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TESTING OF AUTOMOTIVE INDUSTRY PRODUCTS USING MECHATRONIC SYSTEMS

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Abstract: Higher quality requirements in the automotive industry, more and fiercer competition on the automotive market, and growing consumer demands, require the implementation of new testing and product quality testing methods. Another requirement is to increase working productivity by outsourcing to companies specialized in the automotive industry. Work productivity combined with increasing product quality is possible by automating assembly lines and implementing additional test and verification station. Automated testing and verification systems, being very complex, have combined mechatronic elements, enabling manufacturers to implement and adopt quality systems imposed by the beneficiaries. This paper describes a test algorithm on the assembly line of the car seat belt.
Keywords: mechatronic, pneumatic, seat belt, quality, FluidSim

INTRODUCTION

Under the conditions of increasing competition, the market has necessitated the development of systems that produce on the principle of production in flux, but in the conditions of serial production, i.e. of integrated systems of production organization. They meet under different names, such as [1]:

- linear programming;
- PERT method;
- CPM method (critical path method);
- "Just in Time" method (J.I.T.).

Pneumatic actuators are represented in the technical documentation by schemes. At the same time, the pneumatic actuators are made up of one or more pneumatic circuits, each of which fulfills a certain functional role in the scheme. The large number of possible functions distinguishes some elementary functions that are encountered in most of the current pneumatic drives used [2].

Mechatronics is the result of natural evolution in technological development. The scientific progress of electronics, informatics and mechanics and their synergistic and systematic combination led to the emergence of mechatronics.

Being a real-time combination of electronics, informatics and mechanics, it has quickly become applicable in real life, industry, and preponderantly in the Automotive industry, forcing major manufacturers to reorganize their technological flows. With the emergence of mechatronics there have also been developed programs for the design and simulation of technological flows.

PNEUMOTRONIC SYSTEM DESIGN AND SIMULATION, USING FLUIDSIM

In the present paper, the FluidSim program showed how to model and simulate a pneutronic verification system (quality and safety) of the belt head assembly.

In the technological belts testing process, the testing systems were reorganized using pneutronic systems. By introducing pneumatic systems, manufacturers have sought to reduce test times, costs, and ensure that headband belt assembly testing is functional and that only the functional parts leave the test area after the test process.

The figures below show the sketch of the experimental seat belt test stand as well as the functional diagram made in the FluidSim program [2].

FluidSim is a program for the design and simulation of pneutronic systems. This program can be used to perform experiments, produce real-time simulations and can be used as a virtual system control modulator.

As we can see in the figures below, everything started from a sketch showing the headband belt test. Pneutronic system must perform four basic operations, figure 1.

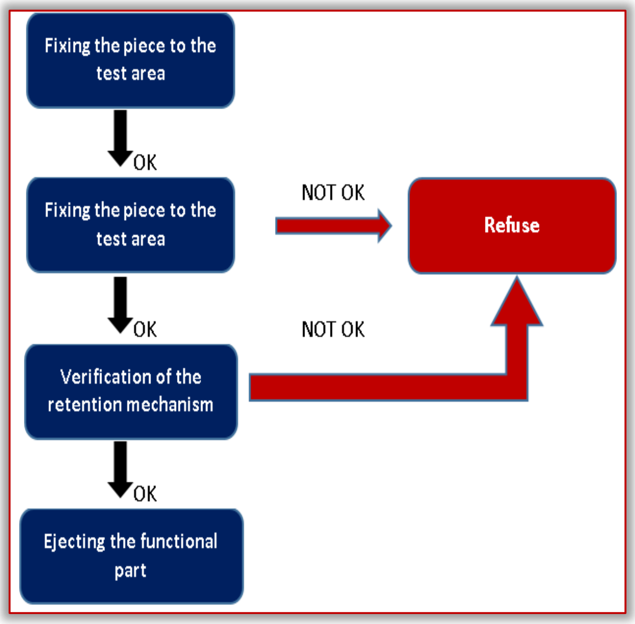

Figure 1. The operating algorithm of the mechatronic test system

In the first operation, the piece is fastened to the test area, followed by the belt release button check.

