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Research Announcement: Recursive Construction for Families of Difference Sets

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Recursive construction for families of difference sets

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A \((v, k, \lambda, n)\)-difference set is a \(k\)-subset \(D\) of a group \(G\) of order \(v\) for
which the multiset \(\{d_1 d_2^{-1} : d_1, d_2, \in D\}\) contains each nonzero element of
\(G\) exactly \(\lambda\) times; \(n = k - \lambda\). We give a recursive construction for families
of difference sets with parameters

\[
\begin{align*}
  v_i &= u^i v_0 + u^{i+2} n_0 (u^i - 1)/(u - 1) \\
  k_i &= u^i \lambda_0 + u^i n_0 (u^{i+1} - 1)/(u - 1) \\
  \lambda_i &= u^i \lambda_0 + u^i n_0 (u^i - 1)/(u - 1) \\
  n_i &= u^{2i} n_0
\end{align*}
\]

for each integer \(i \geq 0\), where \(u\) is integer. This parameter family includes
as special cases the Hadamard parameters (satisfying \(v = 4n\)), the McFarland
parameters, and the Spence parameters. We construct examples of
difference sets with McFarland parameters in an infinite family of groups
in which existence was previously unknown. We also construct new infinite
families of difference sets whose parameters do not belong to any previ­
ously known family. In particular, we construct \((320, 88, 24, 64)\)-difference
sets in the groups \(Z_2^6 \times Z_5\), \(Z_2^4 \times Z_4 \times Z_5\), and \(Z_2^2 \times Z_4^2 \times Z_5\). Details of the
construction will be given in a forthcoming paper.

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