SCIENTIFIC AND TECHNICAL REPORT (extract)

Project title: **Knowledge-Based System for Welded Structures and Technologies**

Stage 3: **Finalising of the knowledge-based system for welded structures and technologies and disseminating the results**

Project coordinator: ISIM Timisoara, Romania

Project partners: SAM ROBOTICS SRL, Romania
Izertis SL, Spain

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CONTENT
of the Scientifical and technical report (RST) in extenso

Summary

Welding is an essential manufacturing process implemented in almost every major industry, welds quality and integrity being essential for the safety of a wide range of products and structures.

In this context, the COFUND-MANUNET III project, acronym: KBS-Weld, contract 25 from 1st of March 2018, entitled "Knowledge-Based System for Welded Structures and Technologies", aims at developing a knowledge-based system that works as a computing support for planning the welding process, allowing the end-users to choose the best combinations of welding materials, welding technologies and welding parameters to create the welded structure with the required properties.

For implementation of the COFUND-MANUNET III-KBS-Weld project, a consortium of the following institutions in Romania was established:
- Project Coordinator (CO) - National Institute for Research and Development in Welding and Material Testing - ISIM Timisoara;
- Partner (P): S.C. SAM ROBOTICS SRL, Timisoara.

COFUND-MANUNET III-KBS-Weld project consortium is completed by the European partner: Izertis S.L, Gijón, Spain.

All partners of the consortium participated in implementation of the stage 3/2020 entitled "Knowledge-Based System for Welded Structures and Technologies". The project management ensured that the planning and implementation of the activities foreseen in the implementation plan were achieved, which led to the fulfilment of the stage 3/2020 specific objectives:
- SO3. Construction of an advanced and easy-to-use model for the correlation and optimisation of input and output data of a welding process;
- SO4. Integration of computational components and validation of the whole ICT system at lab scale.

To achieve the current stage objectives, the following scientific and technical activities were carried out:

Project management:
- Supervising the activities to be implemented;
- Communicating with the partners and with the project team;
- Communicating with the managing authority and reporting the results.

Thus, during the stage 3/2020, the CO has managed, analysed and synthesized the partial scientific and financial data received from project consortium partners, data that were stored and processed.

System construction, integration and validation:
- Finalisation of the knowledge-based system for welded structures and technologies (KBS-Weld);
- Validation of the KBS-Weld system for relevant scenarios.

<u>Dissemination of the project / project results:</u>

- Updating the project website;

- Publication of scientific papers in journals and presentations at international conferences;

- Patent application;

- Media campaign.

All activities carried out and the results obtained during implementation of the stage 3/2020 are described in detail in scientific and technical report (RST) in extenso.

In order to finalize the knowledge-based system for welded structures and technologies (KBS-Weld), the experimental program was developed to generate new data and correlations between the welding parameters and the mechanical characteristics obtained for GMAW of fine-grained steels plates (S420MC and S460MC respectively).

Thus, chapter 1 of the RTS presents the experimental program and the results obtained.

Chapter 2 presents the experimental program implemented to validate the KBS-Weld system.

Chapter 3 presents the dissemination report that includes all the actions and events organized within the project in order to disseminate the results obtained, to ensure the project visibility (media campaign and organization of workshops). In this report are mentioned both the scientific papers published or presented, as well as those developed to be presented at future international conferences. The report also presents a patent application.

Chapter 4 presents the conclusions regarding the activities carried out and the results obtained in the stage 3/2020.

In the frame of the project stage 3/2020, the KBS-Weld project website was updated. It could be accessed on: <u>http://kbs-weld.ro</u>.

Conclusions

During the third stage, the knowledge-based system for welded structures and technologies was finalized and an experimental program was developed in order to validate the KBS-Weld knowledge-based system, in the laboratory conditions.

The system has been validated for the particular case of the fillet welded joints made of S420ML fine-grained steel sheets of 4 mm thick. In this case the welding process was modelled properly, the system providing two combinations of welding parameters which, by implementation, lead to proper quality of the welds, corresponding to the level B of acceptance (very good quality of the welded joints).

The system was also validated in the particular case of the butt welded joints made of S420ML fine-grained steel sheets of 4 mm thick, but in this case, it was appreciated that the KBS-Weld system provided two combinations of welding parameters which, by implementation, lead to a quality of the welded joints considered to be at the limit. The results obtained are encouraging, but it can be improved by increasing the number of the experimental results that the system has in its database.

Thus, it has been proven that by exploiting the data generated by advanced machine learning techniques, the KBS-Weld system can provide a combination of materials and welding parameters for various type of welded joints that meet the quality requirements specified by end-users.

The KBS-Weld system serves as a software tool for professionals in the industry of welded components and structures. Users can find useful information on base materials and filler welding materials, welding parameters, welding experiments and results obtained by testing them on the platform.

The system helps to reduce the costs related to the preliminary experiments and the tests that have to be performed in order to develop the Welding Procedure Specification (WPS).

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