Testing the button is done to verify its functionality, being the first step in testing the mechanism. If the button is not working, the test process stops, and the piece has to be removed and taken to refuse. If the button is functional, continue the test process by testing the belt tensioner mechanism. In this test phase, check the belt-to-belt retaining twice. If the mechanism is not functional then the piece is passed to the refuse, the piece remains in the test area and if the piece is functional, the process continues, this being the fourth operation, the piece is taken out of the test area.

We used four, 5/2 way valves, one 2/2 way valve, 3, pneumatic cylinders a one-way rod (button, tongue and release), and 1 pneumatic cylinder double-action and double-barrel, a grease filter, an air filter, two pressure gauges and a drosel, figure 2 [3,4].

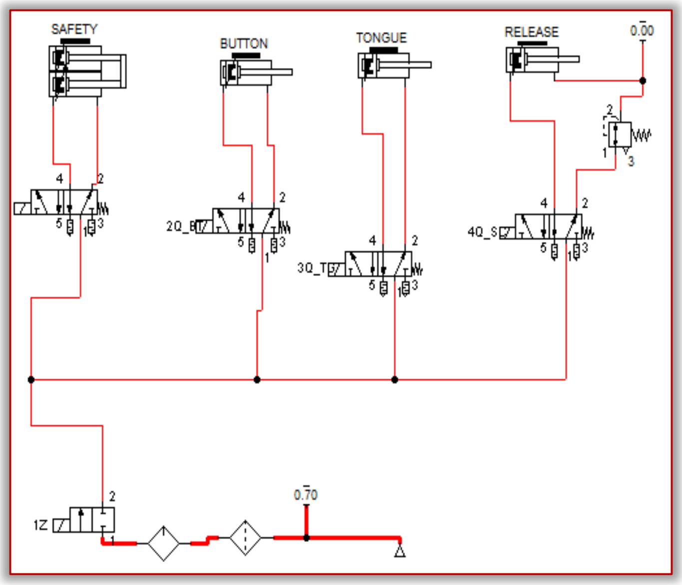

Figure 2. Pneumatic test bench system [4]

Simulation of the pneumatic system of Figure 2 was made using a logic element and coils connected to each other at 24V and 0V and actuated by a button as shown in Figure 3.

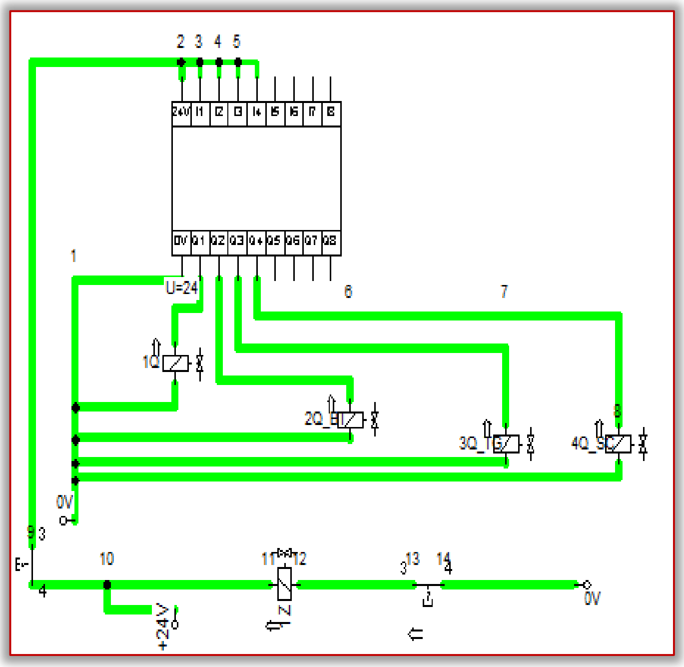

Figure 3. Electrical system of the test stands [4]

For the electrical system to work inside the logic element we used 4 pulse generators and 4 time delayers as in Figure 4.

