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INNOVATIVE ONLINE SIMULATOR WELDING TOOLS FOR COST CALCULATION PRODUCTION PROCESS

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Rezumat *: Societatea modernă depinde în mare măsură de o gamă largă de produse sudate, cum ar fi construcţii navale, poduri, construcţiile de ţevi, cazane, industria constructoare de maşini şi industria construcţiilor. Siguranţa produsului şi dependenţa de aceste produse depind de calitatea materialelor, cunoştinţele şi competenţele de bază ale sudorului, precum şi de îmbunătăţirea continuă a calificărilor acestora spre noi procese şi materiale de sudură, precum şi actualizarea continuă a certificatelor şi diplomelor. Din păcate, pe piaţa europeană nu există instrumente de simulare a costurilor de sudură pentru costuri de sudură, de înaltă calitate, uşor accesibile, orientate către proces şi integrate, pentru a ajuta şcolile, instructorii şi sudorii pentru educaţie, formare profesională (VET) în a crea design-uri accesibile şi care oferă o modalitate solidă şi uşoară de a evalua şi de a anticipa obiectivul factorilor de cost al întregului proces de producţie ca atare. Majoritatea instrumentelor software disponibile pe piaţă sunt utilizate pentru calcularea costurilor detaliate de sudură, cum ar fi temperatura de intrare a căldurii, temperaturile de preîncălzire şi parametrii de sudare bazaţi pe o singură selecţie a materialului, un singur proces de sudare şi uitând interrelaţiile şi dependenţele dintre acestia. Aceste instrumente software sunt mai degrabă simple care vizează un singur tip proces de sudură şi un singur scop.Prin programul Leonardo da Vinci, proiect pilot cu QISIM o nouă generaţie şi metodologie de instruire e disponibilă in domeniul industrial.Acest proiect este o extensie a proiectului Leonardo da Vinci MECCA [2]. Metodologia de instruire dezvoltată include exemple specifice din industria prelucrătoare, scoli de instruire, (VET) şi SME firme mici şi mijlocii.*

Abstract. *The modern society is extensively depending on a range of welded products like shipbuilding, bridges, constructions of pipes, boiler works, car manufacturing industries and building industry (construction industry). The product safety, and our reliance of these products, depends on quality of materials, welder's basic knowledge and competence, and their continuous skills upgrading towards new welding processes and materials as well as their continuous updates of certificates and diplomas.Unfortunately,*

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no high quality, easy accessible, process oriented and integrated general purpose welding cost simulator tools are available on the market in Europe to help Companies, Higher Education and Vocational Education and Training (VET) schools, instructors and welders to create production friendly designs that offer a sound and easy way of evaluating and predicting the costs factors objective of the whole production process as such. Most software tools available on the market are used for calculating detailed welding costs, like heat input, preheating temperatures and welding parameters based on a single material selection, a single welding process only and forgetting their interrelations and dependencies. These software tools are rather simple aiming at one process step and one-purpose only. Through a Leonardo da Vinci pilot project IQSIM [1] was developed and disseminated as a new generation of training methodologies that became available to European wide mechanical industry sectors. This project is an extension of the Leonardo da Vinci pilot project MECCA [2]. The training methodologies developed specifically include tasks and examples for the fabrication industries, vocational education and training schools (VET), and SME's.

Keywords: XML, simulator, welding, mechanical industry, product model

1. Introduction

The modern society is extensively depending on a range of welded products like shipbuilding, bridges, and constructions of pipes, boiler works, car manufacturing industries and building industry (construction industry). The product safety, and our reliance of these products, depends on quality of materials, welder's basic knowledge and competence, and their continuous skills upgrading towards new welding processes and materials as well as their continuous updates of certificates and diplomas. Unfortunately, no high quality, easy accessible, process oriented and integrated general purpose welding cost simulator tools are available on the market in Europe to help Companies, Higher Education and Vocational Education and Training (VET) schools, instructors and welders to create production friendly designs that offer a sound and easy way of evaluating and predicting the costs factors objective of the whole production process as such.

