8760 Fastems newsletter
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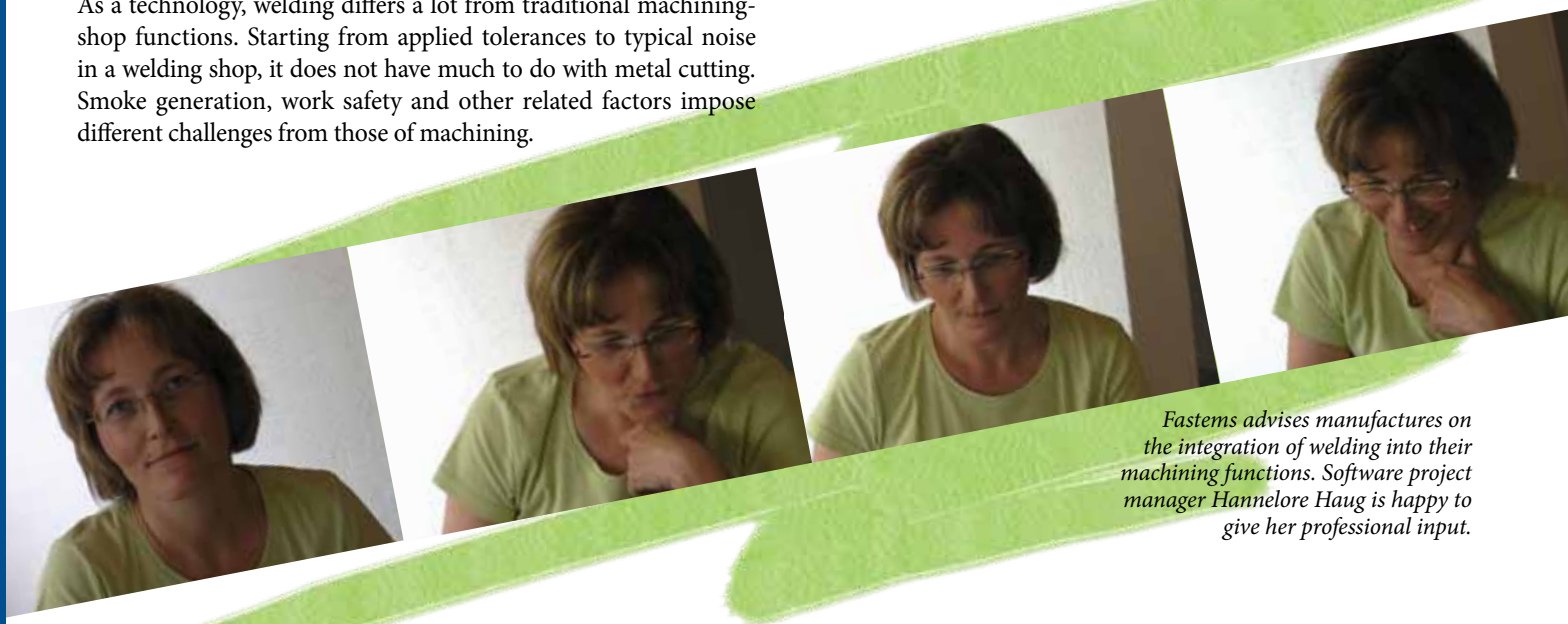
NEW TECHNOLOGIES

FMS welcomes welding to machining shops

WELDING, TYPICALLY OUTSOURCED FROM SUBCONTRACTORS FOR MACHINING, CAN TODAY BE PART OF THE PROCESS IN A MACHINING SHOP. WHEN APPLYING THE PRINCIPLES OF LEAN MANUFACTURING, WELDING CAN BE SEEN AS ANY OTHER ELEMENT IN AUTOMATED MANUFACTURING. IN THE NETWORKED OPERATIONAL ENVIRONMENT, IT CAN BE INTEGRATED IN THE MACHINING PROCESS.

