



## AUTOMATED WORK PIECE LOCALIZATION AND PROGRAM GENERATION FOR ROBOTIC WELDING

### Problem Description

Solid expertise combined with many years of experience: that's what is required for the high-quality production of welded components. Also, as there is a growing shortage of qualified skilled workers, existing technological know-how should be transferred to robot systems in order to use the worker expertise more efficiently. So far, automation of welding tasks in small lot size and high variant production is not cost effective. The reason is the high programming effort required for robot systems. What is needed is a robot system that autonomously generates and executes robot programs for different work steps based on CAD-data.

### Our Solution

The European research initiative SMERobotics is developing new modular and interactive operating concepts and control sys-

tems for the efficient use of robots in a variety of applications. With this in mind, Fraunhofer IPA is designing and developing solutions that make welding robots more intelligent and that simplify the collaboration with workers. The goal is to significantly reduce the programming effort for automated production in small and medium-sized welding businesses. The resulting solution makes automation of welding tasks profitable also in the case of small lot sizes and production quantities, by being easy and intuitive to program by the welder. The welding robot assistant can automatically generate programs thus minimizing the programming effort for new parts. Further the programs are automatically adapted to the actual position of the work piece that is measured by the robot. The programming effort is substantially reduced. Beyond that our solution the need for product specific fixtures that are required today in automated welding systems is avoided. This allows above all small and medium-sized enterprises to respond more flexibly to changes in customer orders.

#### Fraunhofer Institute for Manufacturing Engineering and Automation IPA

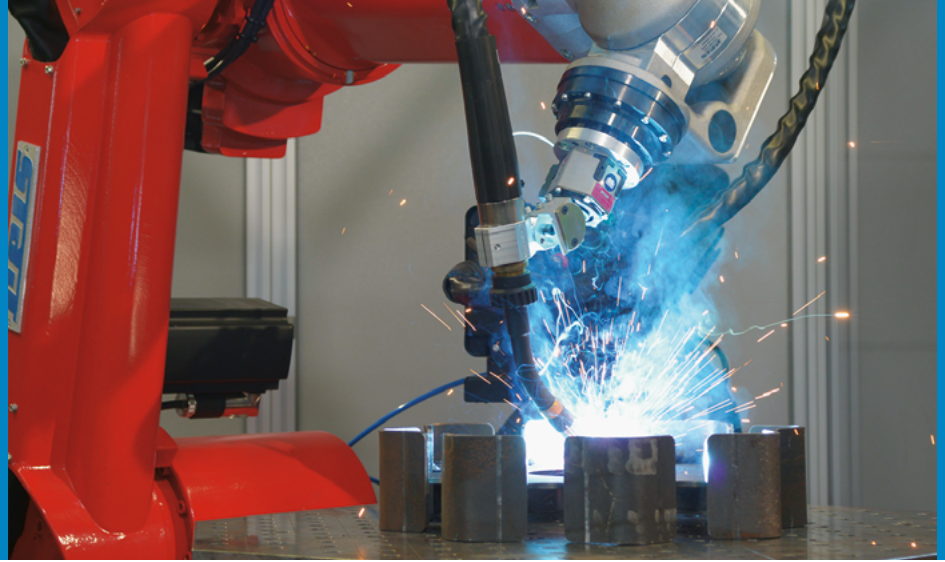
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## System components

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### Automatic program generation

Robot programs are automatically generated on the basis of models of the components, welding process and robot system. Intuitive operation of the automatic program generation by the welding expert directly in the field at the robot cell allows changes to be quickly incorporated and implemented. User inputs as well as sensor-detected data are brought into a logical relationship. This information can then be reused for various downstream processes, such as grinding or quality control. This makes it possible for programming and set-up times to be significantly reduced or avoided at all.

### Component localization

By comparing CAD and sensor data, the welding robot assistant is able to automatically determine the precise position of the component and therefore of the welding paths. This makes it possible to adapt the robot path and to dispense with rigid fixtures for exact positioning of the components.

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## Applications

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### Continuous welding

One possible application for the welding robot assistant is the continuous welding of pre-tacked assemblies. The work piece can be positioned anywhere on the welding table. The position is automatically detected by optical 3D sensors and appropriate software, and the motions of the robot are adapted accordingly. In addition, robot programs can be generated without knowledge of traditional robotics programming. This allows welding experts without experience in the use of robots to operate the welding assistant. Human expert and software interact through a touchscreen tablet. The tablet allows selecting work piece edges, configuring weld-seam properties and checking and correcting planning results. The robot program is then generated automatically. In this way, the welding robot assistant is able to take the process requirements into consideration, e.g. avoidance of collisions between the robot and other components as well as compliance with the correct welding angles and welding rates. Through the use of additional models, it is also possible to automate subsidiary processes, such as grinding or quality control. Since many programming activities are carried out by intelligent software, this makes it possible to significantly reduce the time required for reprogramming the system. This allows cost-effective automation of welding processes also in case of lot size 1 production.

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## Deburring

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The developed approaches have already been applied by Fraunhofer IPA to related processes, especially the deburring of edges. This, too, no longer requires precise, reproducible positioning of the component on the deburring table, because its exact position is detected by the robot and the program is automatically adapted to suit the situation.

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## What we offer

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Fraunhofer IPA will assist you in the:

- design of welding systems
- customization of our software to accurately detect the position of the component in your application
- automatic generation of collision-free robot programs from CAD data for your welding application
- implementation of robot cells in collaboration with system partners

Contact us to discuss your own application scenario.