Lapidus zeta functions of fractal sets and applications

(Talk)

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(joint work with Michel L. Lapidus, University of California, Riverside, and Goran Radunović, University of Zagreb)

In 2009. Michel L. Lapidus has introduced a new class of zeta functions associated with bounded nonempty sets A in $\mathbb{R}^N$, defined by

$$\zeta_A(s) = \int_{A_\delta} d(x, A)^{s-N} dx,$$

where s is a complex number, A_δ is the δ-neighbourhood of A, and $d(x, A)$ is the Euclidean distance from x to A. These zeta functions can serve as a bridge between the geometric theory of fractal sets and complex analyis. A special case are the classical Riemann zeta function and the zeta function of fractal strings. The abscissa of convergence of the Lapidus zeta function of A is equal to the upper box (or Minkowski) dimension of A. Furthemore, if A is Minkowski nondegenerate, then the upper and lower d-dimensional Minkowski contents of A are closely related to the value of the residue of the zeta function of A at $s = d$. We illustrate the properties of zeta functions of fractal sets in the case of generalized Cantor sets and geometric chirps. This is a continuation of previous studies of M. L. Lapidus and his collaborators on fractal strings and their generalizations over the past two decades.

References

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