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Lipschitz Images of Fractal Sets and an Application to Pinned Distance Sets

Fractals are sets with intricate structure at infinitely many scales. One robust way to deal with such arbitrary objects is to decompose them into more usable components. Two powerful methods of decompositions include the Fourier transform and projection theorems.

In this talk, we use these tools to establish relationships between the dimension (Hausdorff or Fourier dimension) of a pair of thin sets and the interior, dimension, and measure of the images of the pair under families of Lipschitz maps. For instance, in a joint work with K. Hambrook, we consider lower bounds on the dimension of the product set XY , where X is a set of scalars and Y is a subset of Euclidean space. In a joint work with K. Simon, we determine the measure of $X + S^1$ when X is a set of Hausdorff dimension 1, as well as the interior of $X + S^1$ when X is a suitable Cartesian product of Cantor sets. We then use these result to study distance sets, and we give the first known result in the literature on the interior of pinned distance sets.