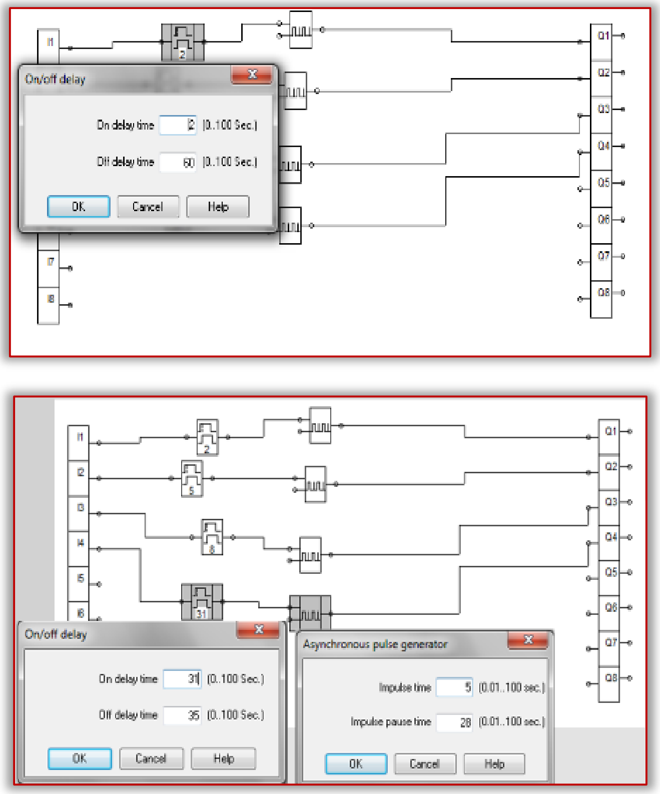

Figure 4. Impulse and time delay generators [4]

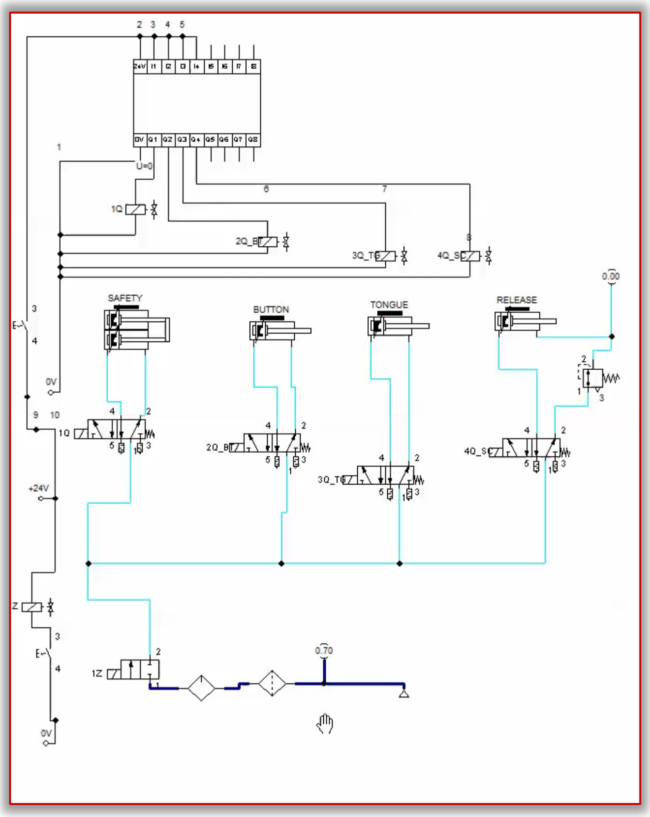

Figure 5. The mechatronic system for the test stands [4]

CONCLUDING REMARKS

For more than 20 years, FluidSIM® has been the world's leading circuit diagram design and simulation program for pneumatics, hydraulics, and now also for electrical engineering. Being able to freely design control systems is motivating, and promotes creativity and focus.

Whether in a training environment or in an engineering office, the simulation of control systems and processes has long been standard in industry, helping to minimize losses due to crashes and ensuring greater efficiency and improved quality. Pneumatics, hydraulics, electrical engineering: the libraries are available separately or together in the same program. The user decides which of the libraries to use in the program. All technologies interact optimally in a circuit diagram or project.

The simulation and design of the mechatronic system with the dedicated FluidSim software has a number of advantages, such as:

- less time and cost for simulation and design;
- real-time visualization of the order and action of the mechatronic system elements (figure 5);
- the possibility of changing the energetic and temporal parameters of the proposed mechatronic system;
- increasing labor productivity and product quality by eliminating the human factor.

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