third, we establish upper bounds for singular vectors in a generalized weighted setting. Finally, we derive an upper bound on the Hausdorff dimension of ω-very singular matrices in these broader settings, extending earlier work of Das, Fishman, Simmons, and Urbanski, who studied the real, unweighted case.

Our approach is dynamical in nature, relying on the construction of a height function inspired by the work of Kadyrov, Kleinbock, Lindenstrauss, and Margulis. This is a joint work with Anish Ghosh.

2 Kedar Damle (TIFR Mumbai)

TITLE: Random geometry of maximum matchings of disordered graphs

ABSTRACT: "Maximum matchings" of large disordered graphs (equivalently, "maximally-packed dimer models" defined on such graphs) typically have an extensive (scaling linearly with the number of vertices) number of unmatched vertices – in the language of the maximally-packed dimer model, these vertices host the "monomers" of the maximally-packed dimer configuration. Using the structure theory of graphs, we decompose the disordered graph into a complete set of non-overlapping monomer-carrying "R-type" and perfectly matched "P-type" regions, and identify (using large-scale computer simulations) unusual percolation phenomena exhibited by these regions. (Joint work with Ritesh Bhola, Sounak Biswas, and Mursalin Islam.)

3 Mahan Mj (TIFR Mumbai)

TITLE: Exceptional directions in hyperbolic FPP

ABSTRACT: First passage percolation (FPP) gives a well-known model of random geometry on a fixed background infinite graph. When we specialize to Cayley graphs of Gromov-hyperbolic

groups $\mathbf{G}$, random trees $\mathbf{T}$ emerge naturally. The first part of the talk will dwell on setting up hyperbolic FPP and outlining its basic properties. This will have a probabilistic emphasis.

In the second part, we will specialize to the study of exceptional directions, i.e. distinct random geodesics in $\mathbf{T}$ that converge asymptotically to the same point in the boundary $\partial\mathbf{G}$ of $\mathbf{G}$. This will have a geometric group theoretic emphasis. (Joint work with Riddhipratim Basu).

4 Sabyasachi Mukherjee (TIFR Mumbai)

TITLE: Where polynomial dynamics meets Fuchsian groups

ABSTRACT: Various connections and philosophical analogies exist between two branches of conformal dynamics; namely, rational dynamics on the Riemann sphere and actions of Kleinian groups. In an attempt to study these common features in a unified framework, we construct combinations/matings of complex polynomials and Fuchsian groups realized as iterated algebraic correspondences. This gives rise to 'products' of Teichmüller spaces of genus zero orbifolds and parameter spaces of polynomials inside the space of algebraic correspondences, which allows one to see these objects through a common lens. We will discuss compactifications of such copies of Teichmüller spaces, and end with a host of open questions. (Based on joint works with Yusheng Luo, Mikhail Lyubich, and Mahan Mj.)

5 Debanjan Nandi (IISc)

TITLE: Lyons–Sullivan discretization and Martin boundaries of Markov processes in hyperbolic spaces

ABSTRACT: We will discuss potential theoretic properties of a Markov process which allow a Lyons–Sullivan type discretization of the process to suitable discrete subsets of Gromov hyperbolic spaces, so that the discretized Markov process captures to a large extent the potential theoretic properties of the original process. Orbits of a large class of groups acting properly discontinuously by isometries appear as Important examples of such subsets, the discretized process in this case being a random walk in the group. This includes for example the class of groups acting geometrically finitely. The Martin boundary of the random walk is identified with the limit set of the action. In specific cases, for example for groups with finite volume quotients, the random walk has finite exponential moment with respect to a geometric norm. The talk will be based on joint work with Werner Ballmann and Panagiotis Polymerakis.

6 Balarka Sen (TIFR Mumbai)

TITLE: Contact domination

ABSTRACT: A recent result due to Joel Fine and Dmitri Panov shows every even dimensional closed manifold admits a map of positive degree (i.e. a domination) from a symplectic manifold of the same dimension. We establish a contact analogue of this theorem by showing that every odd dimensional closed manifold is dominated by a tight (in fact, exactly-fillable) contact manifold. Moreover, we investigate the question of domination by Stein-fillable manifolds. Time permitting, we provide some applications regarding asymptotically contact-holomorphic divisors. This is a joint work with Ritwik Chakraborty and Kiran Ajij.