Most software tools available on the market are used for calculating detailed welding costs, like heat input, preheating temperatures and welding parameters based on a single material selection, a single welding process only and forgetting their interrelations and dependencies. These software tools are rather simple aiming at one process step and one-purpose only. Through a Leonardo da Vinci pilot project IQSIM [1] was developed and disseminated as a new generation of training methodologies that became available to European wide mechanical industry sectors. This project is an extension of the Leonardo da Vinci pilot project MECCA [2]. The training methodologies developed specifically include

tasks and examples for the fabrication industries, vocational education and training schools (VET), and SME's.

2. Background

In the competitive emerging markets it is essential for a company to be able to submit a bid that is highly reliable. Additionally it is crucial for the company to be able to evaluate the consequences of the bid, from an environmental point of view as well as from a cost alteration point of view. Through the available software on the market today, the above items are possible.

Although it is possible, the remaining questions will be if the available software fits the purpose for cost calculation of a product and not only the cost calculation of the weld itself.

Some of our main questions are:

* How easy is it to create a calculation?

* Are the calculations relevant?

* How easy is it to evaluate the alternatives?

* Which are the key important variables?

* What is your main purpose of creating a new calculation?

* How can you ensure that the production tasks are taken into consideration in the calculation?

3. Available software

A number of excellent software packages and tools are available on the internet as free software or commercial software packages like Calculation software of welding published through Japan Welding Society (3). Or you may approach a welding supplier and get access to software which they have developed.

Companies like ESAB, Bøhler, Lincoln Electric and so forth has developed excellent software tools that allow you to calculate the costs for a welding operation.

The system created by ESAB is reliable and gives excellent results. Similar software from the other vendors are following the same calculation paths and calculation philosophy. It may however look differently from an input point of

view, but the key elements are the same. If you search on the Internet, you will find a number of suppliers of calculation software. Some of these software packages have specific elements that reflects the vendor's specific fabrication of equipment or fabrication of filler material.

Software developed with reference to a vendor will often highlight the strength of the products of the vendor and it may very well go in details for the vendors welding processes as such or their specific materials. These data are valuable for the welding engineer. It will help them to get exact information related to a process or specific filler material.

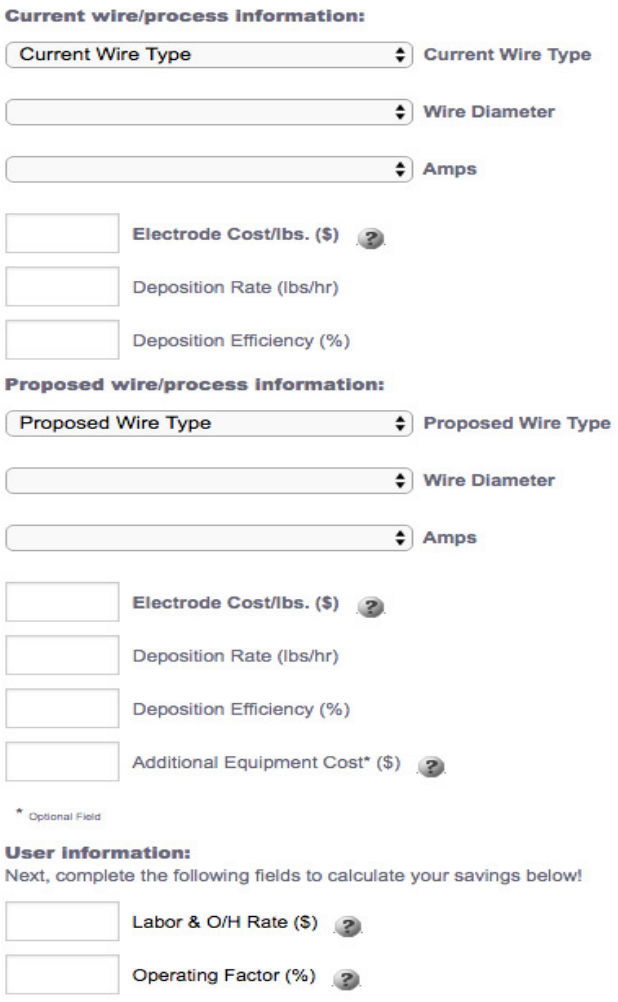

Fig. 1. The screen picture from the ESAB calculation software.

