ISSN 0146-4116

Eng

[redacted]

AUTOMATIC CONTROL AND COMPUTER SCIENCES

(Avtomatika i Vychislitel'naya Tekhnika)

1988

Vol. 22, No. 1

ALLERTON PRESS INC.

(8)(9)

DESIGN OF FLOWCHARTS OF BINARY PROGRAMS FOR SYSTEMS OF BOOLEAN FUNCTIONS SPECIFIED BY TRUTH TABLES

V. I. Rubinov and A. A. Shalyto

Avtomatika i Vychislitel'naya Tekhnika,
Vol. 22, No. 1, pp. 87-92, 1988

UDC 62.507

The paper is concerned with the design of optimized flowcharts of binary programs implementing sets of Boolean functions defined by truth tables. The procedures suggested in the paper are based on mergers of identical rows and identical adjacent values in columns of the truth table. For the former method, optimizing procedures are suggested; for the latter, a technique of flowchart design is presented. This method allows assigning the same code numbers to initially different rows of the truth table.

Binary programs (BP) are an option in microprocessor implementation of systems of Boolean functions (SBF). BP correspond to single-input flowcharts with conditional alternative nodes and operator nodes such as assignment of constants. In [2], BP have been divided into two classes: generalized BP (GBP) and simple BP (SBP).

Operator nodes in GBP flowcharts can occur in any place; for a SBP [2] all the operator nodes are placed after the conditional nodes at the end of each flowchart path. (We should note that in [3] the term "simple BP" is interpreted differently. A BP is said to be simple if on any of its paths in the flowchart no variable occurs more than once.)

The method of construction of a flowchart of SBP for SBF defined by a truth table (TT) has been suggested in [4].

The method of construction of single-input flowcharts of GBP based on Shannon's decomposition with a formula description of SBF has been discussed in [1]; its application for SBF specified by a TT has not been formalized.

In this paper we suggest a method for the construction of single-input flowcharts of BP for SBF from TT, which is an extension of the methodology described in [4].

The problem is solved in the following way.

A system of N fully defined Boolean functions is given, which depend on n variables; it is specified by a TT consisting of N + n columns and 2^n rows. The objective is to construct a flowchart implementing this SBF with a minimal number of nodes.

Since the first n columns of the TT (independent variables) are standard, the optimization of the flowchart is achieved by mergers in the other N columns of the TT (function values).

We will examine two types of mergers: 1) of like rows; 2) of like adjacent values in each column.

The two methods described below are based on these two merger techniques. One is an extension of the method described in [4], where additional optimizing procedures are introduced; the second method is different. The first method can be used to construct the flowchart manually; the second is formalized.

Both methods use canonical tables (CT) [5].

OPTIMIZATION OF SBP FLOWCHART

The method suggested in [4] is based on a merger of the like rows of TT values. In

84