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ON-LINE CORRECTION OF ROBOTS PATH BASED ON COMPUTER VISION

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Abstract: *This paper presents the methodology for a real-time trajectory correction applied to industrial robots. The application is based on computer vision concerned with the line detection creating a trajectory for the robot motion. The algorithm for the line detection was developed in Matlab/Simulink computing software. The trajectory is corrected by a controller implemented in PLC Beckhoff that communicated with the robot controller via DeviceNet in real-time.*

Keywords: ***Computer vision, control, trajectory, PLC, real-time, industrial robot.***

1. Introduction

In industrial robotics there are applications where we need to correct a robot trajectory in real-time. It could be for example robotic welding. To connect two points by a seam, industrial robot interpolates the trajectory by a line. However many variables enter this process, such as the errors of pre-machining, in-process thermal distortions, which would cause changes of the seam position (Shen et al., 2010). Another variable is the accuracy of the robot movement. All of these variables will cause inaccurate placement of the seam and will affect the quality of the seam. That is why the robot path needs to be corrected by a sensory-based system.

2. System description

The whole on-line trajectory correction system includes following parts: industrial camera Manta (Allied Vision Technologies), PLC Beckhoff, industrial robot KUKA and PC (Fig. 1 Photo of the workplace).

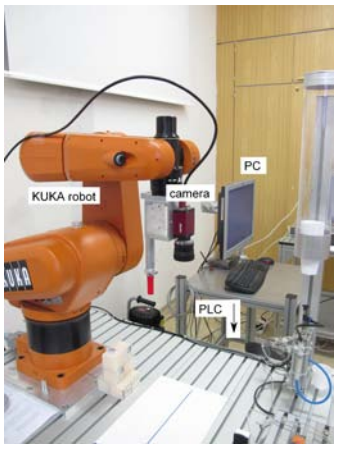

Fig. 1: Photo of the workplace

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2.1. Experiment result

An experiment was designed to test system accuracy to correct robot´s trajectory in an industrial application. The system accuracy could be tested by watching the difference by eyes between a certain drawn trajectory and the robot corrected trajectory. However watching the difference by eyes would not be accurate because we would not get exact information. For the purpose of extracting the number data, the experiment was designed as follows. First a sine curve trajectory was created by the robot. This trajectory was drawn by a fix mounted on the robot´s effector. During the drawing the trajectory points were recorded. Then the robot was moving along the created trajectory and tried to on-line correct the movement by the proposed system. Errors of proposed control system were recorded and both records were then compared against themselves (Fig. 3 Comparison of a drawn sine curve and the robot corrected trajectory).

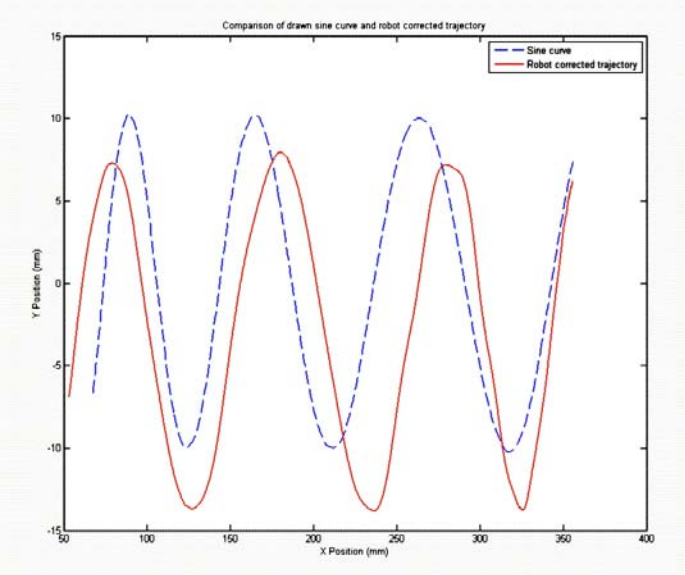

Fig. 3: Comparison of a drawn sine curve and the robot corrected trajectory

3. Conclusions

An experiment has been done to correct the robot´s trajectory by a computer vision system. In the experiment a data from the image processing algorithm were send to the PI controller.

On the Fig. 3 is shown our experiment result. The robot trajectory was corrected only in the Y position. Errors between the drawn sine curve and the robot corrected movement along the sine curve are about 1 to 3 mm. Such a relatively high errors will be reduced towards zero in the next experiment prepared after this pilot study.

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