However, few of these software packages, if any, takes into considerations the whole fabrication process. For a cost engineer the main topic will be what do we have as the total cost for the product we are fabricating. In addition, for the sales and marketing engineers the key question will be : what is our sales price and – what is our profit.

One of the few exceptions are the software package Welding Estimator from The Welding Institute.
This software covers the fabrication process with other cost elements than just the costs of the filler materials, gas, energy and so forth. With this software you can add labour costs, standard cost values for a given task. You can also compare the different welding processes and use such calculation for estimating the result of switching welding process for a given job.

In total, it is more than 150 different software packages available in the market. In addition, if you search on the term “welding related software” in Google you will get approximately 37 300 000 results.

4. A different software approach

Through a Leonardo da Vinci project named IQSIM (2008-2010) a different approach to calculation was used. At that time Flash was used as a tool in order to obtain a dynamical user interface in the software tool that was developed - IQSIM.
The core idea was that the user was not only interested in a price for a given task or product, but that the user was also interested in which cost element was critical for the total cost.
What do we mean? As an example, the wages in a company for the welder is 220 Eur/hour. At the same time, we know that the repair rate in this company is 2.5% which of course will create a certain repair cost.
However, if you outsource the job to another company where the wages are 170 Euro/hour, you will save 50 Euro/hour. But if that company have a repair rate of 4.5% it might very well be that you really lose money if you outsource this job.

Alternatively-if you buy cheaper steel plates or pipes with a different chemical composition, it may result in higher welding costs, higher repair rates or problems with hardness or cracks.

The IQSIM software tool allowed the user to play with the essential variables. Figure 2 shows that each cost element has a graphical slider that can be moved sideways dynamically. Immediately user will see that the total value was changed.

This means that the cost estimator can play with the data in order to evaluate the consequences of the alterations and just as important, see which data is critical for the total cost of the job.[3]

