RADICLE project aims to provide flawless laser welding for strategic industrial sectors

Laser welding adaptive control system integrates sensor data in real time to adjust the laser parameters and deliver welded joints with zero defects

The Radicle project (Real-time dynamic control system for laser welding) aims at creating a multi-sensor, real-time adaptive control system for zero-defect laser welding. This project is of critical relevance as laser welding gains acceptance for high value, high integrity manufacturing applications. Industries using laser welding are increasingly challenged by the uncertainties of rapidly changing market conditions, and requirements for shorter times-to-market, reduced costs, reduced weight and increased campaign life. As a result, companies in these industries must now respond faster and more efficiently to ever more complex and frequently changing designs.

To ensure the success and quick transfer cycle from research to production, the project includes some of the leading technical experts in the field of laser welding, and its outcome will enable the creation of an effective response solution to strengthen and reinforce the EU's position in both laser welding and high value manufacturing.

The challenge to reach zero-defect manufacturing

As a sophisticated and increasingly used process, laser welding is a high performance joining method which can offer significant benefits over conventional welding processes, for industrial sectors such as automotive, aerospace and power generation, representing sophisticated industries manufacturing high added-value products. If a solution could be found that eliminated weld defects in-process, and therefore the associated cost of rework, then the uptake of laser welding systems would increase significantly, benefitting both high value manufacturing industries and laser welding system suppliers.

This project aims at reducing costly and time-consuming quality control activities, by focusing instead on integrated control as part of the overall quality assurance system. Currently, significant time and cost is invested in Non-Destructive Inspection (NDI) as a part of the Quality Assurance process. NDI methods can often only detect defects post-process, resulting in significant additional time and cost penalties. To date, in-process monitoring systems can more readily detect surface defects but struggle to pick up critical defects which may be present inside the welds.

The expected outcomes of this project are anticipated to have a long-lasting impact on the wider applications of laser welding. The goals are ambitious, and include:

- Increased productivity of up to 30%, resulting in:
    - 30% reduced energy usage;
    - 30% reduced emissions;

    - Elimination of the need for part scrappage or rework (saving up to 20%-30% of labor input);
    - Reduction or removal of the need for final NDI testing of the parts;
- Removed need for large enclosed remote welding rooms (saving up to 35% of floor space);
- Increased health and safety benefits;

In addition, RADICLE will contribute to the wider Europe 2020 targets, increasing the potential employment of 20-64 year-olds, increasing R&D spending, reducing energy usage and greenhouse gas emissions, and increasing education, especially at third level education.

Pre-eminent industrial groups and associations ensure the project's success

The project, of a duration of three years, is coordinated by the Manufacturing Technology Centre (UK). To ensure a quicker research-to-production transfer cycle, a group of industrial companies are partnering with MTC – GE (Switzerland), Rolls-Royce (UK), GKN Aerospace (Sweden) and CRF (Italy). These companies have significant market share in the critical markets of automotive, aerospace and power generation. Providing the processing and sensor knowledge are Laser Optical Engineering (UK), Permanova (Sweden), TWI (UK), VTT (Finland), and BitAddict (Sweden) each contributing with their unique skills and competencies on specific fields necessary to develop this project. The European Welding Federation will lead the project's dissemination and business planning activities.

To frame the relevance of this project for the manufacturing sector in Europe, a list of possible industrial sectors that will benefit from the project results could include:

- Automotive;
- Energy/power;
- Medical;
- Agricultural equipment;
- Aerospace;
- Fabricated metal parts.

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