Refined Equidistribution and Metric Estimates for Roots of Exponential Sums

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Abstract

Classical results refining the Fundamental Theorem of Algebra give estimates for the number of roots of a polynomial in a disk, an angular sector, or a half-plane. For instance, 19th century results of Cauchy estimate the largest absolute value of a root, and early 20th century work of Wilder gives precise estimates on how close the phases of the roots are to being equidistributed on the unit circle.

We show how tropical methods allow us to combine and refine both results. As a consequence, we obtain a polyhedral approximation to the amoeba of a multivariate polynomial that extends to exponential sums and admits explicit distance bounds. This approximation is called the Archimedean tropical variety and has many algorithmic applications.

We assume no background in tropical or algebraic geometry. The results presented are joint work with Alperen Ergur and Grigoris Paouris.