

ibs Automation GmbH

Sensor-guided robots with Sinumerik 840D sl for 3-D laser welding

■ **ibs Automation GmbH, Germany**

The First Choice for Specialists

Sensor-based welding seam guidance optimizes the results of laser welding machines. For this purpose, the CNC specialists of ibs Automation GmbH added enhanced functions to Sinumerik 840D sl kernel.

Large plates are difficult workpieces – especially if they need to be precisely welded. That's because they are flexible and are subject to additional warping during welding. When they are automatically welded, it is often necessary to manually adjust the machine during machining. Alternatively, the machine can be equipped with sensors for detecting the exact position of the welding seam or welding gap. This is precisely the field in which

ibs Automation GmbH operates. The company was founded in 1990 by Dr. Walter Schwabe. With decades of experience in NC and CNC technology, ibs today develops CNC functions for control systems with open NC kernels, adding customer-specific enhancements to the CNC operating system.

The Sinumerik CNC system's open NC kernel, which was new at the time, showed the control system ▶▶

»This collaboration has functioned flawlessly for 15 years. Even the transition from the Sinumerik 840D to the Sinumerik 840D sl was mastered with a manageable level of time and effort.«

Dr. Walter Schwabe, Founder and CEO,
ibs Automation GmbH

► experts the way to independence. With the appropriate license, software developers can write functional enhancements directly for the NC kernel, thereby optimizing a standard control system for special technologies. The technical term for this is compile cycle software. "This is a win-win situation for both sides," as Bernd Lehmann, senior sales representative at the Siemens office in Chemnitz, Germany, expresses it. "Our customers receive a complete solution that they do not need to develop themselves, and we can sell systems for application fields that we would not reach otherwise."

Breakthrough in the marketplace with new welding seam guidance

ibs signed the NC kernel OEM contract in 1995. At the time, the control system experts already had concrete ideas for realizing intelligent welding seam guidance. The company achieved a breakthrough in the marketplace with a project for a large German steel producer. "It involved complex welding seams on what are known as tailored blanks, which could be successfully controlled with our system," reports

Functional Enhancements

The CNC specialists of ibs Automation GmbH have enhanced the Sinumerik 840D sl with added functions for realizing intelligent welding seam guidance.

The control system manages the seam guidance, safety, and monitoring functions and optimizes welding quality. Sensors monitor the welding gap from both sides, determining the precise actual geometry. To do this, the sensors "travel" ahead of the laser by approximately 50 mm.

The principle of intelligent seam guidance is based on vectorial addition of the machine position in the workpiece or in the machine coordinate system to the weld position in the sensor coordinate system and the automatic calculation of the set points of the NC set in real time. The determined NC set is then executed by the Sinumerik 840D sl.

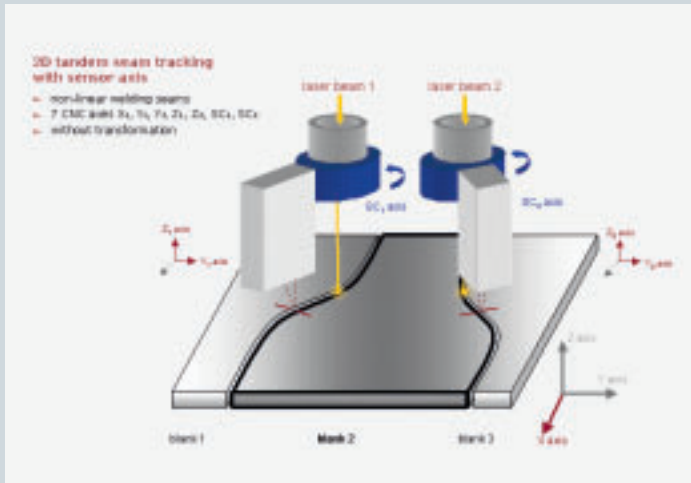
For more information, visit:
www.ibs-automation.de/index_en.htm

Schwabe. Tailored blanks are tailor-made sheet-metal plates consisting of various steel types of different thicknesses that can be joined together with laser welding. The successful completion of the project quickly led to follow-up orders in France, Spain and England, among other countries. ibs and machine tool builders now have operations around the world. Important industries for ibs include automobile production, aircraft manufacturing, ship-building and railcar production.

