COMPUTER AIDED DESIGN OF THE COMBINATION AND SEQUENTIAL PNEUMATIC AND HYDRAULIC CONTROL

Z. Kaposvári, I. Szabó and L. Lőrincz

Institut of Precision Mechanics and Optics,
Technical University, H-1521 Budapest
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Abstract

The paper presents the computer aided design of combinative and sequential pneumatic and hydraulic control system. The combinative network designing program renders the fast minimalisation of networks having one or more outputs possible. The sequential networks designing program produces the output equations on the basis of cycle-diagram of control. Using minimal number of elements provides the program the solution.

Program for designing combination network

The output functions are to be represented with the help of logical functions. For the purpose of minimization, the QUINE-McCLUSKEY method has been used. The program solves the given design task by using minimum number of elements and devices.

The program displays the output functions that has been minimized. By using AND, OR, NOT logical gates the logical network is graphically represented (like equipment-oriented circuit), after this if desired the pneumatic and hydraulic input-output circuit can also be displayed.

The program has been written in BASIC language in COMMODORE-64 persoan computer. Due to limited size of the memory the program in the present form can handle network having max. 6 input and 6 output.

The program uses SIMON'S BASIC software too.

The advantage of the method worked out by us is that it is limited by the capacity of the computer only. Thus theoretically, with the help of our method it is possible to design combination network having arbitary number of input and output. For the better understanding of our method the following example is considered:

Design of combination network having 5 input and 3 output (Fig. 1). Logical network (Fig. 2). Input-output circuit (Fig. 3).

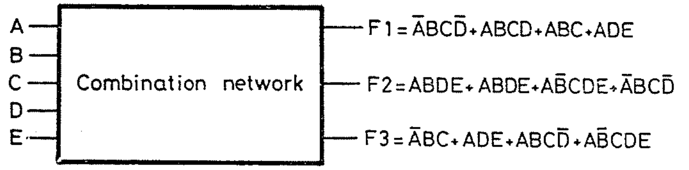

Fig. 1

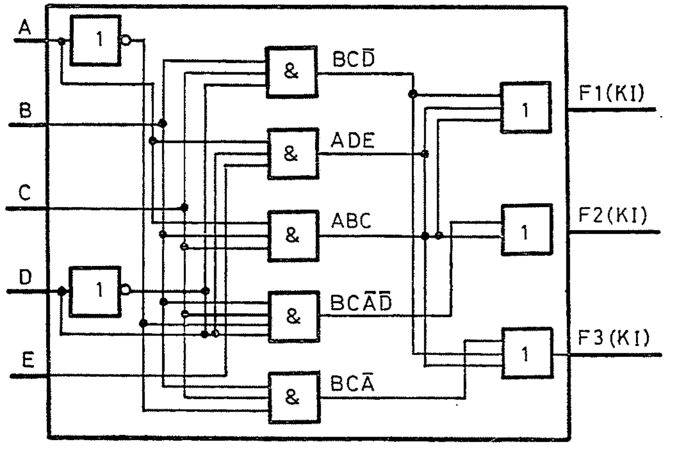

Fig. 2

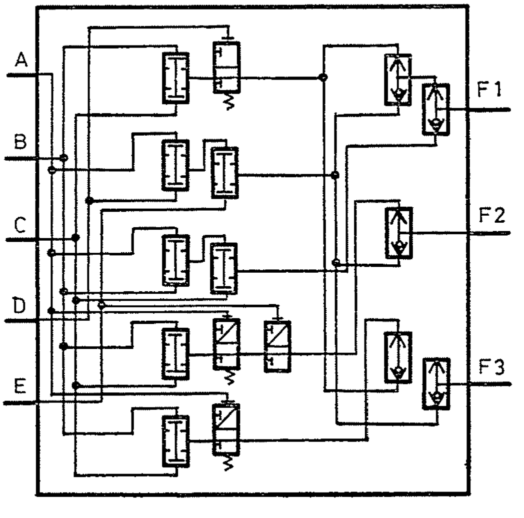

Fig. 3

In the program the negation of the variables are denoted with the help of capital letters.

Description of the computer program developed for the purpose of sequential network design

The program is of great help if quick designing of pneumatic, hydraulic sequential control systems is required. The input signals of the network is provided by the signals of the final state (position) switches, which are connected with the piston-rod of the work-cylinder. The valves that operate the work-cylinders, can be controlled with the help of the output signal of the network.

