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MODELING OF WELDING PROCESS BY ROBOTIC VISION

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ABSTRACT
Modeling of welding process by robotic vision is basically a theoretical problem, means mainly on physical problem, and also technological problem. To obtain a good model of welding process by robotic vision, theoretical researches are required but also constant experimental researches of several welding processes. Until today researches of welding processes has been based on empirical and detailed experimentation. In this paper is presented welding process by robotic and automation points of view with application of new technologies. Welding robotic system has been designed with possibility to control and inspect this process. Parameters that should be controlled during the process have been identified to reach desired quality. Figure of control system of welding process by robotic vision is given in this paper.
Keywords: modeling, welding, robotic vision, control.

1. INTRODUCTION

Researches in this domain are dealing with the relevant technical and the scientific aspects, because is known that welding process has been performed by the human with combination of skills, science, and experience. Robotic vision welding has difficult and demanding goals, so adaptive behaviour of this system is necessary [1,2,3,4,5].

Welding process can be divided in three different phases. First phase is preparation phase where the welding operator sets up the parts to be welded, the welding apparatuses (power source, industrial robots, robot program, robotic vision, etc.) and the welding parameters. The type of gas and type of wire also has to be selected in this phase. Nowadays most of the welding pieces are designed with using CAD software, and then a robot welding pre-program respectively by robotic vision is available and should be placed on-line. That software should be used to generate robot programs that could work as starting points for the welding tasks, needing only minor tuning due to calibration.

Second phase is welding phase where the welding operator acts by adjusting the process variables just by continuously observing the welding operation as shown in Figure 1. Here we must have in mind that system should be able to maintain the torch orientation while following the desired trajectory, perform seam tracking and change welding parameters in real time [3,5].

Third phase is inspection phase where welding operator in the case of an automatic welding system, inspect the obtained welds and decides if they are acceptable or changes are needed. This phase can be performed by advanced sensors like laser 3D cameras.

2. MODELING OF THE WELDING PROCESS BY ROBOTIC VISION

Modeling of welding process by robotic vision as shown on Figure 1 is basically a theoretical problem and a technological problem, in other words the welding process requires theoretical studies but also great experimental investigations to obtain final model [5].

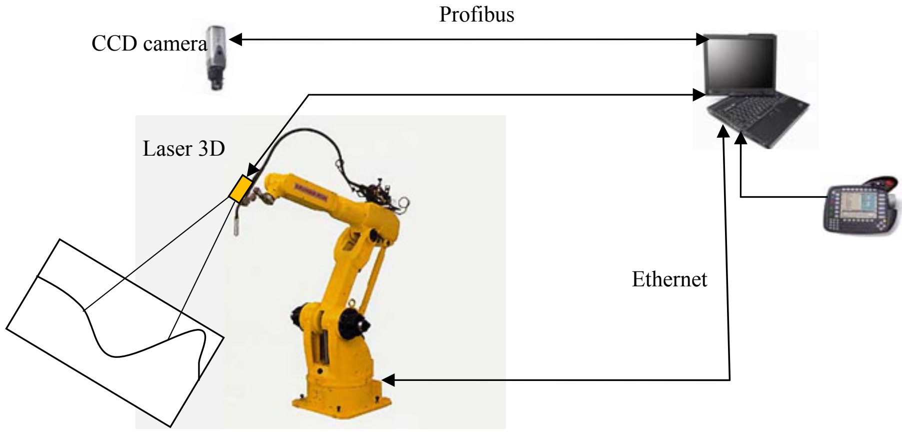

Figure 1. Modeling the welding process

In this paper we will try to present welding process by robotic vision, respectively, by position of robotic vision and process automation taking in to account technological characteristics and automation system demands.

3. DEFINITION OF PARAMETERS OF WELDING PROCESS BY ROBOTIC VISION

To model welding process by robotic vision the first and primary is to identify the welding process related parameters. Parameters should be controlled in a way to obtain desired quality of welded pieces as shown on Figure 2 [3].

