smart
advanced manufacturing

Closed-Loop Equipment Integration & 3D Vision for Enhanced Robotics in DED-arc

CLEVER

ORGANISATION PROFILE

Instituto Soldadura e Qualidade, ISQ

We are a private, independent, reputable, and accredited entity that offers a range of <u>Engineering, Consultancy, Inspection, Testing, Training, R&D, and Innovation services</u>. We generate value for your business, brand, products, and services.

We act in your interest to promote the quality of your products, services, facilities, and processes, bringing you recognition, competitiveness, and innovation.

We act comprehensively throughout the value chain, providing over 250 specialized services, hundreds of technical specialists, and the know-how of over **50 years** plus operating worldwide, leading significant **international projects**.

We have a sustained presence in several countries and run our business with multinational partners and consortia and through our affiliated companies on several continents.

PROPOSAL INTRODUCTION (I)

Vision: Our primary goal is to develop a <u>closed-loop control system</u> for Directed Energy Deposition-arc (DED-ARC) that aims at keeping the thermal behavior constant throughout the process. C.L.E.V.E.R. consortium will also introduce an <u>in-line scanner</u> for real-time quality assurance, addressing geometric control challenges. With these scans, parts in production are compared with the expected part dimensions at each layer/stage of the manufacturing process (online monitoring)

Motivation: The intricacies involved in capturing mathematical relations, physical-based models, solidification sequences, and interdependencies among the diverse process parameters for each processed material demand substantial computational resources and knowledge. Therefore, adopting closed-loop control systems can <u>enhance repeatability</u> and make the process <u>more predictable</u>.

Closed loop control:
- Reduce material usage since it will reduce the amount of trial and error.
- Mitigate heterogeneity in microstructure, hardness, and mechanical properties.
- Improve the final appearance of parts by reducing the irregular waviness through parts' height.

3D scans during the process:
- Check for defects, such as irregular waviness, dimensional inaccuracies, and irregular height at each layer.

Content:
- Integrate and develop software that builds a 3D model out of in-situ scans and makes online monitoring
- Develop the closed-loop software for a DED-ARC system.

PROPOSAL INTRODUCTION (II)

Expected outcome:
The Technological Readiness Level (TRL) of CLEVER currently falls between TRL 5, for the 3D scan and model build integration, and TRL 7, relating to the closed-loop control system.

Impacts:
The implementation of in-situ control technologies not only contributes to economic efficiency but can also save valuable hours in pre-processing, thermal simulations, and preliminary tests with process parameter selection for specific features. Moreover, the controlled processes are expected to save up to 50% more energy compared to uncontrolled processes

Schedule:
Starting date: 1/1/2025
End date: 31/6/2027
Duration: 2,5 years

PARTNERS

Current Consortium: list of partners already involved in the project

Portugal:

- Instituto Soldadura e Qualidade, ISQ:
Additive manufacturing research center
Processes: DED-ARC (GMAW,GTAW,PLASMA), DED-LB (SLM and PBF)

- FAN3D:
Additive manufacturing services company

Partner search:
- IR camera and sensor manufacturer
- End user
- All partners from eligible countries are welcome.

CONTACT INFO

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