COMPARATIVE ANALYSIS OF THE QUINE AND CARNO MAP METHODS OF MINIMIZATION OF BOOLEAN FUNCTIONS

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Minimization of the Boolean functions is one of the typical problems in modern circuitry. The complexity of the Boolean function, and hence the complexity and cost of the circuit (chain) implementing it, are proportional to the number of logical operations and the number of occurrences of variables or their negations. In principle, any logical function can be simplified directly with the help of axioms and theorems of logic, but, as a rule, such transformations require cumbersome calculations. Moreover, the process of simplifying Boolean expressions is not algorithmic. Therefore, it is more useful to use special algorithmic methods of minimization, allowing to simplify the function quickly and without mistakes.

Currently, in the theory of the design of logic circuits, the problems of minimizing disjunctive and conjunctive normal forms that provide a rational solution in the synthesis of combinational circuits, the inputs of which are both variables and their inversions, are the most fully investigated.

The paraphrase representation of variables is easily ensured if they are removed from the trigger outputs used as storage cells of the digital devices being developed. The main task of minimizing SDPN and SCNF is to find terms that are suitable for gluing with subsequent absorption, which for large forms can be a rather complicated task.

Methods that allow minimization to be quick and accurate include the Quinn method, the Carnot map method, the implicant test method, the method of implicit matrices, the Quinn-McCluskey method, and others. These methods are most suitable for ordinary practice. The Carnot card method retains visibility with no more than six variables. In those cases when the number of arguments is more than six, the Quinn-McClassy method is commonly used. In the process of minimizing one or another logic function, the basis in which it will be more effective to realize its minimal form with the help of electronic circuits is usually taken into account.

The Carnot Map is a rectangle divided into squares whose number is equal to the number of sets of a given function (2n). In the Carnot map, the boolean variables from the truth table are ordered in accordance with the principles of the Gray code, in which only one variable varies when passing between adjacent squares. When the table is generated, and the reference values are put in the corresponding cells, the data is organized into the most possible groups containing 2n cells (n = 0,1,2,3 ...). Further, working with these groups a minimum DNF is received.

Disadvantages of the Carnot Card Method:

• it is expedient to apply for the number of variables not more than 5;

• the contours are selected intuitively and there is no algorithm that provides the best solution.

The Quine method (simple implicant method) is another way of minimizing functions of the algebra of logic. It represents functions in the form of DNF or CNF with a minimal number of members and with a minimum set of variables. It is functionally identical to the Carnot map, but the tabular form makes it effective to be used in computer algorithms.

The transformation of the function can be divided into two stages:

1. The transition from the canonical form (SDPN or SCNF) to the abbreviated one is perfomed at the first stage.

2. The transition from the abbreviated form to the minimal one is performed at the second stage.

Similarities between the Quine and Carnot Cards:

• The vectors of the neighboring Carnot map cells are identical to the vectors of the neighboring sections of the merging table of the Quine method.

• Combining the contours on the Carnot map is identical to the merging in the Quine method.

• Finding MDNF and MKNF by the Quine method differs from each other by the same principles as in the Carnot method.

The considered methods of Carnot, Quinn, Quayn-McKlakee refer to the precise methods for minimizing the Boolean functions, allowing us to find a minimal DNF. However, computer blocks are described by functions that have dozens and hundreds of arguments and thousands of terms. Of course, such functions can be minimized using the *Quine* McCluskey *method* , but the minimization time will be unacceptably long (days and weeks). In this connection heuristic methods are used to solve practical problems of large dimension, which allow to find the minimum DNF at an acceptable time. It is important, however, that heuristic methods do not require as much computer memory as precise methods do. Practical methods use the principle of an iterative improvement solution, besides, they do not require all the primary implicants.

ZUR CHARAKTERISIERUNG DER ZUSAMMENHÄNGE IN DEN GEOTECHNISCHEN SYSTEMEN "MENSCH - TECHNIK - NATUR"

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