As a technology, welding differs a lot from traditional machining-shop functions. Starting from applied tolerances to typical noise in a welding shop, it does not have much to do with metal cutting. Smoke generation, work safety and other related factors impose different challenges from those of machining.



Fastems advises manufactures on the integration of welding into their machining functions. Software project manager Hannelore Haug is happy to give her professional input.

BETTER PART ACCURACY AND EQUIPMENT

In recent years, the welding process has developed by major leaps. One of the focal advancements has been the dimensional accuracy of the flame/laser-cut parts to be welded together. Laser cutting has developed in terms of smarter technology and a wider equipment offering. Welding equipment can now be better integrated into automated systems, whatever they may be!

All these elements have provided new opportunities for solving the raw-material supply processes in the manufacturing of machined parts. Thanks to the improved part accuracy and design methods, the amount of welding seam has decreased. This minimizes thermal stresses and distortions, allowing closer tolerances in final parts. As a result, stress relief is no longer required in the process chain, and more parts can be taken directly to final machining and finishing operations. From the FMS point of view, therefore, welding can be regarded as another element to be integrated in the manufacturing system.

Fastems has implemented this integration a couple of times in recent years. At the moment, the Company is receiving more enquiries than ever for welding as an integrated process in a Flexible Manufacturing System.

A FEW STEPS ENABLING WELDING INTEGRATION

Some issues have to be taken into account in a welding FMS. Smoke generation is maybe the most visible thing to be solved. Product finishing is mostly impossible in the same space where welding takes place. High-intensity light emission has to be taken care of, but the ways to do it are different in an automatic process. High electric currents can also create a potential for unexpected disturbances or alarms, as the creation of magnetic fields can cause problems a long distance away.

"From the FMS system point of view, the data and NC/robot program logistics are quite different from those in a traditional metal-cutting FMS, even if the FMS itself is similar," says **Hannelore Haug**, software project manager of Fastems. "A major difference is that each welding robot has its individual robot program, even though it handles the same work piece. One thing that is totally different is the number and speed of different programs which have to be downloaded along the process."

"The second big difference is jig and part handling, if material management is needed for laser-cut parts, says Mrs. Haug. "Our MMS controller had to be 'stubbed' in various places to make the functionality work. Having it now ready and tested, Fastems' control software has become yet more competitive again," concludes

