# Maximal 2-distance sets containing the regular simplex

**Hiroshi Nozaki**

(Aichi University of Education)

## Abstract

A finite subset $X$ of the Euclidean space is called an $s$-distance set if the number of the distances of two distinct vectors in $X$ is equal to $s$. An $s$-distance set $X$ is said to be maximal if any vector cannot be added to $X$ while maintaining $s$-distance. We investigate a necessary and sufficient condition for vectors to be added to the regular simplex such that the set has only 2 distances. We construct several maximal 2-distance sets that contain the regular simplex. In particular, there exist infinitely many maximal non-spherical 2-distance sets that contain both the regular simplex and the representation of a strongly resolvable design. The maximal 2-distance set has size $2k^2(k+1)$, and the dimension is $d = (k-1)(k+1)^2 - 1$, where $k$ is a prime power.