

PROGRAMMING OF ROBOTS FOR EDUCATION OF TEACHERS AT SECONDARY VOCATIONAL SCHOOLS IN CAD SYSTEMS

Vladimír Baláž^{1✉}, Marek Vagaš²

^{1✉} Technical University of Košice, Faculty of Mechanical Engineering, Prototype and Innovation centre,
email: vladimir.balaz@tuke.sk

² Technical University of Košice, Faculty of Mechanical Engineering, Department of Robotics,
email: marek.vagas@tuke.sk

Submitted: 2017-12-05 / Accepted: 2017-12-05 / Published: 2017-12-20

ABSTRACT

The article deals with off-line programming of robots in CAD systems. It explains the process of creating a model in a virtual environment workstation CAD system to generate a robot program. Implementation of off-line programming is one way of increasing economic parameters at plant. Off-line programming allows to significantly reduce time needed to create applications.

KEYWORDS: off-line programming, CAD, simulation, robot

1. Introduction

Currently, deployment of industrial robots in manufacturing is steadily growing therefore, development is directed mainly to the reduction in production times and the continuous quality improvement of robotic workstations. For companies using automatic generation of NC code is potential for enhancing productivity, visual presentation of work, robots and devices desirable to increasingly implement so. Offline programming using CAD systems. This allows the elimination of the problems arising from the planned trajectory, implementation tasks, impact analysis, and the availability of space robots and equipment as well as collisions and many more deploying offline programming appears to be one way of increasing enterprises and economic parameters, because the current production does not allow for any downtime and outages, while these programs allow offline processing of all data outside of work on a remote computer.

2. Off-line Programming of Robots

There are two ways of programming: on-line and off-line. When we are programming a robot method by on-line programmer works directly with the robot. Directs the robot to the technological points creates movement trajectories and solves communication with peripheral devices in the robotic cell. This procedure is quite demanding on especially time and technical resources. Off-line programming by used software can model of robotic workstation and corresponds directly to real workstation simulation environment. Not demand the present the real workstation. Data transmission scheme for off-line programming is on Fig.1.

