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Abstract

Logic synthesis of specific Boolean functions

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Logic synthesis has been the subject of intensive research for many years. In recent years, Boolean functions of a specific form, called index generation functions, gained a lot of interest. It is due to their numerous applications in telecommunications and cybersecurity, among others. These functions have many input variables and a relatively small set of vectors in the truth table. Therefore, they can be efficiently minimized using logic synthesis methods.

The main research problem of the dissertation is the implementation of the aforementioned functions that leads to the reduction of memory use. To solve this problem, the following methods were proposed:

- a linear decomposition algorithm using discernibility sets,
- application of dedicated architecture using probabilistic structures,
- functional decomposition algorithms based on graph theory algorithms and the satisfiability modulo theory (SMT) problem.

The obtained results confirm the effectiveness of the proposed solutions.