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DIGITAL CONTROL FOR FLEXIBLE MANUFACTURING SYSTEM

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ABSTRACT:

In this paper presented a flexible manufacturing system for processing. The control system was realized with a dedicated programmable four bits automat. The graphic simulation program written in I-80x86 assembly language.

1.INTRODUCTION

Automatical flexible manufacturing system presented in this paper work is designated for mass serial production and it is composed itself of:

Three manipulation robot (2) ,
one transfer transporter (1) ,
two lathes with numeric command (6),
a rectifying machine (5),
a bore mill (3),
a welding installation (4) ,
a whole machine (7).

The flexible manufacturing system scheme is shown in figure 1.
The transport line supplies itself with pieces, which will suffer different manufacturing operations. The three robots assure the pieces transfer from transporter to tool-machine and reverse. The first robot assures the supplying of the first numeric command lathe and the whole machine, the second robot does the same operation for the second numeric command lathe and the bore mill, and the third robot for the welding installation and the rectifying machine. The control system must assure the execution of all manufacturing (lathe operation, bore operation, hole operation, and weld operation) and manipulation operations, the manufactured product quick change, robots moves synchronization with the other operations, the work process starting/stopping, defects searching and stops in case of trouble. For the control system operations, like the process starting / stopping, defects searching and trouble stops; that's why the current paper work authors propose for: these automats to be replaced by low costs automats in special by the 4 biti automats.

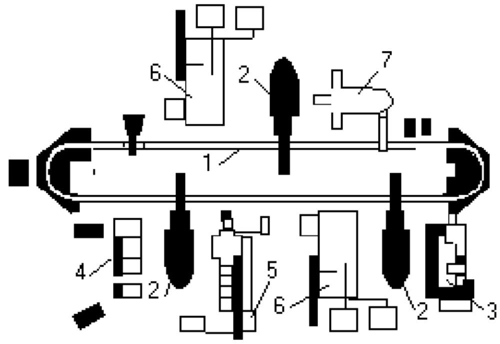

Figure 1: Flexible manufacturing system

2.AUTOMAT'S PRESENTATION

The SSF type automats, indifferent of achievement principles, work as following:
- it reads the binary input variables ;
- it evaluates their values reporting them to certain logical functions, tables of true or transition tables ;
- taking count of the evaluation results, it transmits commands outside and eventually signalments etc.

It results that more regularly this automat performs bit the registers fillings, subroutines calls and less mathematical
calculations. That is why this kind of automat con be achieved on microprogramming principle using the following scheme, in figure 2.

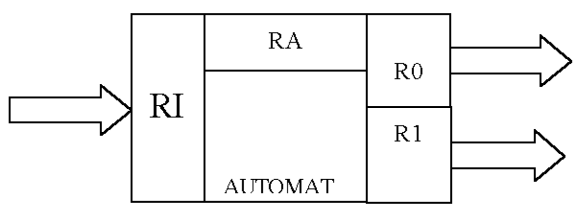

Figure. 2: Automat's Bloc-scheme

For example will consider the case of 4 bits micro programmable automat:
-input register of 4 bits called RI;
two output registers of 4 bits called R0, R1;
-central processing unit (CPU), where is the stack and the address register called RA;
-microprogramming memory will perform programes written in the automat's language;
-the automat can work with the 4 registers R0,R1, RI, RA, the stack and compare the 4 coming input bits ;
-the work with microprogrammes is done through performing of 4 instructions:

A_x :BIT B_i JNZ A_j JMP A_K ; if B_i=1 jump to A_j else A_k ;
A_x:LD Y_i, N_j JMP A_k ; load Y_i with N_j , jump to A_k ;
A_x:CALL A_s RET A_r ; call subroutine A_s with return to A_r ;
A_x:RET ; exit subroutine to address from stack

3.AUTOMAT FUNCTION SIMULATION

The simulation is based on a concrete application acceleration of a motor used to the transport belt (band) starting.
This automat is in recess if u is open and then R0.0=1, through the help of a gate LED 1 is lighted showing the STOP regim. If u shuts then the automat starts to generate acceleration sequences SECV1 and SECV2 and when R0.3=1, meaning B1=1, the automat remains in final states having LED2 lighted showing the MERS(go) regime. On B2 bit will set the clock, B1 bit will bring a reaction from R0.3. The R0 register 4 outputs forms the sequences.

