Non-defective welding construction design using Web – based collaborative tools

TOMAS KAMINSKAS
GENADIJUS KULVIETIS
Mechanics department
Vilnius Gediminas technical university
LITHUANIA
ktomas@me.vtu.lt

Abstract: - There is probability to originate different defects in every welding process. The defects can't be escaped, because they come naturally after every welding process. So it is the essential thing to reach, that they would be as small as possible. To get the point, there can be used an expert system, which gives to the user an information about the defects of welding joints. System asks for totally description of defect to give right recommendation. In the data base of expert system there is ushered in all kinds of defects, reasons of rising and the ways to eliminate them.

Key- Words: - computer tools, database, expert system, welding, knowledge management.

1 Introduction

Projecting welding conjugations and construction generally are used universal systems of computer design. But there are passinely polarized to particularly of projecting welding conjugations. Projector, non welding specialist, has difficulties to project qualitative welding construction, which would suit to constructional and technological specifications. Also there are used engineering computer programs, where using of multiplex algorithm gives typical answers in doing typical problems, but the algorithm doesn't change. That is why the interest in expert system, where is used program tools of collective work, is growing. Suchlike expert systems allow atomizing the solution of various different problems, like projecting, design, diagnostic. It lets to collaborate effectively in generating projects.

Control of defects in welding joints is an important part of quality control system. Quality system is the set of control devices and methods, which slows the chances of defects spring. The point of quality control – estimate the quality of product. The seans of quality control consultation are showed on fig.1.

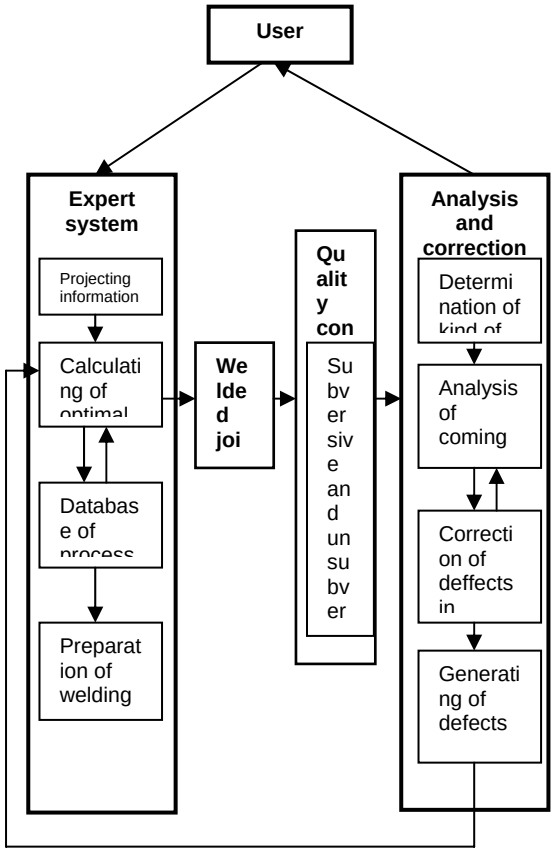

Fig.1. Algorithm of quality control consultation showing.

2 Welding process design in the expert system

That is why interest in expert system, where is used program tools of collective work, is growing. Suchlike expert systems allow atomizing the solution of various different problems, like projecting, design, diagnostic. It lets to collaborate effectively in generating projects.

Information in existing expert systems mostly is designed to fixate. But major section of database is changing constantly like standards, norms, materials, equipment and other or may be unknown at all. In the intellectual system are the search of analogues and the accumulation of results. It means, system is shifting and perfecting constantly. Most important there is work of processes computerizing: creation of information database for single stage and for all process (intellectual algorithm), the designing of projecting environment (norms, materials, technologies).

Using tools of collective work gives new facilities for projecting systems (1 pic.):

1. one make connect to expert system server when he is far away;
2. database constantly is supplement with newest and most actual information;
3. user in each time can connect and use expert system and database;
4. various users can be connected contemporaneously.

It secures quick and exact preparation of technology considering how quick situation will change.

Projecting the expert system of welding joints there were used program product of IBM – Lotus Notes & Domino, which is intended for tools of collective work.

The work success determines information, which is necessary to compose new technology of welding joint, choosing equipment and material and prosecute welding operation. These problems are confusing and contradictory. Of late years the change of situation in welding material and equipment market made difficulties for arrangement of technology. Besides, welding joints mostly are complicated construction and there is variety of used material.

There is a confusing deformation in the welding of T-joint constructions. Longitudinal shortening reducible the length fractionally, but the rise on vertical flat is plenty big. Free ledge of vertical pane bows inside. A possible deformation depends of:

1. proportion of vertical and horizontal pane;
2. priority of welding;
3. Quantity of energy input.

The size of longitudinal deformations in welding of two planes depends of proportion between the cabarets of horizontal and vertical panes. In fig.2 is showed the graphic of longitudinal deformations.

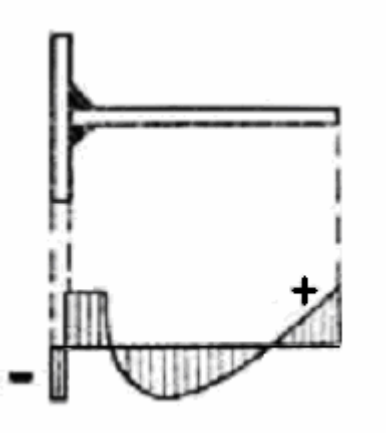

Fig.2. Graphic of longitudinal deformation.

There were fulfilled an experiment, which shows equity of recommendations of expert system. The specimen decomposed of two T-joint plates. For the experiment there were used three completes. The measurements of the plate were 1500x10x8 mm.

