**Abstract**

# Algebraic reconstruction of some difference sets

**Kristijan Tabak**

**Faculty of Electrical Engineering and Computing , Department of Applied Mathematics, Unska 3, 10000 Zagreb**

The maim aim of this talk is developing of a method which provides algebraic reconstruction of some difference sets in groups of a type $\langle a,\ b \mid a^n = b^2 = 1,\ a^b \in \langle a \rangle \rangle$. Basic tactics if to develop knowledge and describe a structure of known difference set $D$ , and to use that information to generalize on some bigger cases. A heuristic approach is used for $(64, 28, 12)$ difference set in $G = \langle x,\ y \mid x^{32} = y^2 = 1,\ x^y = x^{17} \rangle$. It is known that there is a such difference set, and it can be written as

$$D = (1+x+x^2+x^3+x^4+x^9+x^{10}+x^{11}+x^{13}+x^{16}+x^{17}+x^{20}+x^{21}+x^{25}+x^{30}+x^6)+$$

$$+(1 + x^{12} + x^{13} + x^{16} + x^{18} + x^{19} + x^{21} + x^{26} + x^{27} + x^{28} + x^{30} + x^6)y.$$

Suppose that $D = \sum_{t=1}^{16} x^{\alpha_t} + \sum_{s=1}^{12} x^{\beta_s} y$, is a $(64, 28, 12)$ difference set in $G = \langle x,\ y \mid x^{32} = y^2 = 1,\ x^y = x^{17} \rangle$. Then we will explore sets of a type $A_1 = \sum_{t=1}^{16} \varepsilon^{\alpha_t},\ B_1 = \sum_{s=1}^{12} \varepsilon^{\beta_s},\ \varepsilon^{32} = 1$, and as major part of investigation, with notation $A_2 = A_1^{(2)},\ B_2 = B_1^{(2)}$ we will prove that

1. $|A_2^{(i)} + (-1)^j B_2^{(i)}| = 4,\ i = 0, ..., 15,\ j = 0, 1;$
2. $|A_1|^2 + |B_1|^2 = 16,$
3. $\overline{A}_1 B_1^{(17)} + \overline{B}_1 A_1^{(17)} = 0$

Target is to find solution of such system of equation, without knowing difference set $D$.