Feeding of data:

First the number of the work-cylinder has to be given, then the number of the states of control (i.e., the number of stroke) is to be fed. After this the task can be typed or the cycle-diagram can be presented on the display.

Results of the program:

The program provides the result in the form of network (logical) equations:
1. Output equations
2, Writing and erasing equations of memory
3. Writing and erasing equations of the closing valves.

These equations uniquely represent the network. The program has been written in BASIC language in COMMODORE-64 personal computer. The program can take into consideration maximum 6 work-cylinders and 20 cycle states.

The advantage of the method worked out by us is that the size of the network is limited due to the limited size of the memory only, theoretically, arbitary number of work-cylinder and arbitary number of strokes can be considered.

As an example solution of a control problem is given in which 4 work-cylinders and cycle diagram having 12 states are considered (Fig. 4).

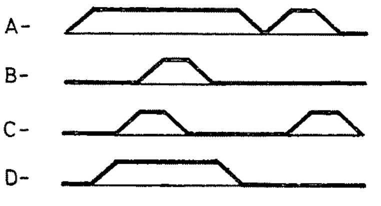

Fig. 4

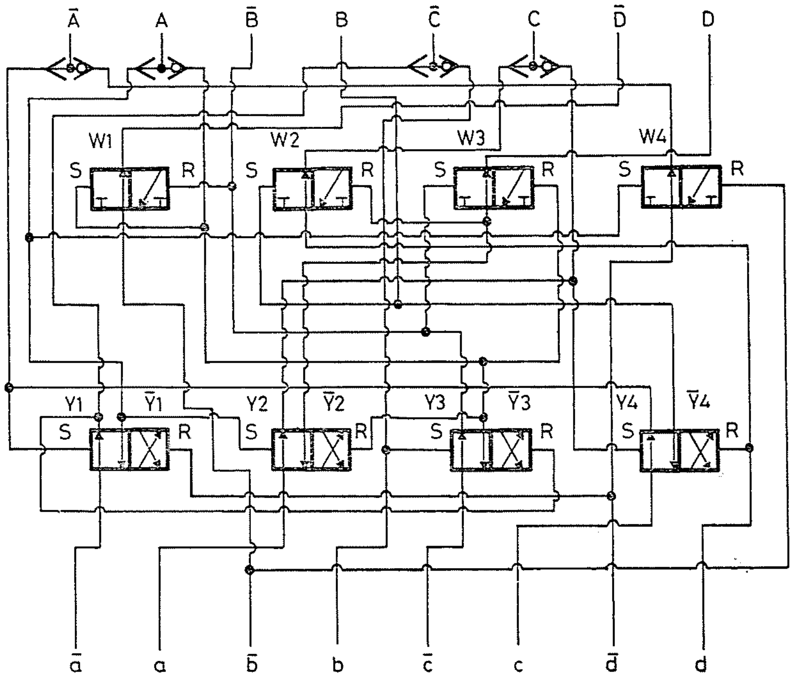

Fig. 5

Output equations:

$\bar{A} = \bar{a}W(4)+cY(04)$
$A = \overline{cy}(03)+\overline{ay}(01)$
$\bar{B} = \bar{c}Y(03)$
$B = c\bar{y}(04)$
$\bar{c} = b+\bar{a}Y(01)$
$C = dW(2)+aY(02)$
$\bar{D} = \bar{b}W(1)$
$D = a\bar{y}(02)W(3)$

Equations of memory:

Set $Y(1) = cY(04)$
Set $Y(2) = \overline{ay}(01)$
Set $Y(3) = b$
Set $Y(4) = aY(02)$

Reset $Y(1) = \bar{a}$
Reset $Y(2) = \overline{cy}(03)$
Reset $Y(3) = \bar{a}Y(01)$
Reset $Y(4) = d.$

Equations of the closing values:

Set $W(1) = \bar{c}Y(03)$
Set $W(2) = a\bar{y}(02)$
Set $W(3) = \overline{cy}(03)$
Set $W(4) = \bar{b}$
Reset $W(1) = \overline{cy}(03)$
Reset $W(2) = c\bar{y}(04)$
Reset $W(3) = \bar{c}Y(03)$
Reset $W(4) = \overline{ay}(01)$
Input-output circuit (Fig. 5.).

References

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Dr. Zoltán KAPOSVÁRI
István SZABÓ
László LŐRINCZ
H-1521, Budapest