# Eigenvalues of large distance sets and its applications

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**Abstract**

A finite subset $X$ of the Euclidean space is called an s-distance set if the number of distances between distinct vectors of $X$ is equal to $s$. We obtain a graph which has s relations from an $s$-distance set by a natural way. We show that if the size of an $s$-distance set is greater than some value then an eigenvalue of the graph becomes some special value, so called the generalized Larman-Rogers-Seidel's ratio. By this result, we give some result about a Euclidean representation of a graph having $s$ relations, and we also prove a new lower bound for the maximum distance of integral point sets. Here if an $s$-distance set satisfies all distances are integers, then it is called an integral point set.