

MANAGEMENT, PRODUCTION AND DESIGN

Advanced and sustainable welding processes

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Context of the research activity	The research activity is based on the development and monitoring of innovating and sustainable welding processes. The monitoring systems will be used to evaluate in real-time the process parameters to control the joining process and predict joint quality.
Objectives	<p>In recent years, economic and environmental trends are leading to the development of a new production model that must not only maximize throughput and efficiency but also be flexible, make value chains more reliable, and adopt new technologies for circular economy and sustainability. In such a context, it is essential to react with innovative processes and products, and to develop automatic systems and numerical algorithms for the design of human-centered systems. The research activity will be devoted to theoretical and experimental investigations of innovative and sustainable joining technologies, which might include Resistance Element Welding (REW), Friction Element Welding (FEW), and hybrid arc-laser welding. The research activity will evaluate these different innovative welding technologies both in terms of joint configuration and strength, as well as of energy and environmental aspects.</p> <p>The research will also address the study of systems for monitoring the joining technologies, allowing to provide a decision support system for the operator in evaluating the joining process, joint quality, and energy consumption. Instruments and sensors (e.g., infrared thermography, load cells, speed sensors, etc...) will be used to measure in real-time the process parameters (e.g. torch and electrode displacements, welding speeds, torques, energy supply, etc.) and possible harmful phenomena (e.g., improper electrode wear, metal expulsion, etc...).</p> <p>Research will also be aimed at evaluating methods for the non-destructive inspection of welded joints such as optical quality control and active thermography.</p>
Skills and competencies for the development of	Previous experiences in welding operations (e.g., laser welding), microstructural and mechanical characterization of welded joints.