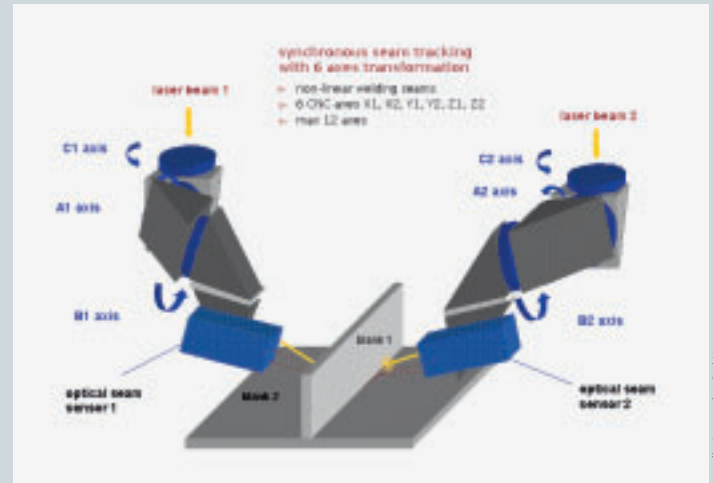
Complex, spatially contorted structures must often be welded in the aircraft construction industry. The aluminum sheet-metal parts can be up to 10 m long, 3 m wide, and 1.5 m deep (z-axis). Even at these sizes, an accuracy of $\pm 50 \mu\text{m}$ is expected. "The difficulty lies in hitting the welding joints precisely with the laser beam. Another challenge is that two lasers are often used at the same time – from the right and left – in one process," explains Schwabe. This cannot be accomplished with pre-programmed CNC systems like those used in metal-cutting.

Competitive advantages thanks to systems that are reliable in production

In the ibs solution, sensors monitor the welding gap from both sides, determining the precise actual geometry. To do this, the sensors "travel" ahead of the laser by approximately 50 mm. The principle of intelligent seam guidance is based on vectorial addition of the machine position in the workpiece or in the machine coordinate system to the weld position in the sensor coordinate system, along with the automatic calculation of the NC set-points in real-time. The determined NC set is then executed by the Sinumerik 840D sl. At an operating speed of



Intelligent seam guidance increases productivity, whether as 2-D tandem seam guidance with a sensor axis ...



... or as synchronous 3-D seam guidance with kinematic six-axis transformation

10–12 m/min, this must happen in next to no time. The control system is not only very well-equipped for this output, it also takes over seam guidance, safety and monitoring tasks, as well as optimization of the welding quality. Schwabe says, “The goal is to construct productive systems that are reliable in production and allow the customer to make money.” The seam guidance can be 2-D or 3-D, and it can be implemented as tandem or synchronous machining. There have already been machines with 24 synchronous axes, requiring three-channel design of the control system.

It is by no means just software that ibs supplies to its customers. In fact, the Chemnitz specialists design complete automation systems in cooperation with machine manufacturers, machining technologists, and Siemens, which supplies the control and drive systems. An impact-point welding unit from SM Calvörde Sondermaschinenbau is just one example. The unit has more than four NC channels with 16 axes and a sensor-guided welding-spot position detection system. The unit utilizes a Sinumerik 840D sl CNC system, Sinamics S120 drives and Simatic WinCC flexible as a tool for the creation of user interfaces.

Expert local service

“Since every system is different in special-purpose machine building, the systems are always designed with support from the Siemens office in Chemnitz. We help select the system and give ibs information about possible improvements such as software versions, for example,” explains Lehmann. The ibs experts take care of the systems integration, develop the schematics, design the control cabinets, have them built, carry out system tests, and com-

mission the system at the end of the process. This collaboration has functioned flawlessly for 15 years. “Even the transition from the Sinumerik 840D to the Sinumerik 840D sl was mastered with a manageable level of time and effort,” attests Schwabe.

The company’s founder sees the global presence of Siemens as an additional benefit: “If a fault is found somewhere with a system, we know where to find expert local service. We do not need to intervene until we have clarified that the fault was definitely caused by our part of the system.” ibs sees the future in the addition of innovative functions to the Siemens line in the form of control technology system solutions for machines and sensor-guided robots with Sinumerik 840D sl. Schwabe continues, “The more innovative we are, the better our chances are in the different markets.”

The Chemnitz-based company currently has seven employees. The control system experts mainly specialize in the development and delivery of CNC system solutions for innovative machine concepts. They also work on hardware configuration with CAE (computer-aided engineering), NC programming, user interfaces and programmable logic controllers (PLCs), as well as supervising the manufacture of configured equipment. ibs also offers commission support services. ■

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