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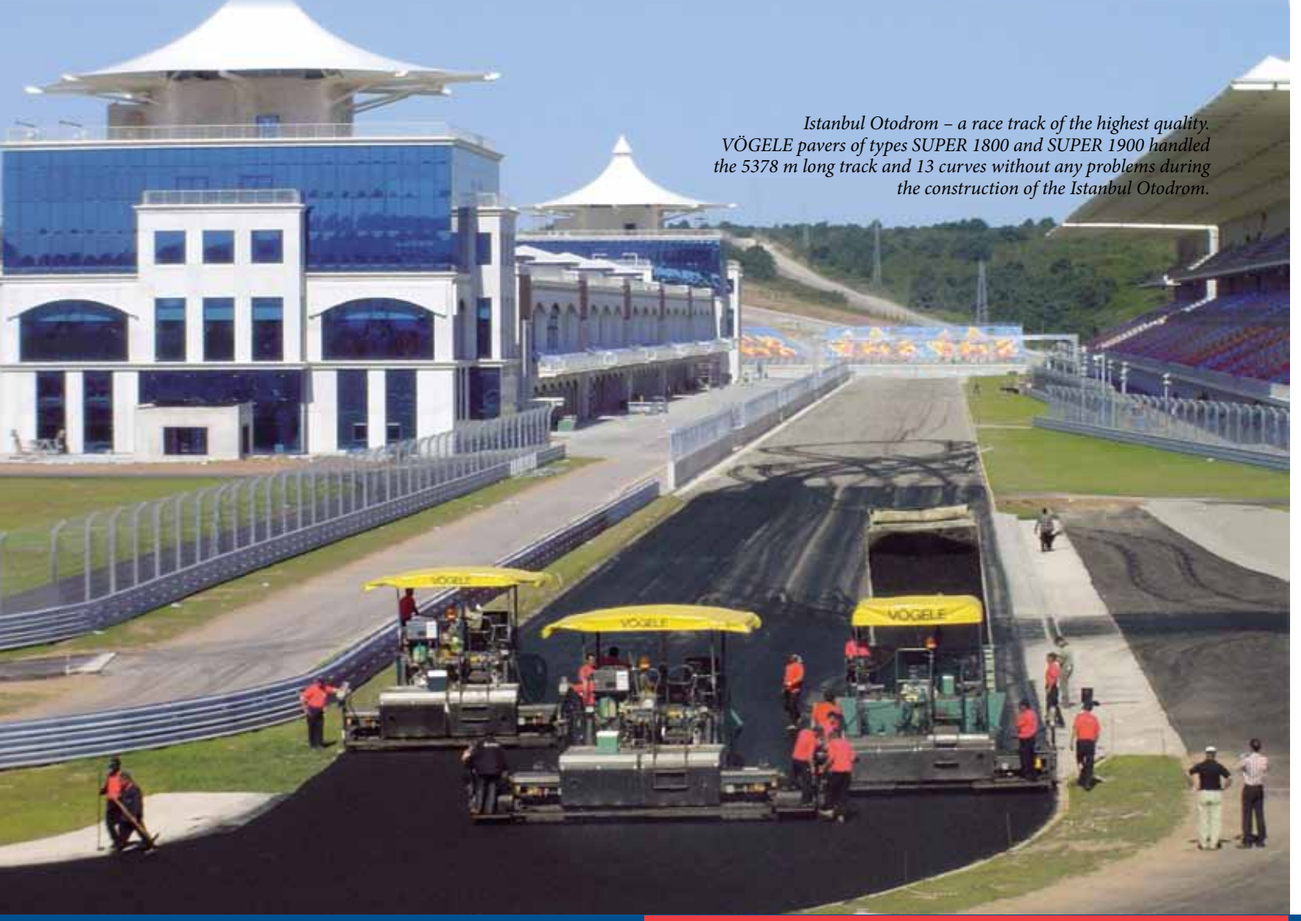
WELDING TO THE MAX

USE OF A FASTEMS FLEXIBLE MANUFACTURING SYSTEM FOR WELDING OF LAYING PLANKS AT VÖGELE

FOR SOME TIME NOW, AUTOMATED MACHINING CENTERS AND OTHER MANUFACTURING UNITS HAVE BEEN RELIABLE ENOUGH TO ENABLE ROUND-THE-CLOCK PRODUCTION. IDEALLY, 24 HOURS, 365 DAYS A YEAR. THIS TRANSLATES TO 8760 HOURS PER YEAR. BUT IS IT NECESSARY FOR AN OPERATOR TO BE PRESENT ON-SITE AT ALL TIMES? NO, SAYS FASTEMS, WHILE OFFERING A SOLUTION: MODULAR-CONSTRUCTION FLEXIBLE MANUFACTURING SYSTEMS (FMS), AVAILABLE BOTH IN STANDARD AND CUSTOMIZED VERSIONS. BOTH PROCESS WORKPIECES CLAMPED ONTO WELDING PALLETS BEFORE LEADING THEM TO AUTOMATED WELDING ROBOTS FROM WHERE THEY ARE FETCHED BACK AGAIN. AT JOSEPH VÖGELE AG, PART OF THE HIGHLY SUCCESSFUL WIRTGEN GROUP, THREE FASTEMS SYSTEMS ARE CURRENTLY IN USE FOR OPERATING A VARIETY OF MANUFACTURING CELLS.



Istanbul Otodrom – a race track of the highest quality. VÖGELE pavers of types SUPER 1800 and SUPER 1900 handled the 5378 m long track and 13 curves without any problems during the construction of the Istanbul Otodrom.