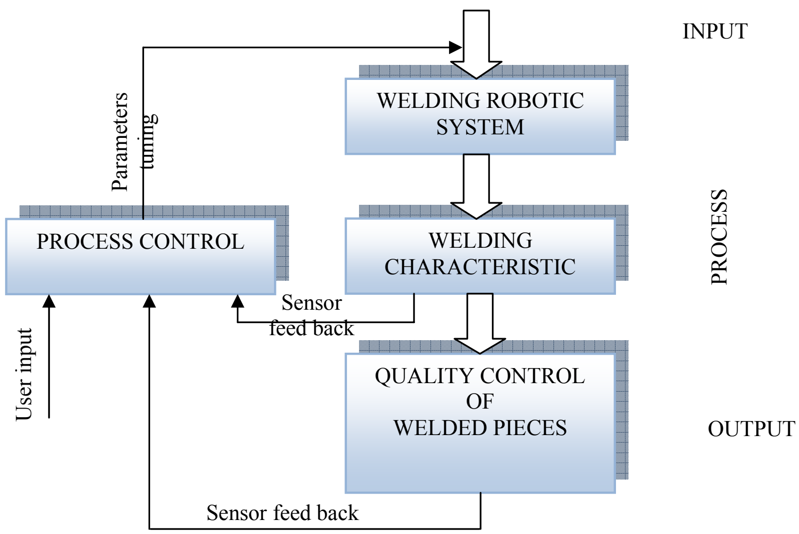

Figure 2. Control system of welding process by robotic vision

Input parameters can be classified in three different categories. Variables that can be modified on line during the welding process can be named primary inputs and that are the voltage, the wire feed rate, and the torch speed. In MIG welding process, the voltage and the wire feed rate are analog signals commanded to the welding power source, and generated from the robot controller or process PLC.
Variables defined when process is selected are named secondary inputs. As example the MIG process those parameters include the type of the shielding gas composition, the gas flow, the torch angle, and size and type of the wire used in process.
Unchanged parameters or fixed inputs are parameters that user cannot change during the welding process. These parameters are usually connected with selected welding process, as example, joint geometry, plate thickness, physical properties of the metal plate, etc.
Here we must take a care about correct preparation of the setup and the selection of the secondary inputs is fundamental to control the primary inputs efficiently.
One of the important sets of parameters is the output parameters which there are two types of these parameters: geometrical and metallurgical.
Those parameters characterize the weld and are used to evaluate its quality.

4. CONTROL OF THE WELDING PROCESS BY ROBOTIC VISION

To control effectively the welding process the robotic vision system should adopt to actual conditions, like the human welder does, and be able to move effectively the welding torch and control the power source (the voltage, the wire feed rate and the torch speed for example in MIG process). Basic scheme of robotic vision welding control system is shown on figure 3 [3].

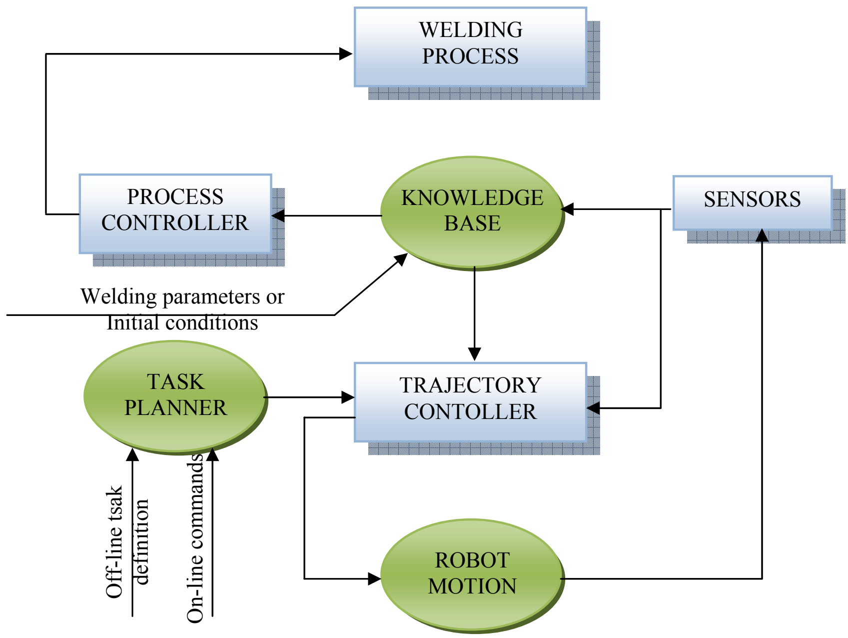

Figure 3. Scheme of robotic welding control

Taking a care about previously mentioned in previous chapter, three different phases must be performed to be able efficiently mimic a human welder with automatic robotic vision system which are: knowledge base, sensors and interfaces, programmable and flexible control system facilities.

5. CONCLUSION

Modeling of welding process by robotic vision is basically a theoretical problem, means mainly on physical problem, and also technological problem. Welding process can be divided in three different phases. First phase is preparation phase where are setting up the parts to be welded, the welding apparatuses (power source, industrial robots, robot program, robotic vision, etc.) and the welding parameters gas type and variable type, constantly observing the welding process. System should be able to maintain the torch orientation while following the desired trajectory, perform seam tracking and change welding parameters in real time. Final phase is inspection of the obtained welds by automatic control and decision if they are acceptable or changes are needed.

6. REFERENCES

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