Flannery, D. L.

Transgression and the calculation of cocyclic matrices. (English) Zbl 0833.05013

Australas. J. Comb. 11, 67-78 (1995).

Let G be a group of order $4t$. A function f from $G \times G$ to Z_2 is cocyclic, if f satisfies the following equations: $f(a,b)f(ab,c) = f(b,c)f(a,bc)$ for all elements a, b and c of G. A matrix whose entries are ± 1 is called binary. A binary matrix M labelled by the elements of G is called cocylic (over G), if there exist a function g from G to Z_2 and a cocyclic function f from $G \times G$ to Z_2 such that $M = (f(a,b)g(ab))$. The following cocyclic Hadamard conjecture was made by *W. de Launey* and *K. J. Horadam* in [Des. Codes Cryptography 3, No. 1, 75-87 (1993)]: For all $t \geq 1$, there is a cocyclic matrix of degree $4t$ that is Hadamard. *W. de Launey*, *K. J. Horadam* and *A. Baliga* presented methods to calculate cocyclic Hadamard matrices over abelian groups; see Des. Codes Cryptography 3, No. 1, 75-87 (1993), J. Algebr. Comb. 2, No. 3, 267-290 (1993; Zbl 0785.05019), and Australas. J. Comb. 11, 123-134 (1995).

In the present paper, the author presents a method to calculate so-called representative cocyclic Hadamard matrices over not necessarily abelian groups utilizing more standard results (including the universal coefficient theorem) in the cohomology theory of finite groups. In particular, the author gives the explicit calculation in the case of a dihedral group of order 8.

Reviewer: N.Ito (Nagoya-Tenpaku)

MSC:

05B20 Combinatorial aspects of matrices (incidence, Hadamard, etc.)
20J99 Connections of group theory with homological algebra and category theory
20J06 Cohomology of groups

Keywords:

transgression homomorphism; binary matrix; cocyclic Hadamard conjecture; cocyclic matrix; cocyclic Hadamard matrices; universal coefficient theorem; cohomology; dihedral group