Abstract

Pless symmetry codes, ternary QR codes, and related Hadamard matrices and designs

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We consider a code $L(q)$ which is monomially equivalent to the Pless symmetry code $C(q)$ of length $2q + 2$ that contains the (0,1)-incidence matrix of a Hadamard 3-$(2q + 2, q + 1, (q - 1)/2)$ design $D(q)$ associated with a Paley-Hadamard matrix of type II. Similarly, any ternary extended quadratic residue code contains the incidence matrix of a Hadamard 3-design associated with a Paley-Hadamard matrix of type I. If $q = 5, 11, 17$ and 23 then the full permutation automorphism group of $L(q)$ coincides with the full automorphism group of $D(q)$, and a similar result holds for the ternary extended quadratic residue codes of lengths 24 and 48. All Hadamard matrices of order 36 formed by codewords of the Pless symmetry code $C(17)$ are enumerated and classified up to equivalence. There are two equivalence classes of such matrices: the Paley-Hadamard matrix H of type I with a full automorphism group of order 19584, and a second regular Hadamard matrix H' such that the symmetric 2-$(36, 15, 6)$ design D associated with H' has trivial full automorphism group, and the incidence matrix of D spans a ternary code equivalent to $C(17)$.