



FEED-RATE-REGULATED LASER BEAM BRAZING

Task

Laser beam brazing has become established in the automobile industry as a joining process for manufacturing car bodies. The industry uses this process to join two-piece trunk lids as well as to connect the roof and side wall with a visible seam. The requirements upon the optical appearance of the brazed seam are, thus, very high. In terms of the seam's impression, meaning surface roughness as well as lack of pores, its quality is significantly influenced by how constant the energy per unit length is applied along the seam. Depending on process control, however, dynamic speed changes can appear – for example, when the laser optic is reoriented as well as when the handling system accelerates quickly.

For these reasons, Fraunhofer ILT has developed a controlled laser beam brazing process that guarantees constant energy per unit length even when the feed rate changes.

Method

A camera-based monitoring system has been coaxially integrated in the laser beam path of an industrial processing head. The feed rate can be identified by calculating a displacement vector of two consecutive images. Here, the so-called full-search block-matching has been implemented in real time by using FPGA technology.

On the basis of the effective measured feed rate, analog control signals are made available, which can be used as input to control the laser power as well as the wire feed rate.

Result

In the first laboratory tests, the laser power as well as the wire feed rate could be adjusted to the measured feed rate. For joining of flanged seams, the feed rate of the laser was varied in a range of over 400 percent. In spite of this speed variation, the process remains stable – a smooth and nearly homogeneous seam surface was generated.

Applications

Since all of the brazing parameters can be automatically adapted to the process control, a stable brazing process is guaranteed. Moreover, set-up times can be shortened, which makes this laser beam brazing process all the more economical, especially for SMEs where lot sizes are small.

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³ Measured feed rate (green), programmed feed rate (black) as well as a brazing result for each with and without feed-rate-based control.