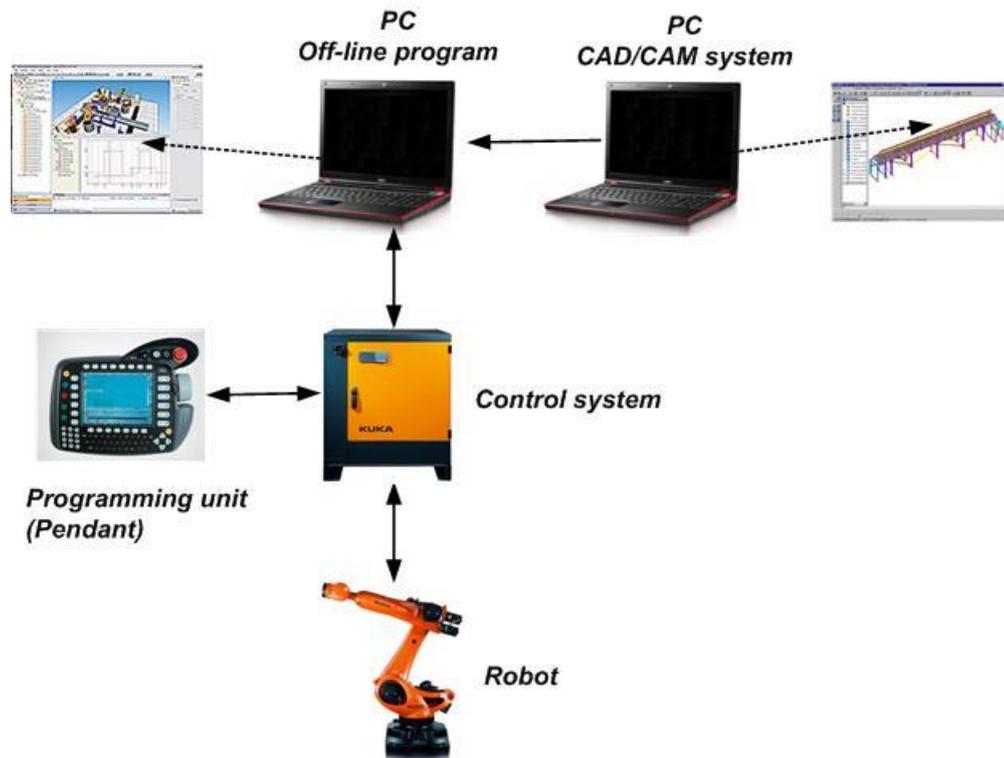


Fig. 1. Off-line programming

Off-line programming allows detailed 3D simulation that is possible to detect conflict situations, and verify changes in the future, to test reach ability handling points. This allows to the user not only to search optimal deployment of equipment in the manufacturing cell, but also optimum handling cycles of operation. Many off-line programming systems is monitoring real time course of action robot, support the selection of appropriate tools or technological process parameters.

Off-line preparation programs are achieved:

- minimize the time re-sort,
- maximizing production,
- reduce errors in program,
- detect the not realized and dangerous situations
- import of various objects in the format STEP, ...

The whole process of off-line programming system can be divided into several steps, Fig.2. In the first phase, off line programming is necessary to create a virtual workstation. Therefore, the first step selects type of robot and peripherals needed for the required technological activity (working instrument, transportation equipment, safety elements - fencing ...). These objects are usually accessible in their own simulation programs. If it is necessary, you can create your own objects in CAD systems and import them in an approved format at simulation environment.

After deployment of objects in robotic cells (exact distance setting and the relationship between objects) we are approaching to development of program. It defines technological points in workstation, serving next step to creating a robot path. If is programmer defined of approximation robot bypasses that is defined points in the desired distance. If there is no defined approximation, then robot passes directly through the technological point. Designed robot path needs to be verified. The proposed pathway is verified by simulation work cycle. Simulation speed can be influenced by setting the appropriate parameter values. The simulation environment verifies the suitability of the set path, collision states and total time work cycle, Fig.3. After a successful racing simulator followed by export program to control system of robot.

