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*Linear Codes from q-analogues in Design Theory*

Rudolph (1967) introduced majority logic decoding for linear codes from combinatorial designs: If the point-block incidence matrix of a combinatorial $t$-design (with $t \geq 2$) is taken as a parity check matrix of a linear code, majority logic decoding can be used for this code.

However, such a linear code is 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 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.

Dela Cruz, Wassermann (2021) showed that linear codes from subspace designs ($q$-analogues of combinatorial designs) have the same decoding properties as the linear codes from their corresponding geometric designs, but for many parameters the majority logic decoder needs exponentially less parity check equations.

In this talk, we will show that Hamada's formula can also be applied to $q$-analogues of group divisible designs and lifted MRD codes ($q$-analogues of transversal designs), which may make these classes of codes interesting.

Today, majority logic decodable codes are still interesting for devices with low computational power and because of the relation to linear locally repairable codes and private information retrieval (PIR) codes.