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EVOLUTION OF THE ASPHALT PAVER

VÖGELE played a prominent role in the long evolution of the "Asphalt Paver" as a genre - nowadays the company's core product. VÖGELE pioneered the first machines which lived up to the expectations placed on a road paver. Major breakthroughs in both paver engineering and paver technology were based on VÖGELE innovations such as infinitely variable hydraulic drives for paver functions, Automated Grade and Slope Control, the tamping and vibrating screed, the extending screed's single-tube system for pave width control, electric screed heating or pressure bar(s) for high compaction driven by pulsed flow hydraulics, to mention just a few examples. Thanks to Fastems factory automation, the company's Mannheim factory managed to increase its 1996 production of 300 road pavers to 1800 machines by 2007. All machines were manufactured in basically the same production area.

ABB welding robot with welding pallet and welding fixture on the orbiter.

FLEXIBLE MANUFACTURING SYSTEM FOR AUTOMATIC FEED OF WELDING ROBOT CELLS

The welding of laying planks, explains technologist **Rüdiger Schleidt**, begins with the cutting of sheet metal and the subsequent bending operations for certain parts. Next, the parts for a concrete laying plank are bound on a fixture in a way that ensures Vögele's high quality standards are met. Once bound, the welding begins. To enable us to manufacture welding workpieces of batch size one as efficiently as in machine production of laying planks, Vögele sought a comparable solution with a Fastems flexible manufacturing system. This was then achieved in collaboration with the company ABB, which installed the welding robot cells.

By integrating four welding robots into the flexible welding manufacturing system, Rüdiger Schleidt continues, we have come up with the optimal technological solution for our purposes. All four welding robots are capable of performing the entire spectrum of welding tasks. Despite this, special tasks have still been assigned to robots for further optimization of the material flow within the flexible welding manufacturing system. The flexible Fastems system, explains **Klaus Maurmaier**, the Fastems sales manager for Germany, comprises an MLS-XMD system with a load bearing capacity of 1.5 tons. Automatic handling of welding workpieces posed no problems for Fastems. The workpieces to be welded, which are clamped on standard welding fixtures, are handled as machining or material pallets in the flexible welding manufacturing system. The welding fixtures remain in the system at all times. The ready welded components are unclamped for further processing and the welding fixtures are stored on the storage rack again.

The 67 meter long and 6.3 meter high storage rack contains 152 pallet places. Transport of the welding fixtures is handled by a DMC-XMD Extra Medium Duty Fastems dual-mast stacker crane. It is equipped with frequency-controlled motors, which enable it to work fast while at the same time keeping wear to a minimum. The stacker crane is fitted with telescopic forks designed to handle Vögele welding pallets. The stacker crane transfers the welding pallets to the orbiter of the robot welding cells, which clamps the fixture in the welding cell. The orbiter has three numerically-controlled axes, which rotate and tilt the clamped workpiece so that the welding robot can weld in horizontal position, ensuring optimal quality.

The flexible welding manufacturing system, explains Rüdiger Schleidt, starts at the entrance to the factory hall and ends before the binding station, where the frames of paving planks AB500-2 and AB600-2 are bound together for our large-sized pavers. The top of the storage rack is right below the lower edge of our factory's overhead crane. After binding, Rüdiger Schleidt goes on, we remove the workpieces from the binding fixtures and clamp them onto a

MLS-XMD: 67 m long, 6.3 m high, 152 welding pallets, 4 ABB welding robots, 8 binding and infeed/retrieval stations, ergonomic, simple, and safe.

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welding fixture, which is retrieved from the Fastems storage rack beforehand. The Fastems system has a total of eight welding pallet stations for retrieving the required welding fixtures and feeding in the clamped workpieces. Each of these eight stations consists of a roller conveyor with a lifting table at the end, which enables clamping and unclamping of workpieces at an individually adjustable ergonomic height. Four of these lifting tables also have fixed-installation swivel units, which enable ergonomic clamping of larger parts.