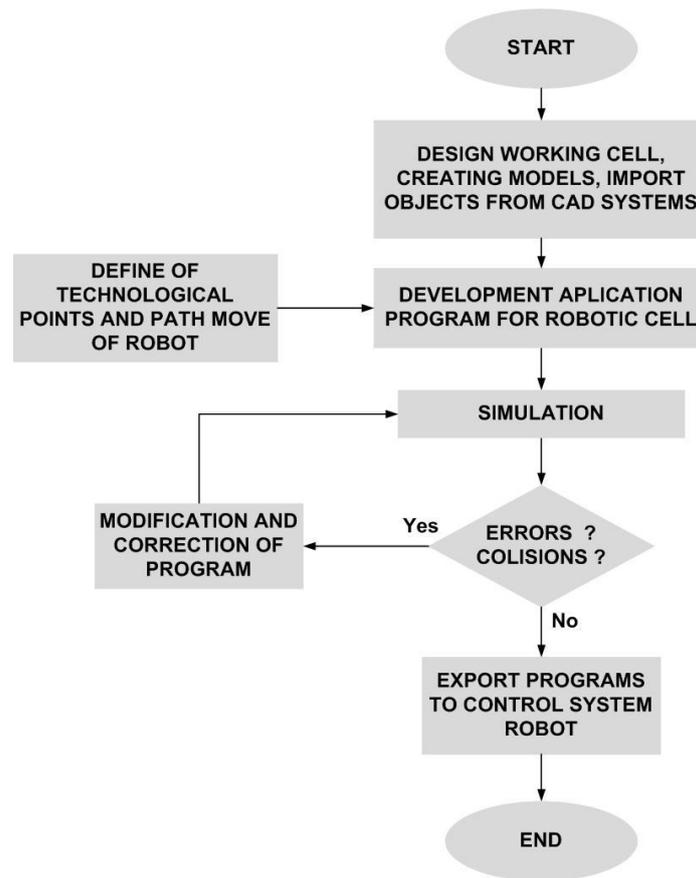
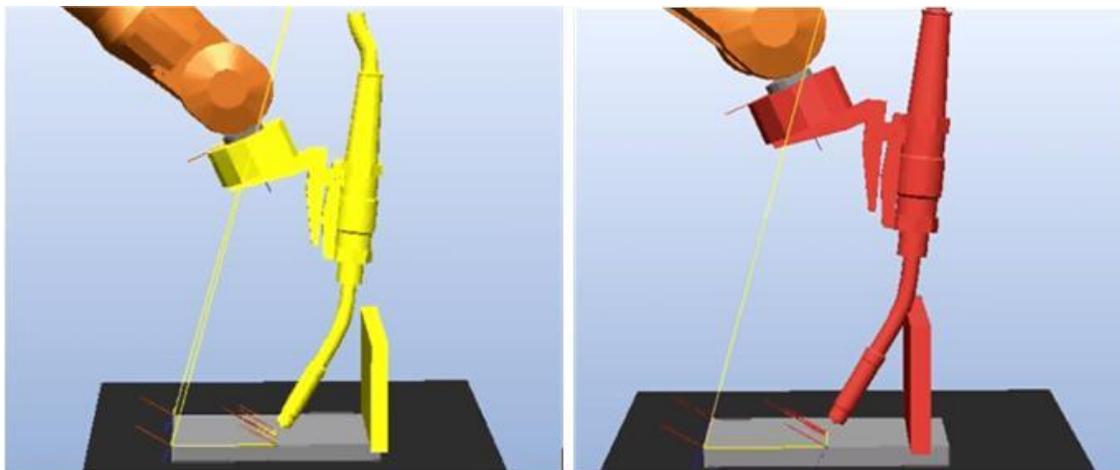


Fig. 2. Working procedures in off-line programming robots.



a)

b)

Fig. 3. State before collision (a) and collision state (b)

Some systems offer the possibility of automatically removing collision situations. By generating new points for welding head, we can accept but do not to accept. Removing of conflict situation can be dealt with manually setting of new work points. This conflict can be removed by setting the correct welding head geometry (angle of inclination, orientation tool), Fig.4.

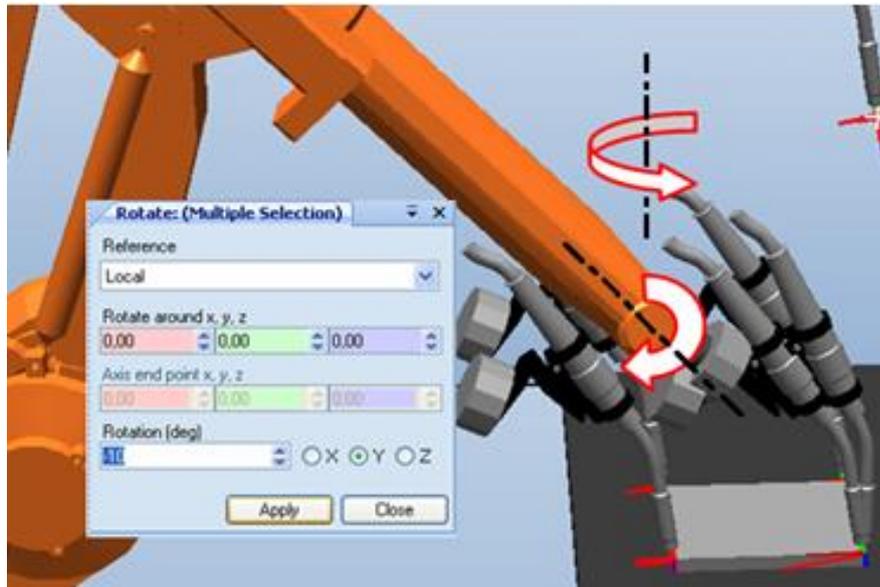


Fig. 4. Setting the parameters of the welding head geometry

Programs for off-line programming of robots are usually equipped with a virtual control unit. They allow us to perform movements directly from your computer. This requires a connection to computer where it is installed CAD program with the robot. Real robot movements are then displayed on a computer screen in the CAD system. The Fig.5 shows the details of the model work for robotic arc welding with biaxial positioning unit.

