Euclidean Designs and Relative $t$-Designs

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Abstract

Delsarte (1973) introduced the theory of $t$-designs on Q-polynomial association schemes. Delsarte-Goethals-Seidel (1977) generalized the theory to the case of finite subsets on spheres in Euclidean space. Neumaier-Seidel (1988) further generalized it to finite subsets in Euclidean space. This concept of Euclidean designs is closely related to the cubature formulas in analysis.

The purpose of this talk is to point out the similarity between the concept of Euclidean $t$-designs and that of relative $t$-designs on Q-polynomial association schemes, which was defined by another paper of Delsarte (1977): Pairs of vectors in the space of an association scheme. Relative designs are defined with respect to a fixed point on the given association scheme. In the case of Euclidean designs, we specify the origin.

We discuss the Fisher type bounds on the sizes of relative $t$-designs, and discuss the concept of tight relative $t$-designs on Q-polynomial association schemes. We point out that tight relative 2-designs in binary Hamming association scheme $H(n, 2)$ is related to the concept of $\lambda$-designs in the sense of H. J. Ryser and D. R. Woodall.

This talk is based on ongoing joint work with Eiichi Bannai (SJTU) and Zengti Li (Hebei Normal University/Langfang Normal College)