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Nonstandard analysis, Hausdorff dimension and Brownian motion

In this paper we explore a nonstandard formulation of Hausdorff dimension. By considering an adapted form of the counting measure formulation of Lebesgue measure, we prove a nonstandard version of Frostman's lemma and find that Hausdorff dimension can be computed through a counting argument rather than by taking the infimum of a sum of certain covers. This formulation is then applied to obtain a simple proof of the doubling of the dimension of certain sets under a Brownian motion. In addition, the fractal properties of the rapid points of Brownian motion are explored using the new method, strengthening a result of Orey and Taylor's.