

The non-associative properties of quasigroups are useful in cryptography. A. Drápal and I. M. Wanless have recently analyzed the existence of a maximally non-associative quasigroup of order n in their work, but there remain orders n for which the existence is not known. This thesis is an introduction to a new method of tackling the problem.

After presenting the most recent results and hinting at a possible cryptographic application, the thesis proposes the construction of a 3-dimensional abstract simplicial complex from non-associative triples of a finite quasigroup. It shows that the complex forms of a union of closed orientable pseudomanifolds of dimension 3. For orders up to 6, we independently verify the findings of Ježek and Kepka regarding the associativity spectrum of n and classify possible decompositions of the non-associativity complexes into strongly connected components by analyzing their dual graphs.

The main result of the thesis performs the first step towards resolving the singularities in the complex. We show that links of vertices in the complex have solvable singularities, enabling us to normalize the links of vertices algorithmically. Lastly, we illustrate the types of vertex neighborhoods on examples of small quasigroups by calculating the genera of their components.