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Polynomials in Prime Ergodic Averages On Monothetic Groups

Abstract: We say a topological group G, is monothetic if it contains an element α, called a generator, such that the closure of $(n\alpha)_{n=1}^{\infty}$ is G. Monothetic groups are of necessity, abelian. For $\alpha_1, \ldots, \alpha_k \in G$, let

$$\rho(n) = \alpha_k n^k + \alpha_{k-1} n^{k-1} + \ldots + \alpha_1 n + \alpha_0.$$

Also let $(p_n)_{n \geq 1}$ be the sequence of rational primes and let λ denote Haar measure on G.

Suppose G is a compact monothetic group, where one of the elements $\alpha_1, \ldots, \alpha_k \in G$ is a generator and that $f \in L^p(G)$ for $p > 1$. We describe the limit

$$\lim_{N \to \infty} \frac{1}{N} \sum_{n=1}^{N} f(x + \rho(p_n)),$$

for almost all x with respect to λ in terms of the connectivity and arithmetic character of G.

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