SYNTHESIS AND SIMULATION OF COMBINATION CIRCUITS THROUGH THE BASIC FUNCTIONS OF A PROGRAMMABLE LOGIC CONTROLER

Antoaneta Hinova
Technical college-Lovech, Bulgaria, hinovi@abv.bg

Abstract:. The purpose of this article is to assist and enrich the laboratory and teaching practice in technical and vocational education with preliminary information, examples and solved tasks. The advantages of electronic modeling, which is designed to facilitate the ever-expanding electronization of the learning process, are explained. The synthesis of combinatoric summers is a task related to the methodology of practical study of digital and logic circuits through a programmable logic controller. The schematic examples are intended for students, students, teachers - specialists and lecturers in all technical specialties of vocational high schools, colleges and universities. Examples are presented illustrating the advantages of electronic modeling in research and design, the possible application of software products for electronics in the automation of engineering work and in non-electrical subjects such as electrical engineering, electrical equipment, mechatronics and others. The programmable logic controller "LOGO" from Siemens is easily portable, simplified enough to study the programming with it and, moreover, the virtual simulation of the circuits can be monitored at every stage of their operation. The teaching practice shows that the combination of LOGO's PLC programming environment and the study of the synthesis of combinational aggregators in this environment gives the fastest and highest results in the learning process, especially in non-electronic specialties. The method can also be successfully applied in design practice.
The Siemens LOGO module is highly functional and easy to operate. It runs and runs on Windows, Linux, MacOSX. Programs can be tested, recorded, printed and archived independently of the controller. LOGO on a modular principle is easily portable, needs fewer accessories and can be expanded as needed. Other advantages include simple installation and easy programming. The LOGO controller remembers the program permanently, it is not erased when the power is turned off. The program remains stored until it is deleted with the corresponding command. The program part can be used for computer simulations of synthesized circuits and without the physical presence of the controller.
The best result compared to other simulators is obtained with the CEEMS controller due to its main advantages of visualizing the work environment. The simplicity of installation and uninstall, the poor computer requirements, the ability to monitor and record all the simulation variants and the individual windows are discussed in this material.
Keywords: synthesis, simulation, summaries, basic functions, programmable logic controller, combinational logical circuits

1. INTRODUCTION

The one-off combiner add-on is intended for the binary collection operation. If the summator has two inputs and works according to the rules
0 + 0 = 0; 0 + 1 = 1; 1 + 1 = 1; 1 + 1 = 0 (1) is called half-adder [1]. (1)

2. EXPOSITION

The synthesis of a half-adder in the LOGO program environment is shown in Fig. 1.
Sum Q1i = not (I1i). I2i + I1i.not (I2i) Carry Q2i = I1i.I2i (2)

Fig.1. Half-adder

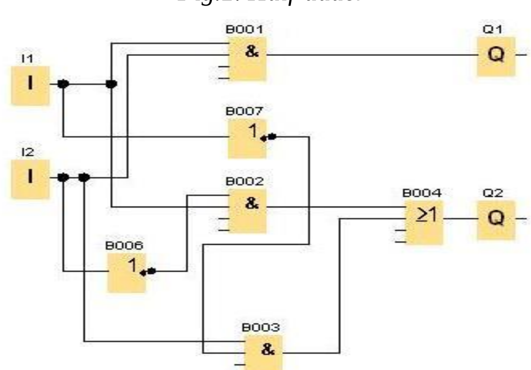
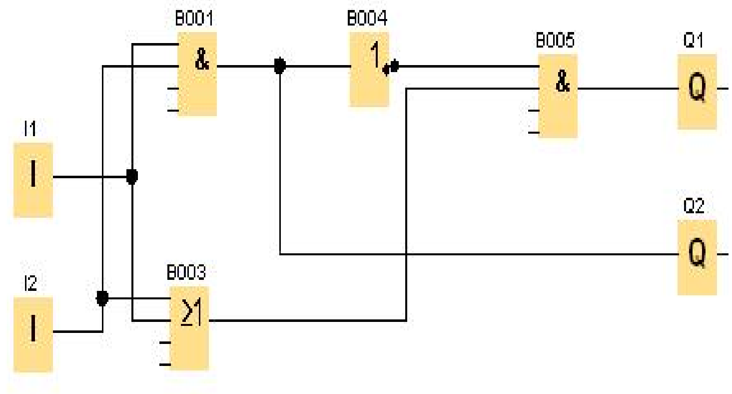