INTEGRATED MATERIALS MANAGEMENT FOR ADDED SAFETY

Production Processes Manager **Siegfried Köhler** stresses that the flexible welding manufacturing system has been designed in a way that minimizes the amount of materials that need to be transported with forklift trucks. This has enabled the economization of material flow while at the same time increasing safety in this area.

The eight welding pallet stations, says Rüdiger Schleidt, have been arranged to achieve an optimal material flow. The master computer and a pallet station are installed after the first robot cell, via which the majority of the welded pieces are retrieved for further machining. Another robot cell and two pallet stations follow. Three more material pallet stations are installed after the third robot cell. A fourth robot cell and two further infeed and retrieval stations are connected to the Fastems storage rack.

For precise welding, explains Rüdiger Schleidt, we teach each welding workpiece in the conventional manner in the robot cell where it is then welded. The program, which has been taught and then optimized, then runs on the robot on which it originated. We then send this program to the Fastems master computer, plus a copy to manufacturing preparation at Vögele for archiving. As soon as the stacker crane transports a pallet into the corresponding robot cell, the Fastems master computer sends the appropriate welding program to the robot control unit of the welding cell. The Fastems master computer controls the material flow within the flexible welding manufacturing system in accordance with the specifications of the manufacturing organization.

CASE STEMPLINGER: MILLING AND WELDING IN ONE SYSTEM

Stemplinger Maschinenbau GmbH manufactures front hydraulics for global agricultural machinery suppliers, such as Case, Deutz, Steyr, John Deere, and Valtra. The Company operates in a 5,200 m^2 facility in Hauzenberg, Germany, with a workforce of over fifty. With the investment in a Fastems system, the Company is aiming to strongly enhance its productivity.

According to **Johann Stemplinger**, the Company will need fewer operators for production, and can even run unmanned shifts. “We will need less manpower for the same production hours. We can also simplify our production process and material flows.”

“Integration is a key benefit,” Mr Stemplinger continues. Both the raw material stock and work in process (WIP) will be automatically integrated in production. Due to the integrated storage, less floor space will be needed for material storage. “We can also integrate the milling and welding processes into one system.”

Due to the automatic production process, the expensive transportation of individual workpieces to the machining centers will no longer be needed at Stemplinger. As the system controls the production logistics and material handling automatically, the number of mistakes will be reduced to a minimum.

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Hannelore, who made and tested the needed modifications in a large FMS delivery in Germany.

FASTEMS HELPS WITH INTEGRATING WELDING INTO FMS

Each welding system has its own ‘welding pallet’ types; there are even no standards to their extent in FMS for machine tools. Mostly the welding pallets are also welded constructions. This means that pallet handling always has to be customized according to customer needs. The use of earlier ‘standards’ is nearly impossible. As mentioned above, the NC programs are totally different from those of traditional FMS. With the DNC option, sending the programs to the robots is not enough; each robot also needs to be provided with its own parameter data, such as welding current, speed and times. The programs cannot be executed by external programming tools, which only produce a frame for them. The real working program has to be instructed and checked at each single robot. It is possible to use a program from one robot to another, but not without testing and adapting the new robot to it. The system is comprehensive and rather demanding for operators.

An operator who has experience in using a traditional FMS with a Fastems control system can easily run the welding system and operate it as well, because the graphic user interface is the same in general. As opposed to a machining FMS, an FMS designed for purely welding does not include the tool management function. It can, however, be acquired as an option later on. Should future robots need one, it can be easily integrated in the system – another proof of the flexibility of Fastems’ FMS.

A few other specific technical issues need to be taken into account when putting a system like this into operation. “A ‘try and fix’ method of commissioning can create fatal risks,” advises Hannelore Haug. “A welding robot system is a different challenge; it makes my job demanding but very interesting!”

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