Welding automation for overlay cladding

Fronius's retrofittable SpeedClad 2.0 overlay cladding system won the Excellence in Welding Award at the American Welding Society's 2023 FABTECH show in Chicago. Anton Leithenmair, head of Fronius Welding Automation, and Siegfried Wiesinger, a global overlay welding expert, outline the company's automation capability.

As well as being a global leader in the manufacture and supply of advanced welding power sources and associated process control innovation, Fronius Welding Automation also develops and installs customised welding automation solutions from the start of an enquiry, through the development and start up phases and throughout the entire service life of the welding system. And, thanks to updated options and retrofits, Fronius customers anywhere in the world can now access additional benefits from the company's latest overlay welding and other automation solutions.

Realistic welding tests and feasibility studies

Every new overlay welding project at Fronius Welding Automation begins with feasibility studies and welding tests, notes Anton Leithenmair, head of Fronius Welding Automation. Overlay welding is a highly complex process. In addition to the base material of the components to be surfaced, parameters such as amperage, wire speed, welding speed, filler metal, shielding gas, ambient temperature and humidity also play a critical role, he says.

Even minor deviations can have unwanted effects on the welding result. This is why welding tests should be as realistic as possible—with components, filler metals and shielding gases that will be used when the system goes into live operation. If possible, the tests should also be carried out under the same climatic conditions that prevail at the intended place of use.

"We need an open, trusting exchange of information from the outset to ensure that overlay welding systems are customised to customer requirements. Are there any specifications regarding the filler metal and shielding gas? What about the local climatic conditions? One particularly important factor is being able to carry out our welding tests with original components rather than resorting to using mock-ups. This is the only way our systems can deliver the desired welding results, even under the harsh conditions of continuous operation," argues Leithenmair.

Over a period of more than forty years, Fronius has developed application-based overlay welding systems that are either used as standard or modified to meet special customer requirements, most notably for the global oil and gas industry.

Siegfried Wiesinger programs the system using the HMI-T21 system controls.

Leithenmair highlights Fronius' Compact Cladding Cell (CCC), which has a typical footprint of 6.0 m^2 mounted on a transportable platform. "The Fronius CCC is a compact solution for overlay welding, developed as a cost-effective internal cladding solution for valve components with a maximum bore/depth and component diameter of 1.0 m and a total component weight capacity of 2 500 kg," he says.

This powerful system stands out for its ease of use, precise positioning and sequencing, and its comprehensive range of data recording options. The ergonomic design includes a wire spool holder at a comfortable user height, a welding torch with a quick-change system, and Fronius power sources on rails.

The CCC also boasts innovative software functions, maximum process security and ultimate reliability in continuous operation. The HMI interface offers next-level ease of use with a 21-inch touch display, real-time process visualisation, multi-user management, and more.

Fronius SpeedClad 2.0

For overlay welding applications of valve components requiring the highest possible productivity, Fronius' SpeedClad 2.0 hot-wire TIG is recommended, being faster, resource efficient and more economical than the traditional hot-wire TIG processes. This innovation stands apart thanks to its high deposition rate, impressive speed, and low shielding gas consumption. In recognition of these exceptional results, the process was awarded the Excellence in Welding Award by the American Welding Society at FABTECH in Chicago on September 13, 2023.

The judges were impressed by the high deposition rate of the nickel-based alloy being used for overlay welding, which was increased from 1.63 to 6.0 kg/h, with Fronius now using a 1.6 mm wire in place of the 1.2 mm wire. The welding speed was raised from 33 cm/min to 135 cm/min, and the average pulsed current went from 240 A to 460 A.

With this process, Fronius customers can use the ideal heat input – heat input=VI/welding speed – as the starting point for optimising the welding parameters and speed. Also, argon gas consumption can be reduced from 516 ℓ/kg to as little as 140 ℓ/kg and the re-developed welding torch allows cladding in components with significantly narrower diameters, down to 100 mm from 150 mm.

