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PRACTICAL RESULTS REGARDING THE COMPETITIVE PRODUCT DEVELOPING METHODOLOGIES

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Abstract: *In this paper the authors will present some practical results obtained for the implementation of the Concurrent Engineering methodology. In the followings we will present our results in the field of competitive product development, with some concrete practical case studies.*
Keywords: *Competitive product, Concurrent Engineering, DFMA.*

1. INTRODUCTION

The world competitive manufactures attention is on the competitive and environment – friendly products, technologies development and the idea of Concurrent Simultaneous Engineering. Customer needs started to be increasingly sophisticated, individualized and diverse so developing high quality products in order to offer them at a lower price and deliver them in a significantly shorter time to the competitive global market it is highly required.

One of the key concepts meeting those challenges is Concurrent Simultaneous Engineering methodologies with Rapid Prototyping Technologies. Imposing itself progressively in research departments, the domain of rapid prototyping has been enriched with complementary techniques like Reverse Engineering and Concurrent Engineering (CE) [1].

Many companies invested heavily in production automation and computer integrated manufacturing (CIM), but in most cases each department within these firms remained responsible for only its own costs.

The objective of the program was the integration of several systems, i.e. integration of all subsystems in the final product during the developing stage. To meet these requirements, the integration of technical and organizational interfaces is necessary. Simultaneous Engineering (SE) is based on reactions of European industry to the time advantage of Japanese companies launching new products or product generations.

Because of the similarity and relationship between the methods CE and SE, is known under one term called Concurrent Simultaneous Engineering (CSE).

The most important elements when applying CSE are human beings and design of product development processes.

This involves:

- Cutting back barriers among departments and hierarchies
- Promoting interdepartmental co-operation
- Building up close links between suppliers and customers
- Supporting CSE by the top management [2].

The benefits of CSE can be seen in the optimization of the product development process regarding the Magic Triangle consisting of time, costs, and quality.

Starting with the peculiarities of the Romanian industry and by using the obtained experience in the DFMA methodology applications, we elaborated a strategy in order to coordinate the application of the methodology in a large field (Fig.1).

Teaking into account the developments that

were made in the last years, we tried to combine the possibilities offered by DFMA software with the Rapid Prototyping technologies and Pro-Engineering / Solid Works computer aided design (CAD).

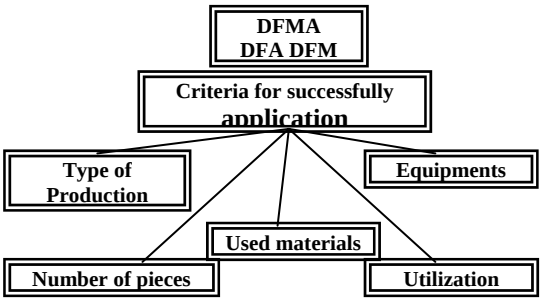

Fig. 1. The strategy of choosing the products for DFMA software analysis

2. CASE STUDY: PRODUCT DEVELOPMENT USING 3D MODELLING AND DFMA ANALYSING - PRESURE REGULATOR

In this case study the results of modeling and analysis of the assembly process of the product *Pressure regulator* (Fig.2), produced by Company S.C. "Armătura" S.A. Cluj-Napoca are being presented. The 3D model has been realized by using the SolidWorks software package and the assembly analysis was made by using the Design for Assembly method [3]. Based on this analysis, the product is redesigned, leading to an increased assembly efficiency of 49%.

2.1 Modeling the product

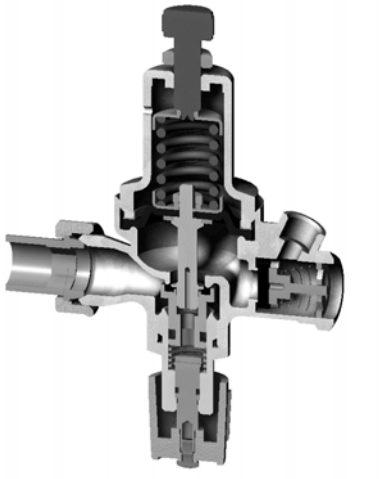

Fig. 2. Section view of the assembly modeled in SolidWorks

The product it is used in closed circuit heating plants and its purpose is to create the possibility of adjusting the output pressure of water. We approached the design and redesign problem of the parts and of the assembly by using the SolidWorks software package (Fig. 3).