Methology of research:

1. T-joint plate is fixative in the special case (fig.3);
2. deformation is measuring up in the selected points;
3. fulfilled the measurement, T-joint beam is welding by the first seam;
4. Fulfilled the measurement, T-joint beam is welding by the second seam. Measuring the deformations.

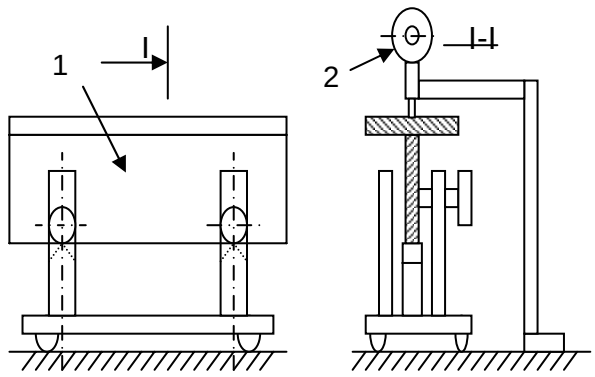

Fig.3. Stand of measurement.

The expert system often provides several possible variants of technology solution. As electrode thickness and current are not given in exact numbers, but in a range of possible numbers, this is the engineer who has to choose the exact number. It is also in the competence of the engineer to choose the best variant from the several possible ones provides by the software.

The expert system calculated peak rise – 6,71mm (fig.4).

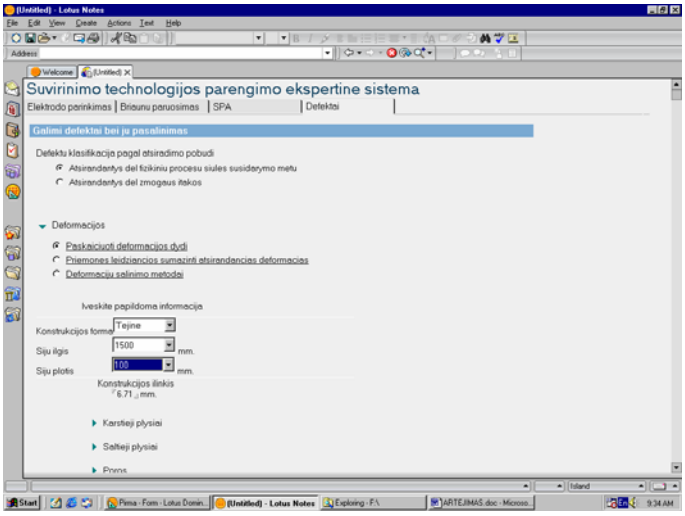

Fig.4. the expert system calculated peak rise – 6,71mm.

Variation of beam dimension change in experiment:

Rise of first beam – 5, 8 mm;
Rise of second beam – 6, 2 mm;
Rise of third beam – 5, 2 mm.

The expert system provides the user with instructions of how to weld according to the given task and in case of problems should suggest how to eliminate or correct the defect or incorrect weld position. Having gathered all the necessary information about the defect, the software can make recommendations.

According to the entered data the expert system can select all the necessary welding parameters, which are as follows:
1) material thickness
2) welding position
3) connection type
4) preparation of joint

The expert system then provides the necessary welding parameters ,which are as follows:
1) age preparation
2) welding
3) electrode diameter
4) welding current

About 85-95 percents of all defects depends of these factors. The factor F has number of parameters P, which depends on number of defects, their dimension andcharakteristics:

$$F \rightarrow (\Sigma P_i) \rightarrow (P_i x_i \ldots P_n X_n).$$

Every factor is characterizating by its parameters, which describes parameter X_i, lets estimate safe limits of values. If values are biger than safe limits, technology of welding system becomes destabilizated, springs out defects.

The software contains the interdependency of these parameters. The design expert system selects data in the dialogue window where user has to enter primary, most necessary data. According to the user's answers, the software selects suitable variants from the database using the filter function. In such a way, it is easier for an engineer to select the most suitable welding parameters.

In this expert system there is subsidiary function, which takes the chosen information and saves it in weld procedure history window, which suppose to Lithuania Republic standards LST EN 288-2+AI:1998 and Europe standards EN 288-2:1992. The software fills in full window, using the information, which was given to expert system and the results.

3 Conclusion

In the paper is given model and architecture of welding expert system. This model can be used in detection of welding defects. It has characteristics:

1. the algorithm lets to store the database;
2. the software can create welding technologies;
3. expert system can be used for the choosing of welding parameters and database printing;
4. the algorithm of system lets to expand the database;

Hereby computer expert system lets to summarize database.

References:

1. Maine E.M.A., Ashby M.F. submitted to material and Design 2001.
2. Anderson M.M., Gudnason C.H. Planning and integration of product development, in G.Salvendy (Ed.). Handbook of Industrial Engineering, 2nd edition, Wiley, New York, 1992.
3. Valiulis A.V. Specialūs suvirinimo metodai. Vilnius: Technika, 1993.
4. Bargelis A. Mechanikos gaminių gamybos automatizavimas. Kaunas. Technologija, 1996.
5. Lucas W. The welding institute approach to writing information software for welding engineers. Pergamon. Viena, 1998.
6. C. LeBacq, Y. Brechet, H. R. Shercliff, T. Jeggy, L. Salvo. Selection of joining methods in mechanical design. Materials and design 23, 2002.
7. P. G. Maropoulos, Z. Yao, H. D. Bradley, K. Y. G. Paramon. An integrated design and planing environment for welding. Journas of Materials processing technology 107, 2000, 3 – 8p.
8. K. A. Persson. Welding and cutting beyond the year 2000. Svetsaren. 1999.