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**The cocyclic Hadamard matrices of order less than 40.** (English) Zbl 1246.05033

Des. Codes Cryptography 58, No. 1, 73-88 (2011).

Summary: In this paper all cocyclic Hadamard matrices of order less than 40 are classified. That is, all such Hadamard matrices are explicitly constructed, up to Hadamard equivalence. This represents a significant extension and completion of work by de Launey and Ito.

The theory of cocyclic development is discussed, and an algorithm for determining whether a given Hadamard matrix is cocyclic is described. Since all Hadamard matrices of order at most 28 have been classified, this algorithm suffices to classify cocyclic Hadamard matrices of order at most 28. Not even the total numbers of Hadamard matrices of orders 32 and 36 are known. Thus we use a different method to construct all cocyclic Hadamard matrices at these orders.

A result of *W. de Launey, D. L. Flannery* and *K. J. Horadam* [Discrete Appl. Math. 102, No.1–2, 47–61 (2000; [Zbl 0956.05026](#))] on the relationship between cocyclic Hadamard matrices and relative difference sets is used in the classification of cocyclic Hadamard matrices of orders 32 and 36. This is achieved through a complete enumeration and construction of  $(4t, 2, 4t, 2t)$ -relative difference sets in the groups of orders 64 and 72.

**MSC:**

[05B20](#) Combinatorial aspects of matrices (incidence, Hadamard, etc.)

[05B10](#) Combinatorial aspects of difference sets (number-theoretic, group-theoretic, etc.)

Cited in **1** Review  
Cited in **11** Documents

**Keywords:**

[cocyclic Hadamard matrices](#); [relative difference sets](#); [classification of Hadamard matrices](#)

**Software:**

[GAP](#); [Magma](#); [nauty](#)

**Full Text:** [DOI](#)

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