Highlight

Zamudio,
March 20, 2012

Technical Specifications of Vision System within a Laser Welding Machine

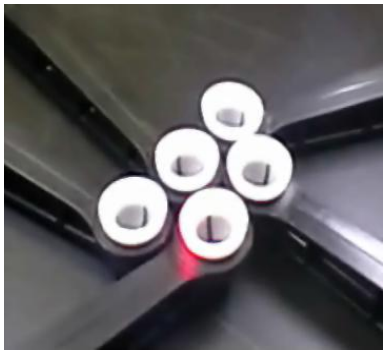

Figure 1: Simulating polymer welds at five arbitrarily arranged white rings with a red laser pointer.

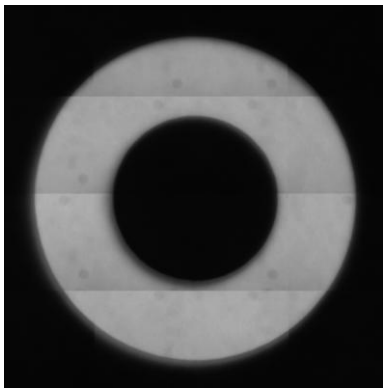

Figure 2: Composition of coaxial camera images of a polymer ring.

Laser polymer welding offers significant prospects compared to conventional plastic joining means. This technology in conjunction with scanners allows welding flexible geometries at high speeds. However, precise positioning of a weld contour relative to the entire workpiece is still a challenge. Using cameras, position recognition of workpieces previous to the welding operation can be achieved in a non-intrusive way. Within the frame of the EU-funded "POLYBRIGHT" collaborative Project, Tecnalia has developed a machine vision functional prototype that faces this challenge by using calibration of a scanner-based laser welding system.

This prototype uses a compact scanner (Arges, Fiber Rhino 31), with a Fiber Box with integrated bending mirror and a 1Mpx monochrome camera in conjunction with ultra diffuse lighting. It provides a vision system for automatic calibration and detection of workpieces position. The positioning accuracy of the prototype was tested by marking printed workpieces with an IPG 20W fiber laser.

Two configurations of the prototype are possible depending on how the camera interacts with the system. The first configuration makes use of an external camera, with fixed relation between camera view relative to the workspace. The second configuration is based on a camera coaxially mounted relative to the laser beam.

Regarding the external camera configuration, for a working area of 150x150mm^2 the mean positioning error is 0.12mm while the maximum one is 0.33mm.

Regarding the coaxial camera configuration, the accuracy of the system is directly related to the working area size. We obtained the following results for the tested workspace areas:

- 50x50mm^2, mean error 0.025mm, maximum error 0.03mm.
- 100x100mm^2, mean error 0.056mm, maximum error 0.09mm.
- 150x150mm^2, mean error 0.143mm, maximum error 0.49mm.

Comparing both two camera configurations, the suitability of either one depends on the working area, cycle time and accuracy needed. While the coaxial configuration accuracy can be 10 times higher than the external one, it requires at least one shot per workpiece in contrast to the single shot required for the external configuration.

SEVENTH FRAMEWORK PROGRAMME

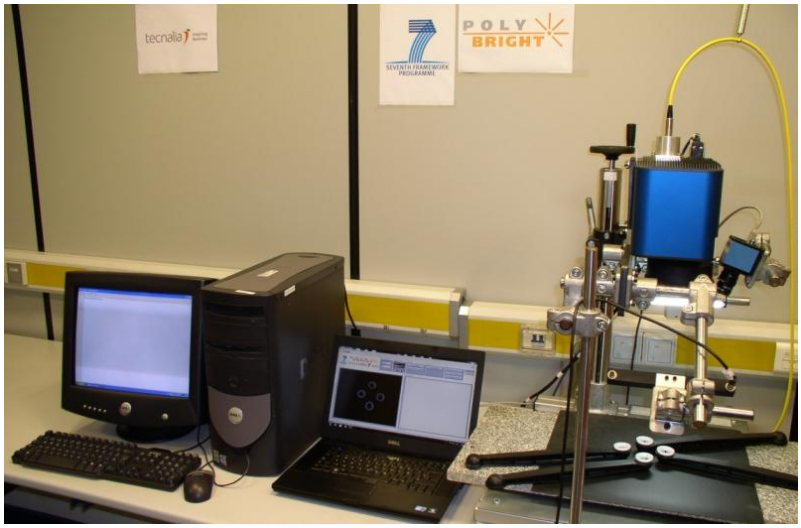

Figure 4: General view of the functional prototype.

For any further questions our expert will be pleased to provide you assistance:

Contacts at Tecnalia
Dr. Zelmar Echegoyen
Phone +34 946 430 850
zelmar.echegoyen@tecnalia.com
Metal Forming & Intelligent Manufacturing Systems
Transport Unit – TECNALIA
Parque Tecnológico, Edif. 202
48170 Zamudio, Spain
Phone +34 946 430 850
www.tecnalia.com

Contacts at Fraunhofer ILT
Dr. Alexander Olowinsky
Phone +49 241 8906-491
Alexander.olowinsky@ilt.fraunhofer.de
Fraunhofer Institute for Laser Technology ILT
Steinbachstrasse 15
52074 Aachen, Germany
Phone +49 241 8906-0
Fax +49 241 8906-121
www.ilt.fraunhofer.de