Fig.2. Simple half-adder



In this example, I1i and I2i denote the i th disposals of the collections, and with Q1i and Q2i, respectively, the sum and the transfer formed in the half-adder. The scheme can be simplified if the following carrysons are made (Figure 2):

Q1i = (I1i + I2i). [Not (I1i) + not (I2i)] = (I1i + I2i). not [I1i. I2i] = (I1i + I2i). not (Q2i) (3)

Carry Q2i = I1i.I2i (4)

If the i-1 discharge is considered, the combiner is called full. Figure 2 shows the corresponding scheme.

From the various simulation cases shown in Fig. 3, Fig. 4 and Fig. 5, the relevant conclusions can be drawn about the action of the adder scheme by tracing switching on the lamp on output Q1 (sum) and output Q2 (carry).

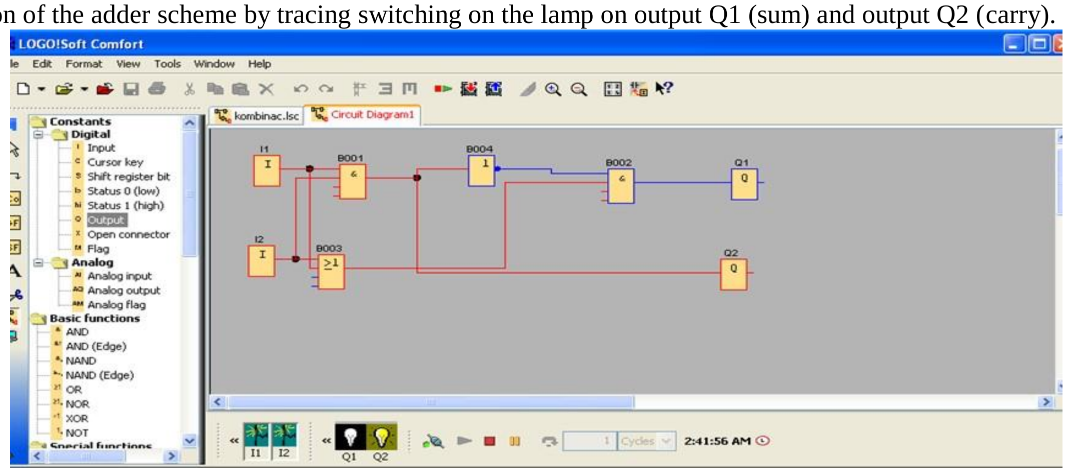


Fig.3 Simulation simple half-adder

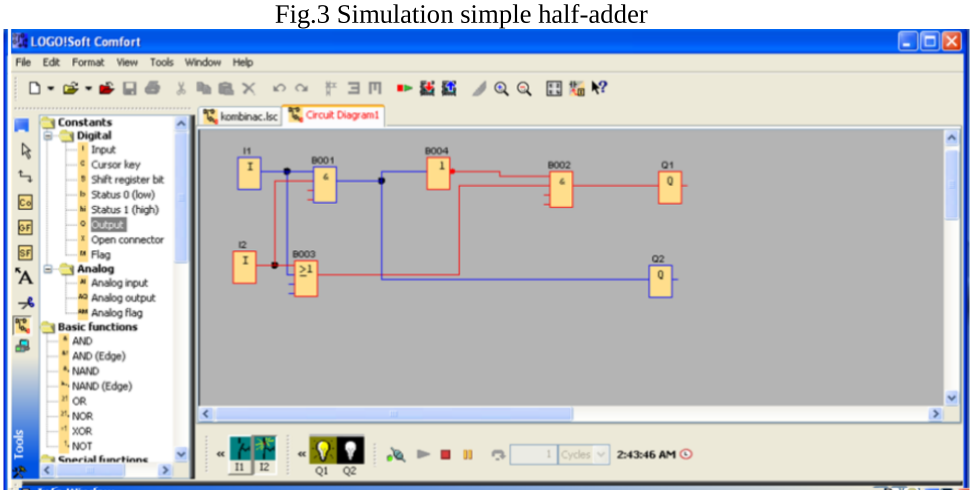


Fig.4 Simulation with sum activation Q1

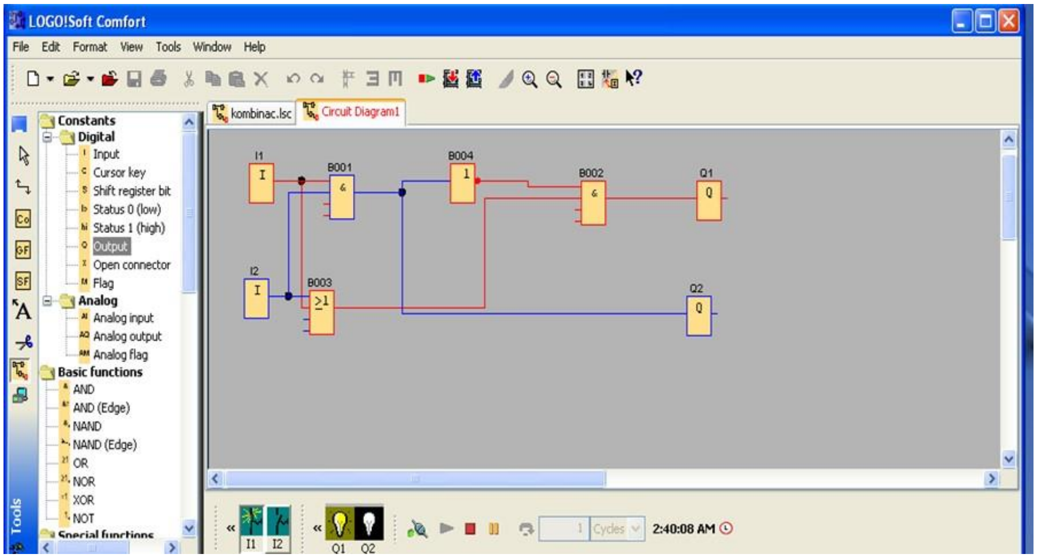


Fig.5. Simulation with activated input I1 of the half-adder.

From the simulations, we can see that the transfer of the Q2 output is activated with the signals input at both inputs. In the operating environment of the programmable controller, it is possible to trace in detail the operation of the synthesized circuit and the individual connections between the blocks of the basic functions of the controller. Blocks B001 and B002 are the basic logical functions "AND". Block B003 is the basic logical function "OR". Block B004 is an inverter. The controller does not run unfinished programs.. Here, I1i and I2i are discharged to the collections, such as I1 = I1i, and I2 = I2i. Input I3 = O2i-1, i. transfer from (I-1) a discharge. The outputs Q1i = Ci-sum, a Q3 = Q2i - the adder.

