Abstract

Linear Codes from q-analogues in Design Theory

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In 1967, Rudolph presented a decoding method for linear codes based on majority decision with *non-orthogonal* parity check equations. Whenever a linear code has a point-block incidence matrix of a combinatorial design (with $t \geq 2$) as a parity check matrix, this decoder can be used.

These linear codes from combinatorial designs are only interesting if the p-rank of the point-block incidence matrix is small enough. Hamada (1973) determined the p-rank for the incidence matrices of the so-called classical or geometric designs. It is a long-standing conjecture that the incidence matrices from this class of designs are of minimal p-rank.

In this talk we will show that linear codes from subspace designs (q-analogues of combinatorial designs) are at least as good to decode with Rudolph's method as the linear codes from their corresponding geometric designs, but for many parameters the decoder needs exponentially less parity check equations.

Now, an obvious step is to search for q-analogues of other combinatorial structures and study the linear codes from their incidence matrices. In this talk, we will explore q-analogues of group divisible designs, lifted MRD codes and designs in polar spaces and show how those objects fit into the picture.