The key features of a SpeedClad 2 system include:

Fronius' Endless Torch Rotation (ETR) system: The ETR's endlessly rotating welding head makes it possible to continuously weld components with different bores and bore angles with internal diameters of up to 1.0 m. The welding torch and the wire feeder rotate together around the bore axis. Components are centred automatically, which shortens set-up times considerably and saves production costs. And if there is any risk of the torch colliding with the component, the electropneumatic collision detection system stops all axes of movement and protects the welding torch against damage.

Fronius recently enhanced the ETR system with an even more flexible ETR Ultimate torch. In addition to overlay welding tasks, this versatile system now makes it possible to join larger components with challenging geometries and difficult seams. As with the Compact Cladding Cell, both the ETR and ETR Ultimate systems come with system controls accessible via a convenient 21-inch touch display, which offers real-time process visualisation and multi-user management as standard.

Above: Fronius' tilting positioner with an ETR (Endless Torch Rotation System) offers unlimited rotation and positioning of the welding head.

Left: Fronius' Compact Cladding Cell (CCC) with rotating positioner, HMI-T21 system and remote control.

Where necessary, the ETR or ETR Ultimate welding torch and the positioner move in sync, to enable the SpeedClad 2.0 to deliver maximum productivity.

All parameters live and at a glance: The HMI-T21 system controls used for the SpeedClad 2.0 are Industry 4.0-ready with a large, intuitive 21-inch touchscreen, multi-user accounts with individually assigned authorisations, process visualisation in real time, on-the-fly parameter adjustments, and innovative functions such as X-Ray View, Component Editor, Bore-to-Bore Advanced, actual value monitoring in real time, and STEP file import.

The system also offers remote maintenance capabilities. The X-Ray view provides a transparent outline of the component to give the operator an excellent overview. The Bore-to-Bore-Advanced function offers assistance when several offset transverse bores with non-90° angles, or flanges with bores have to be clad. And all relevant welding parameters are displayed live using system-integrated actual value monitoring.

A solution for every need: Welding operators can create components step by step in the Component Editor via the HMI-T21 touchscreen. The height and diameter are defined by inputting the relevant dimensions, and the various components appear in real time as 3D graphics on the screen. In addition to cylindrical shapes, flat and conical shapes are also possible. There are also options to model bores and extensions, such as flanges. The CNC technology now integrated into Fronius' automation systems creates scope for even more component geometries than before, including intersection bores on conical components.

The welding processes are programmed in the Program Editor. Operators select the individual sections of the components and define the welding sequence. One especially helpful aspect is that the welding torch can be shown at the starting point.

The system offers a selection of jobs with fixed parameters that can be adjusted at any time—even on-the-fly—in the Weld Adjust menu. AVR (Actual Value Recording) records the values of the welding current, voltage, wire speed, gas consumption and welding position during the welding processes – in tabular form. The PC software packages, Data Logger HMI and Data Viewer HMI are optionally available for graphical evaluations and analyses.

Once the home position of the welding torch has been calibrated, the torch moves independently to its starting point for each overlay welding application, explains Siegfried Wiesinger, overlay welding expert at Fronius. "The remote control can be used to fine-tune a range of parameters even just before igniting the arc. For example, the AVC (Arc Voltage Control) function adjusts the starting point and distance of the welding torch to the component," he adds.

Seam and robotic welding systems

As a solution provider, Fronius Welding Automation produces mechanised and robotic welding systems for industrial fabrication tasks. These include longitudinal and circumferential seam welding systems, welding carriages and robotic handling-to-welding systems.

Collaborative systems, intelligent sensor technology, software solutions for data management, and offline programming and welding simulation open up profitable welding opportunities for metal processing companies, starting from a single batch. We are able to analyse specific requirements for the welding system with customers, and this is followed by the creation of a unique customised solution," continues Anton Leithenmair. Since 1975, more than 3 500 Fronius systems have been installed and used across 45 countries by over 2 000 customers, he notes.

The Fronius team is looking forward to showing these innovations at the ADIPEC trade show in Abu Dhabi, on 4th to 7th of November 2024, Hall 14, Stand 14316.

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