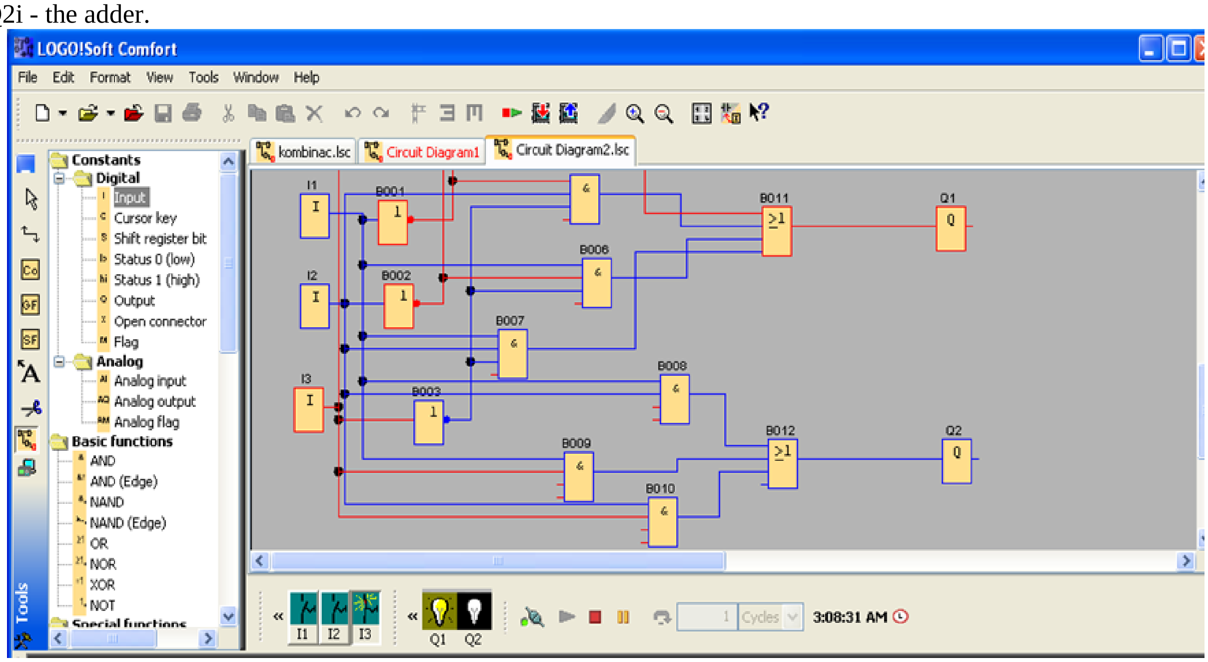


Fig.6.. Simulation with activated input I1 of the full-adder.