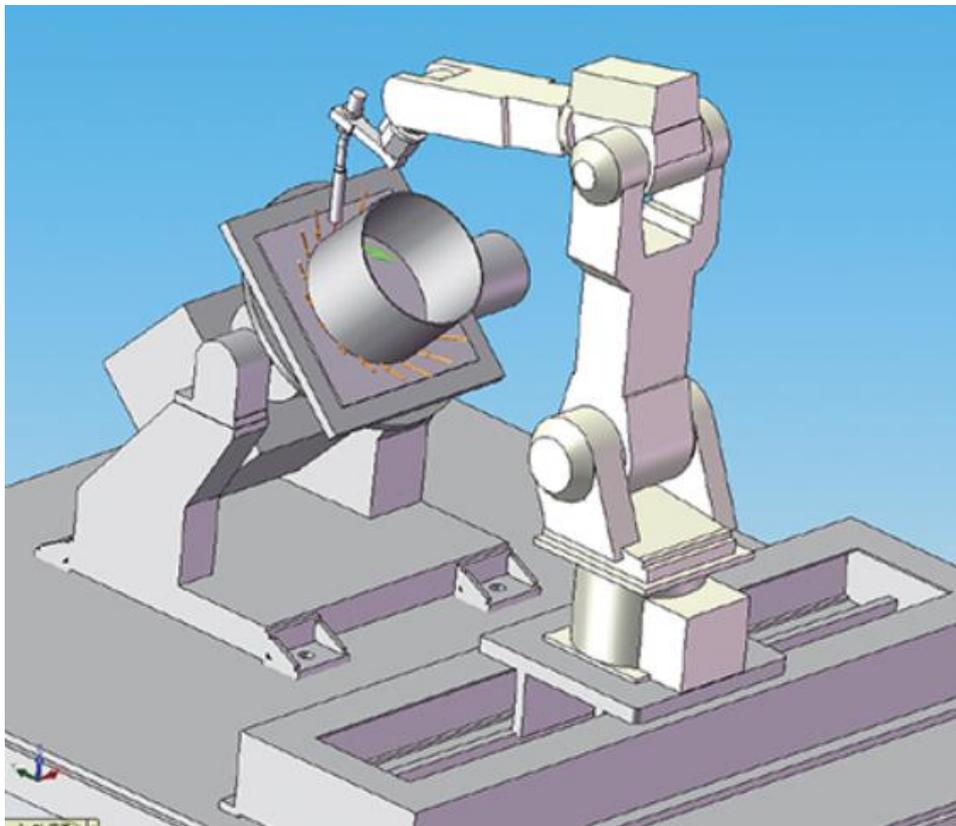


Fig. 5. Illustration robot workstation created in the simulation environment

3. Conclusion

Implementation of off-line programming is one way of increasing economic parameters at plant. Preparation of technological programs from outside of real workstation by no limited production and give to us an option for programmers' test workstation in simulation environments. Off-line programming allows to significantly reduce time needed to create applications. To test reach ability of technological points we determine optimal paths of robots in production process and protect to collision conditions.

Acknowledgements

"This paper is the result of the Project implementation: University Science Park TECHNICOM for Innovation Applications Supported by Knowledge Technology, ITMS: 26220220182, supported by the Research & Development Operational Programme funded by the ERDF."

The paper presents results of researches supported by EU within the project RUSOS „Robotics for teachers of secondary vocational schools”, 2015-1-SK1-KA202 - 008970, under the ERASMUS+ Programme. This publication represents only the author's opinion and neither the European Commission nor the National Agency is responsible for any of the information contained in it.

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