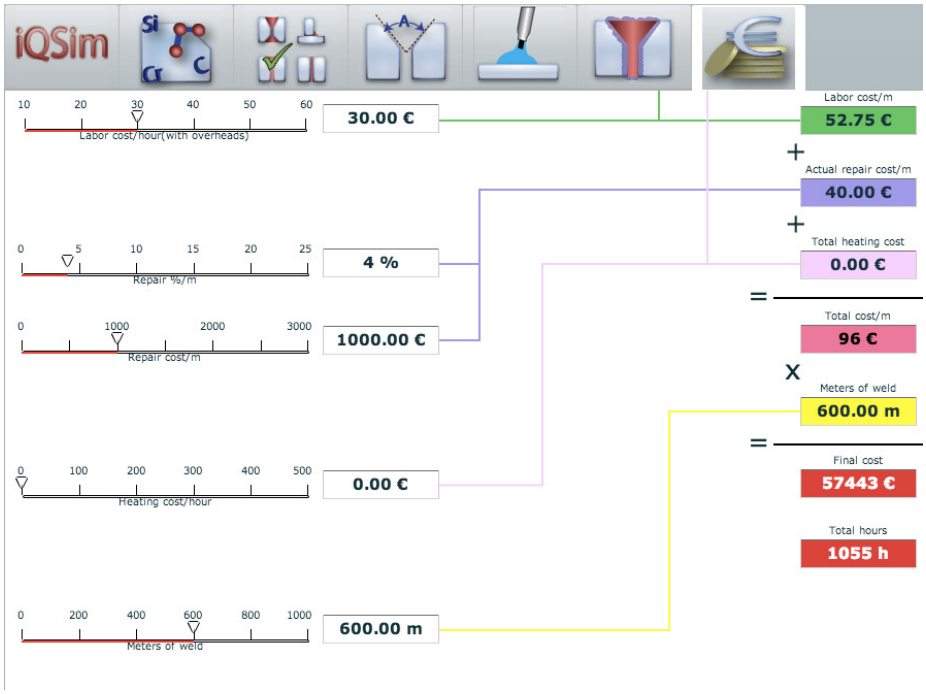

Fig. 2. One screen picture from IQSIM showing calculation details.

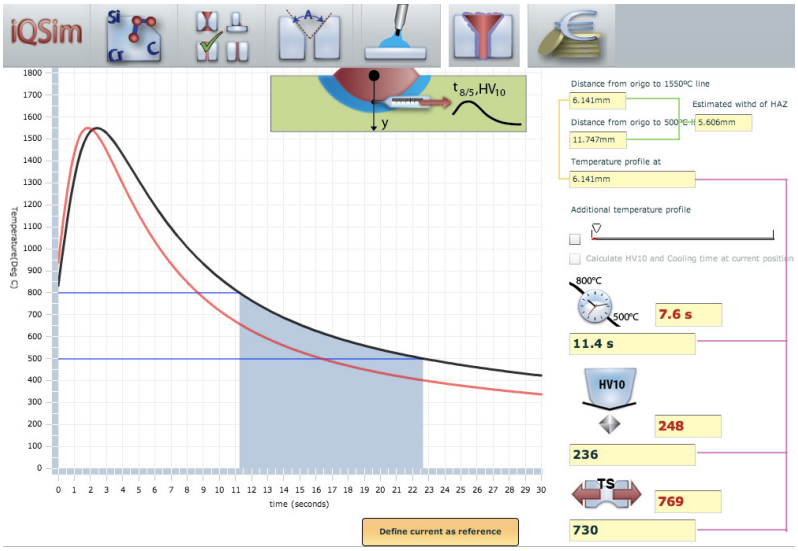

Fig. 3. Print screen picture from IQSIM showing a technical calculation.

In Figure 3 the cost estimator evaluates some of the technical results of the weld. In this picture, the estimator has gone through the following steps:

1. The base materials have been chemically defined
2 The joint configuration has been defined
3. The welding method has been defined
4. The welding parameters have been defined

Based on these data the temperature curve and hardness and tensile data have been defined, here showed as a black curve.
Then the estimator has altered some of the welding process data in order to see the influence on the technical data, here showed as a red curve and red data set.

However when altering the welding data then the efficiency and the deposit rate for the weld will be altered as well as well as the welding hours for the job.

If the estimator the go directly to the estimation task then the total cost have been alter as well.

The great advantage by this approach is that you can alter ant data and see the consequences of the alteration through the whole fabrication process as well.

5. The product model.

A product model is a visualization and a description of the product. A product model is scalable through its description and the geometrical relation. In this context, we use a product model and add descriptive data of the production process.
By using this model, we can scale any part of the product in all directions and all related parts will automatically follow.

IQSIM will be integrated with a generic product model. The model can be tailor to the product of the client, ex boilers, steel structures and so forth.

By manipulating the product model all prices and technical data will be adjust accordingly.

6. Conclusion and future work.

The new software tools available on the market allows us to develop new software for cost simulation, that can be highly dynamic.[4] IQSIM is the first example of the software where the users could modify all essential variables on the fly, back

and forth, and see the results dynamically in order to obtain the best cost results for a given job.

For cost estimation, it will be essential not only to establish the right price. Just as important is the knowledge of what is the critical elements in the calculation and what values can be altered if required without modifying the total price.
Through new software projects IQSIM will be developed further and enhanced with the user experience from the first version.

Abbreviation

SME Small and Medium-sized Enterprise

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