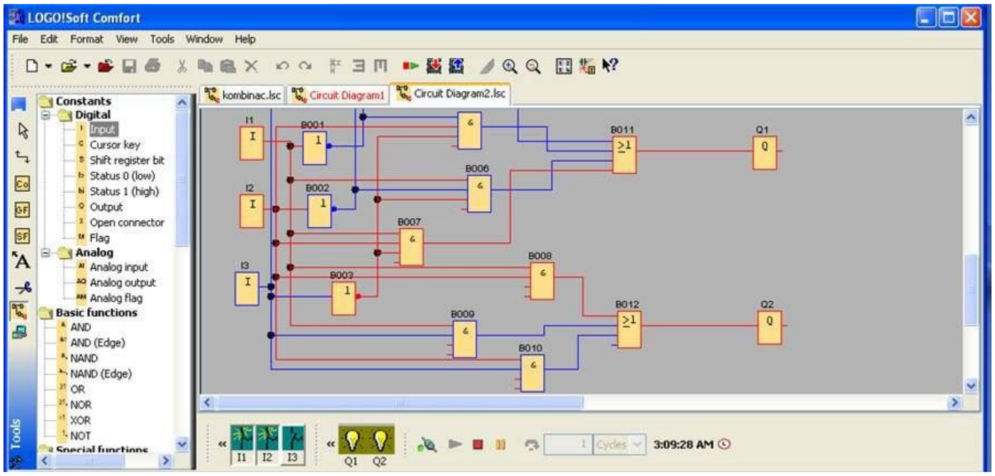


Fig.7.Simulation with two inputs included

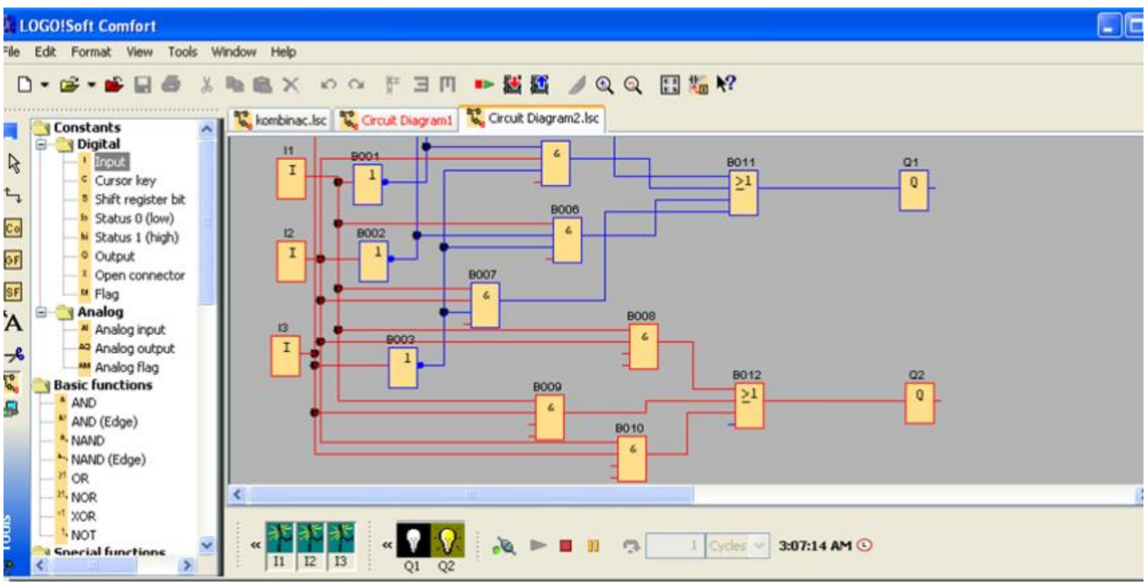


Fig.8. Simulation with 3 inputs included

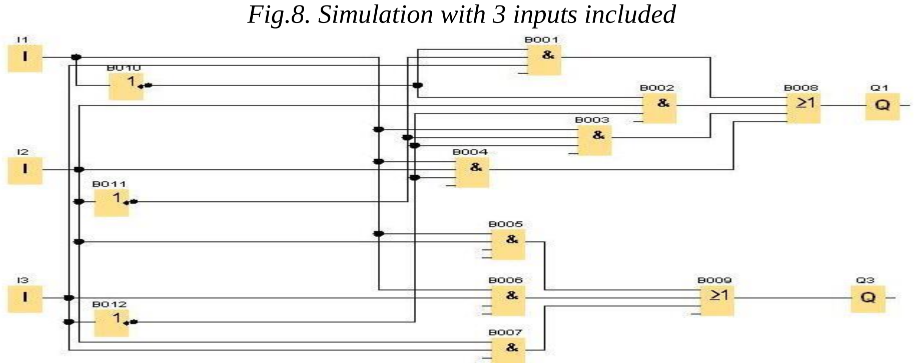


Fig.9 Full adder

An advantage of such a three-factor adder is the unity of the elements used.

In a similar way, binary chip schemes are synthesized. Three binary subtraction scheme is also provided if inverters are set at input I1 = I1i and output Q1 = Q1i of a full adder. There are combined binary subtraction and collection schemes. In this case, a fourth (managing) input allowing for summing or subtraction is required.

Combined circuits do not contain a logical memory element, so their effect, if ignoring the delay of signals in the logical elements, is not time dependent. The state of this scheme depends only on the specific input set variables then drawing time tables, all fronts are presented idealized, ignoring delays in logical elements.

If we have a line for counting and summing details, it is necessary to use an optoelectronic sensor. Image sensors have been widely used to solve a number of tasks such as measuring and tracking geometric dimensions of objects, recognizing images and characters, measuring small linear displacements, and many others [2]. The logic circuitry of the counters together with linear image sensors when we have relative motion between the object and the receiver have found a wider application in the matrix phototransfer.

3. CONCLUSION