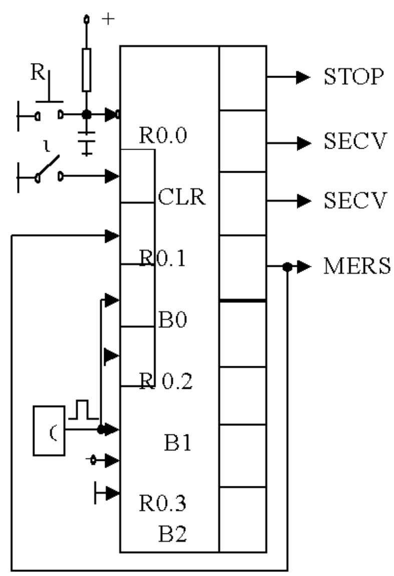

Figure 3: Simulated Automat's bloc-scheme.

4. THE AUTOMAT PROGRAM.

This program is activated by the push of the DEMO1 button from MENU.Through the push of DEMO2 button from MENU it activates a program that achieves a Cross assembler(object code is generated by computer to be on the run on the projected automat).The automat has the ROM memory matrix type achieved by two welded type MOS decoders and from these two decoders are used only the first 8 outputs for every circuits. Through code is generated after the compiler's analysis modules performed lexical, semantically and syntactical analyses.Lexical analysis represents the compilation first phase, which identifies "atomic" components of the program (written in the assembly language achieved editor).

The base principle for this compiler achievement is the following one : any M normal expression can be changed into a finite automat who recognizes any word from the described language by M and only those words or mnemonics belonging to the automat specified language.As following it presents automat's algorithm (figure 4), taking care of the fact that the passing from STOP regime to SECV1 is done through clock impulse, and from the last sequence SECV2 to MERS regime is done through a clock impulse, too.

A_0: BIT u JNZ A_2 JMP A_2

A_1 : BIT Q_3 JNZ A_0 JMP A_3

A_2 : LD R0, JMP A_0
A_3 : CALL A_9 RET A_4
A_4 : LD R0,2 JMP A_5
A_5 : CALL A_9 RET A_6
A_6 : LD R0,4 JMP A_7
A_7 : CALL A_9 RET A_8
A_8 : LD R0,8 JMP A_0
A_9 : BIT ϕ JNZ A_9 JMP A_{10}
A_{10} : BIT ϕ JNZ A_{11} JMP A_{10}
A_{11} : RET

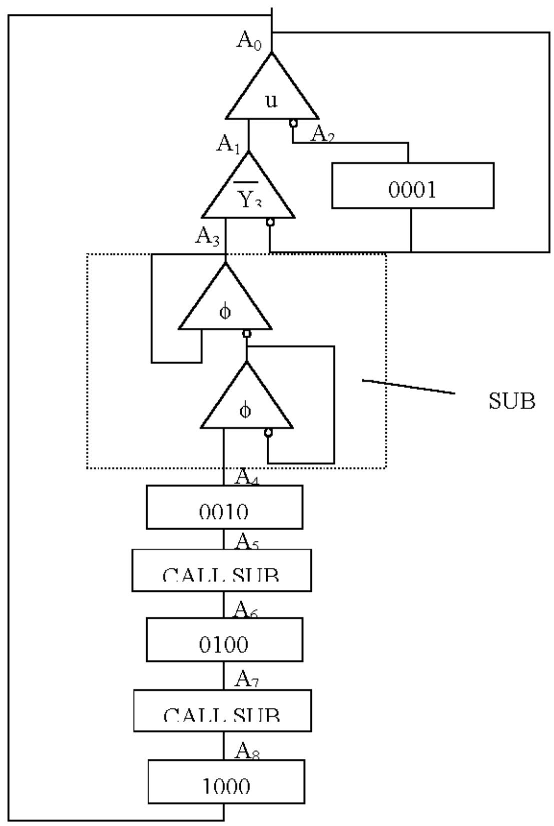

Figure 4 : Automat's algorithm

Programmer's windows are presented in figures 5,6.

