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About classification of the general functional equations, having three subject variables, on the set of invertible two-placed functions

A two-placed function f, defined on an arbitrary set Q, is said to be *invertible* or *quasigroup*, if every of the equations $f(x;a)=b$, $f(a;y)=b$ has a unique solution for all a, b of Q. Assigning x and y to every pair $(a;b)$ defines invertible functions f^{ℓ} and f^{r} on Q. So, the superidentities

$$F(F^{\ell}(x;y);y)=x, \quad F(x;F^{r}(x;y))=y, \quad (F^{\ell})^{\ell}=F, \quad (F^{r})^{r}=F \tag{1}$$

hold, i.e. the equalities are true for all $F\in\Delta$ and $x,y\in Q$, where Δ denotes the set of all invertible functions of the set Q.

Functional equations, having no functional and subject constants and having two-placed functional variable only, are under consideration. A functional equation is called *general*, if all functional variables are pairwise different. Two functional equations are said to be *parastrophic equivalent* (see [1]), if one can be obtained from the other in a finite number of renaming functional or subject variables or applying the superidentities (1).

If a functional equation has one occurrence of a subject variable and has a solution on Δ, then $|Q|=1$. A subject variable having exactly two occurrences in a functional equation is said to be *quadratic*. A functional equations is called *quadratic*, if every its subject variable is quadratic. The functional equations of associativity, bisymmetry, transitivity are quadratic (see [2]). The distributivity and Moufung functional equations have two quadratic variables, and the third variable has tree and four occurrences respectively.

Theorem. *Every general functional equation, having two quadratic variables and one three (four) occurrence variable, is parastrophic equivalent to at least one of five (respectively, eight) functional equations.*

Eleven of these thirteen functional equations have been solved (see [3]).

[1] Sokhatsky F.M. Classification of functional equations on quasigroups // Ukrainian mathematical journal **56** 9 (2004), 1259 - 1266.

[2] Aczél J., Dhombres: Functional equations in several variables. Cambridge university press, 1989, 432.

[3] Krainichuk H.V., Sokhatsky F.M. About solving of the general functional equations, having three subject variables, on the set of invertible two-placed functions. (here)