AUTOMATION AND CONTROL IN ENGINEERING SYSTEMS THE ROLE OF AUTOMATED WELDING ROBOTS IN INDUSTRIAL AND MANUFACTURING SECTORS OF ENGINEERING SOFTWARE

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Introduction:

General aspects of Automation

Automation of technical systems is a combination of various mathematical, logical and numerical methods application and design of complex systems and mechanisms. Besides it is one of the main areas in various spheres of human activity: scientific and technical progress, the machine-building and robot production. The main feature of this sector is practically no human involvement in sophisticated industry processes [1].

Development of automation:

The history of automation goes back more than 200 years and belongs to the era of scientific and technological revolution (STR). The most important discovery of the time is the invention of an automatic control of steam supply boiler by Russian mechanic Polzunov Ivan Ivanovich (1765). At the turn of the 18-th and the 19-th centuries there was observed a sharp rise in the development of level and extent of automated industry and production. Having reached up to our days automated equipment is used in virtually every company that is engaged in industrial production.

Essential tasks of automation in mechanical engineering:

The implementation of the following items can improve the production work:

- Refinement of the regulation quality
- Increase of the coefficient of equipment performance
- Safety and quality of motor vehicles

These problems can be solved fully or partially by the following actions:

1) introduction of modern automation methods
2) invention of new high-tech equipment
3) training of qualified specialists

The main application of welding robots in engineering production in leading factories and companies:

Currently, all the biggest machine-building companies use automation system for the modern cars fitting. They are BMW, Audi, Volkswagen and AutoVAZ. They have long used automated equipment.

Types of welding work:

Before proceeding to the detailed examination of one type of the welding robots, I would like to mention the main types of welding used in the automotive industry:

- Forge welding
- Laser welding
- Electro-arc welding
- High-frequency currents welding
- Diffusion bonding
- Gas welding
- Resistance welding

Figure 1 and figure 2 show the progress of body and frames vehicle welding with the help of robotic equipment.

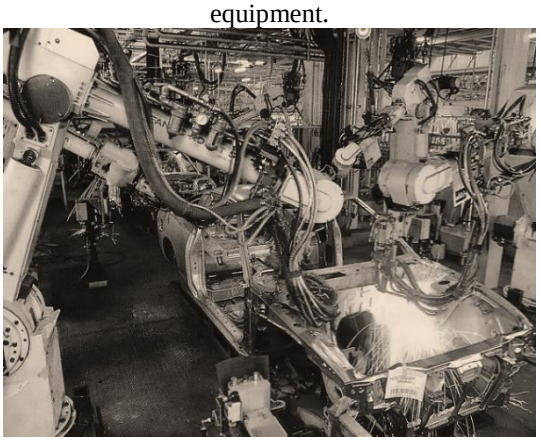

Fig. 1: Body car welding

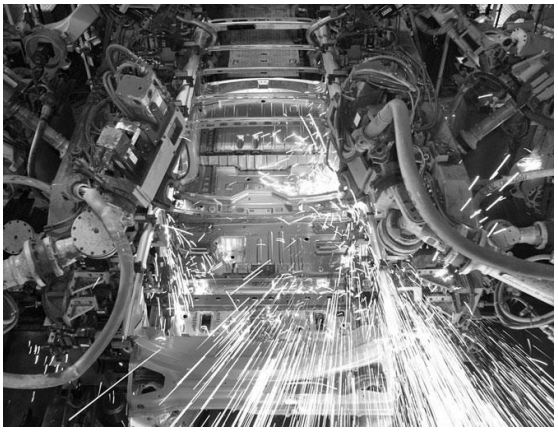

Fig. 2: Process of car frame welding

The main problem of this technique is its maintenance. The requirements for reliability and continuity of the work force manufacturers to improve the performance of manufactured industrial robots: some suppliers guarantee 1 year of continuous operation without service and maintenance [2].

Detailed overview of contact welding robot in automotive industry:

Figure 3 shows the industrial robot. Welding pincers (3) are fixed on the manipulator (2) which is managed by the controller (1). They are connected to the welding transformer (4) by means of flexible shunts (5). This diagram describes the obvious advantages of automated equipment in detail: welding robot claws are set by the program, it increases the positioning accuracy, productivity and quality of work which differs greatly from the human one.

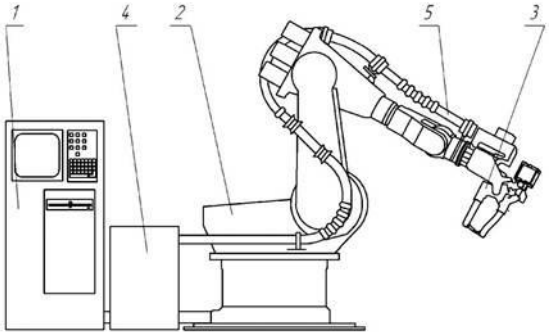

Fig 3: Scheme of contact welding robot

But this model has a serious drawback. As it is shown in the figure the source of welding current for resistance welding is embedded directly in robot's hand. During the process of welding significant electromagnetic loads are transmitted to the hand of the robot. Thus robots become destroyed; their life-time of 24 hours day work is about 1-2 months. The compromise had been found; carmakers choose more profitable scheme of work. Figure 4 shows the modern scheme of constructing a robot for resistance welding without welding gun: manipulator (2), working with the help of controller (1) has the gripper (3), the robot positions a part of stationary welding machine [4].

This scheme has the advantages that are typical for the first two configurations: maximum decrease of masses to be moved which increases the service life of the robot, the speed of linear movement and accuracy; reduction in the size of the welding circuit and installed power equipment; possibility of welding parts of greater thickness. The explanation is in the fact that the power and weight of the welding machine are not limited.

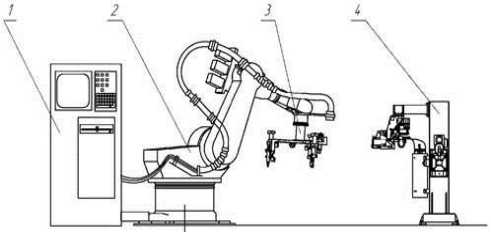

Fig. 4: Scheme of robot without welding hands

Conclusion

To conclude it is worth saying that the use of automated equipment in industry is an important issue in any modern enterprise. It is not only the increase of the amount of processing material, but also the question of safety. After all, a person does not have to follow the work of the machine and be right next to her. He is to sit at the computer and watch the work of the robot from that place. All errors and problems associated with the equipment will be recorded on a personal computer, as all the equipment is fitted with the most advanced touch sensors which are able to scan the entire body of the equipment down to the smallest parts, so that there will be the warning of any mechanical or technical damage.

References

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2. The official website for KUKA Systems http://www.kuka-robotics.com/russia/ru/ [Electronic resource] - Mode of access: free (10.12.2014).

3. The official website of the contact welding. http://k-svarka.com/ [Electronic resource] - Mode of access: free (15.10.2014).