# On spectrum of rotational extended Steiner triple systems

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An **extended Steiner triple system (**$ESTS$**)** is (see [1]) a pair $\langle V, B\rangle$, where $V$ is a set of elements (points) and $B$ is a given collection of unordered triples (blocks) of points with the property that any two (not necessarily distinct) points from $V$ lie in exactly one block of $B$. In an $ESTS$, there are three types of blocks: $\{x, y, z\}$ (triangle), $\{x, x, y\}$ (lollipop), $\{x, x, x\}$ (loop). If $B$ consists from triangles only, then it is a $STS$.

The groupoid $\langle V, \cdot\rangle$ where $x \cdot y = z \Leftrightarrow \{x, y, z\} \in B$ is a totally symmetric quasigroup if and only if $\langle V, B\rangle$ is an $ESTS$. Hereby $x \in V$ is an idempotent if and only if $\{x, x, x\} \in B$. Let $ESTS(v, a)$ denotes an $ESTS$ $\langle V, B\rangle$ with $v$ ($v = |V|$) points and $a$ idempotents.

An **automorphism** of an $ESTS$ $\langle V, B\rangle$ is a permutation of $V$ which preserves the blocks of $B$. Let $f \geq 0$ and $k > 0$ be integers. An $ESTS(v, a)$ is said to be $(f, k)$-**rotational** (see[2]) if it admits an automorphism consisting of exactly $f$ fixed points and $k$ cycles of length $\frac{v-f}{k}$. By $Spec(f, k)$ is denoted the set of all pairs $(v, a)$ of ingegers such that there exists an $ESTS(v, a)$ which is $(f, k)$-rotational. The set $Spec(f, k)$ is called **spectrum** of $(f, k)$-rotational $ESTS$s.

The spectrum $Spec(f, k)$ for small $f$ and $k$ is studied. The spectrums $Spec(2, 2)$ and $Spec(3, 2)$ are described in [2]. Some results characterising $Spec(f, 3)$ will be presented.

# References

[1] L. Beneteau, Extended triple systems: geometric motivations and algebraic constructions, *Discrete Mathematics*, 208/209, 1999, 31-47.

[2] Chung Je Cho, $(f, 2)$-rotational extended triple systems with $f = 2$ and $f = 3$, *J. Korean Math. Soc.*, 39:4, 2002, 621-651.