Figure 5: Menu Window.

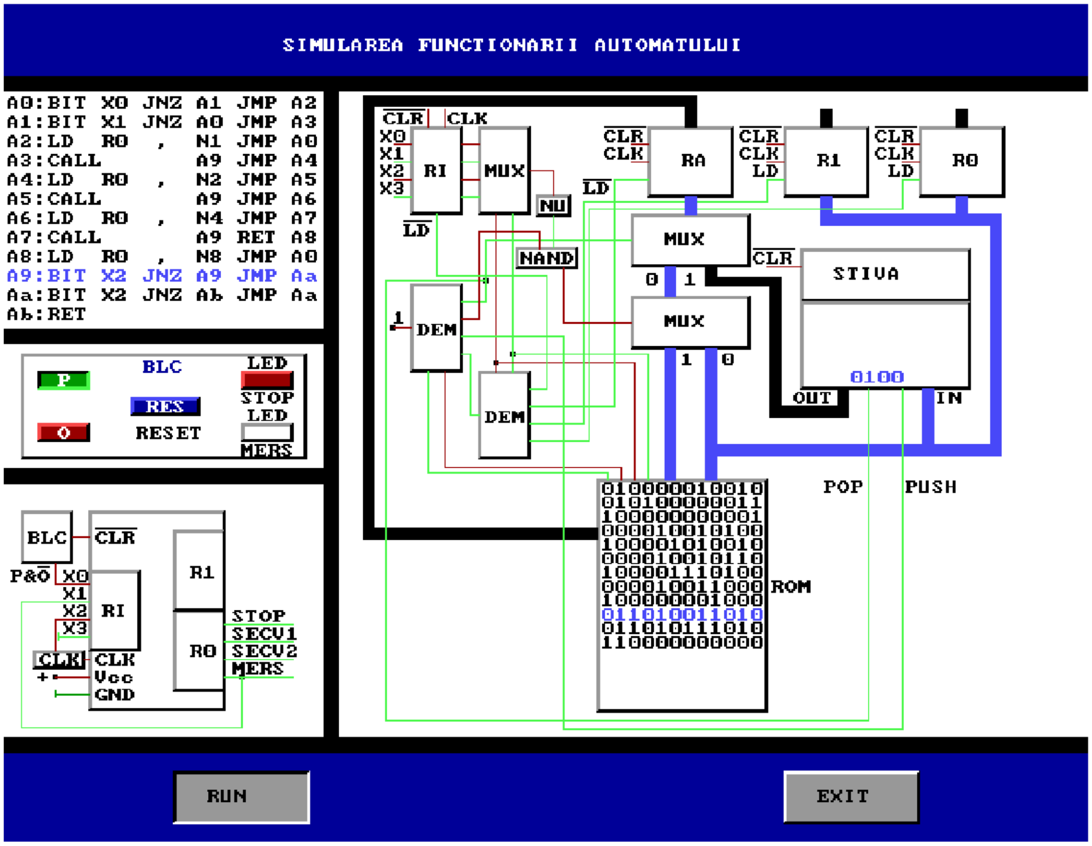

Figure 6: Automat Function Simulation.

5.CONCLUSION

- Achieved and conceived commanding system based on a 4 bits dedicated programmable automat assures production, quality, control and commanding performances increase of the analyzed flexible manufacturing system.
- Control system is organized and the programs are running in real time assuring high flexibility.
- Automat programming is simple and doesn't raise any special problems.
- The simulation presents a concrete application for flexible manufacturing system starting motors acceleration three steps sequential command.

Bibliography:

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