TIMIŞOARA

SCIENTIFIC AND TECHNICAL REPORT (extract)

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

Stage 1: **Realization of the information system database**

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Summary

Welding is an essential manufacturing process that is implemented in almost every major industry. Therefore, the quality and integrity of welds are 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.

To implement 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.

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

All partners of the consortium participated in implementation of the stage 1/2018. 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 phase 1/2018 specific objectives:

- OS1. Development of an extensive experimental program, considering a large number of welding variants and analysis of welds obtained;
- SO2. Generate a large database for compiled data of the experimental program, as well as the for the knowledge of the key experts in the field;

During the implementation, the CO has managed, analysed and synthesized the partial scientific and financial data received from project consortium partners, data that were stored and processed.

To achieve the objectives during this stage the following scientific and technical activities were carried out:

Project management:

- Supervising the activities to be implemented;
- Organization of the project team meetings;
- Communicating with the managing authority and reporting the results.

Experimental program:

- Logistics preparation;
- Collecting specific information;
- Designing and implementing of the experimental welding program;
- Designing and implementing of the testing program;
- Analysing and interpreting of the test results;
- Establishing correlations between the parameters of the welding process and the characteristics of the welded joints;

Generating of the database for the information system:

- Concept design, logical and physical design of the database;
- Data migration.

Dissemination of the project / project results:

- Designing, implementing and updating the website of the project;
- Organization of the project launching event in Romania;
- Publication of scientific papers in journals and presentations at the international conferences;
- Media campaign.

In the frame of the project stage 1/2018, the KBS-Weld project website was designed, implemented and updated. It could be accessed on: http://kbs-weld.ro.

All activities carried out and the results obtained during implementation of the stage 1/2018 are described in detail in this scientific and technical report (RST) in extenso.

Conclusions

During this project stage, studies were carried out on the correlation between GMAW welding parameters of steels and the mechanical characteristics of the joints obtained, on some paradigms of experimental data intelligent processing, as well as on factorial experiments. These studies formed the basis for elaboration of the experimental program designed and implemented within the stage, being useful for establishing correlations between the parameters of the welding process and the mechanical and structural properties of the welded joint.

Factorial experiments of first order with four influence factors, two levels and replicas at the central point were designed and implemented. As input functions, four main technological parameters were selected: the welding current intensity I_a [A], the welding voltage U_a [V], the welding speed v_s [cm / min] and the free length l [mm], parameters that influence significantly the obtain results.

The experimental program implemented during this stage, consisted in making of butt welded samples of 2 mm, 4 mm and 8 mm thickness steel sheets using the GMAW (Gas Metal Arc Welding) procedure - arc welding with fused electrode, in shielding gas protection (Argon + 18% CO_2) and different welding regimes, followed by their quality assessment using non-destructive tests, mechanical tests and analyses.

The results obtained have been analyzed and processed, allowing establishing the mathematical correlations between the welding process parameters the and the main quality indicators of the welds (e.g. tensile strength, maximum bending angle, type, number and dimensions of welding imperfections).

At the same time, during this project stage, the information system database for storing the data obtained within the experimental program was conceived, designed and realized. This database, as well as the correlations obtained so far, will be used in the next project stage, being exploiting by the information system. The information system will allow generation of a computational model for correlating input and output data from a welding process, using intelligent data analysis tools as well as integrating specialized knowledge.

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