Programming is done with FBS (functional block diagrams are fast because it does not include code writing, but it is a logical circuit drawing in the graphical environment of the intended software. Together with the drawing of logical circuits, the programming of the controller itself and the solving of practical tasks with it is also introduced. With elementary logic functions, individual private simulation cases can be tracked, according to table of truth and to detect any error or synthesis scheme. It is important to note that the LOGO controller does not execute incomplete programs and prevents duplicate or interlaced links between the elements. Compared to the other simulators offered for demonstration of logic circuits, the programmable controller is widely applicable in the practical technical product on a modular principle and the concept of its programming is part of the training of any modern specialist.

LITERATURE

Hinova A., (2015) Electronic Models to Support Training in Technical and Vocational Education, Avangard Prima,Sofia

Draganov N.,(2014) Sensors, Part I,, ЕКС-ПРЕС, Gabrovo, 2014, p.198

Parr Э. (2007), per. with 3 rd ed., Parr E., per. with 3 rd ed., Programmable Controllers: A Manual for the Engineer. M.: BINOM. Laboratory of Knowledge.,

Mitin G.P., Hazanova O.V.,(2009) Systems Automation with the Programming and Logic Controllers: Training Toolkit, M .: IKT MGTC "Stankin

Demenkov N.P,(2016). Automatic control systems based on programmable logic controllers, Schneider Electric Technical Collection. Issue 16

.