



JOINT TRACKING AND ADAPTIVE CONTROL BY REAL-TIME IMAGE PROCESSING

Task

In laser beam welding, the laser processing tool has to be guided continuously and precisely in relation to the joining partners since the working steps are mechanized to such a high degree. The sensors used in the image processing systems act as sensory organs, which, for example, function as visual guiding for machines and robots or detect the position of workpieces. Simple laser triangulation methods no longer meet the requirements today, as technical zero gaps are necessary in manufacturing processes or can occur in the process. In the case there are varying gap dimensions, the amount of filler introduced has to be adapted flexibly.

Method

Fraunhofer ILT has developed a system with which the distance between butt joint and laser beam (TCP) as well as the joint width during joining can be adaptively controlled by real-time image processing. In this system, an image sensor is arranged coaxially in the beam path of the processing optics for the fiber-guided laser beam or laterally in CO₂ welding optics.

Results

The institute's engineers have implemented the computationally intensive image processing algorithms required for joint tracking control on field-programmable gate arrays (FPGA) or on a graphics card (GPU) for the texture-based approach with a large number of parallel working graphics processor cores. A real-time process monitoring and control system has thus been created in conjunction with a programmable logic controller for communication with peripheral devices and systems.

Applications

Thanks to the developed real-time image processing, an inline-capable joint tracking system is now available for applications in shipbuilding, steel or rail vehicle construction as well as in profile production. The connection to production machines is independent of the machine type. A transfer of the system to other configurations is supported by modular interfaces.

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- 3 CO₂ profile roll forming plant with laterally arranged joint control.
4 Process image with texture-based joint segmentation.