

Development and integration of a WAAM system

Utilizing a collaborative articulating robot and a MIG/MAG welding power source

Graduate



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Introduction: Wire Arc Additive Manufacturing (WAAM) employs arc welding processes to deposit layers of material onto a substrate, providing an economical method for the additive manufacturing of metals. IWK, the Institute for Materials Technology and Plastics Processing, is conducting research on the cladding of steel using WAAM. To enable this research, a WAAM system was set to be developed as part of this bachelor's thesis.

Approach: The design of the WAAM-System is based around a collaborative articulating robot, used at the IWK for multiple purposes. Thanks to its collaborative nature, the robot can be used without additional safety features. Mounting a welding torch to the robot however, constitutes a modified machine, whose safety must be re-assessed. The WAAM system was developed in accordance with select type-C standards, such as ISO 10218-2, "Safety requirements for industrial robots". A risk assessment concluded that welding fumes and radiation present the highest risks and require additional safety measures.

Result: Based on the health and safety requirements and the needs of the IWK, a cell design built around a fixture table was implemented. Welding curtains spanning the circumference of the cell allow easy access while reducing harmful radiation. The integration of the welding power source into the robot is facilitated by an additional device, which enables the robot controller to take control of the welding power source by use of digital signals. Five layers of a single bead-width geometry were deposited in testing. The results show room for improvement, both in the weld settings as well as the deposition strategy. The WAAM system at hand is suitable for research

purposes. If it is to be used long-term, safety features such as an emergency stop must be integrated into the welding power source and the conformity of the system with the European machinery directive must be assessed.

Fixture table and enclosure
Own presentation



Test setup (without enclosure)
Own presentation



side and top view of demonstrator, NiCr22Mo9Nb deposited onto DC04 mild steel plate
Own presentation



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Subject Area

Automation & Robotics,
Manufacturing Technology,
Construction and System Technology,
Product Development