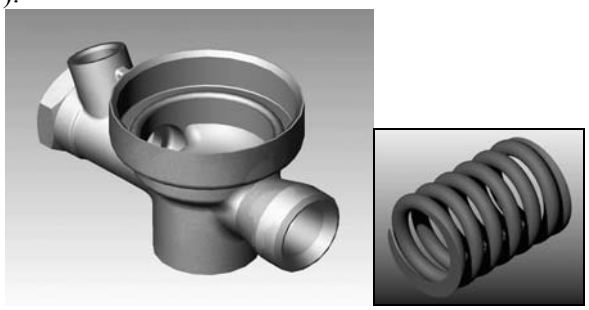

Fig. 3. The 3D model of the main body of the assembly

The 3D part model view helped us in having a more complex overview regarding the part in order to make some changes regarding the possibilities of joining some assembly parts (Fig. 4). 3D assembly option has been used in order to analyze the relations between components (coincidence, parallelism, tangency, concentricity, relative position, etc.).

2.2 Analysis of the assembly process

One of the basic problems for developing new products is the different possibilities of assembling the parts, which defines how easy and efficient the technological process of manufacturing can be made at this stage [4].

For the purpose of making the analysis with DFA, at the beginning the exploding view option of the initial assembly has been activated (Fig. 4.).

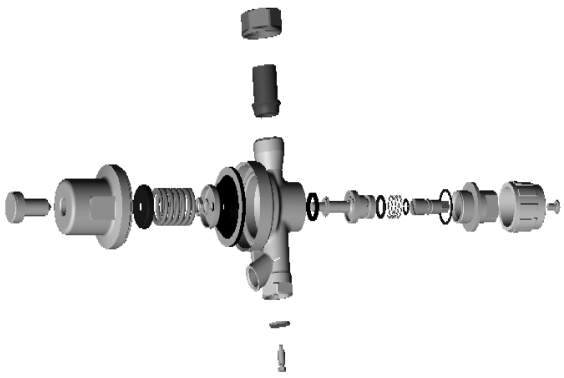

Fig. 4. Exploded view of the assembly (rotated)

Describing every step of the assembly process to the DFA program, the cumulative data for the initial version of Pressure Regulator was obtained as presented in Table 1. It can be observed that the assembly efficiency is 30 % . This parameter should be improved after the analysis by redesigning the parts.

Table 1

Cumulative Data for the initial version of Pressure Regulator

Total assembly cost (dollars)	0.04
Total manual assembly time (seconds)	239
Total number of operations (incl. repeat)	38
Total number of parts	30
Assembly efficiency (%)	30
Labor rate (dollars)	0.65

The assembly efficiency is an essential "ingredient" of DFA method, and it is obtained by dividing the theoretical minimum assembly time by actual assembly time (Boothroyd 1994). It depends on the total number of parts in the product and the easy way of handling, insertion and the multiple possibilities of parts fastening. By analyzing different alternatives, the number of parts has been reduced from 30 to 23, by eliminating, modifying or joining some of them (few examples are presented in Fig. 5 and Fig.6).

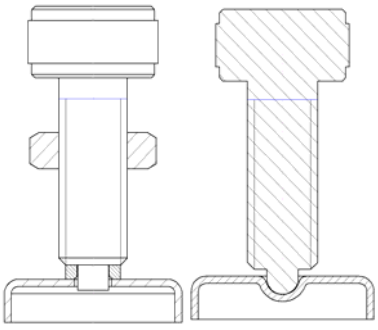

Fig. 5. Modifying the pressure adjuster

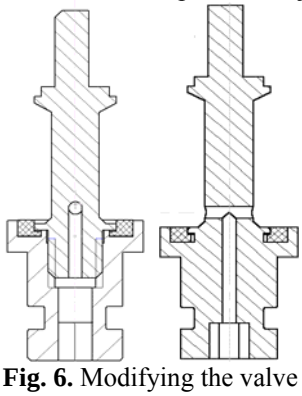

Fig. 6. Modifying the valve

2.3 Conclusions for the case study

The analyzed case study relieved the advantages of combining the 3D modeling software with the competitiveness analyzing software, leading to the improvement of the assembly functionality and meantime to the assembly time and cost decrease (Fig.7).

Even if, in some cases, the shape of the part is more complex, the actual methods of manufacturing can solve this problem.

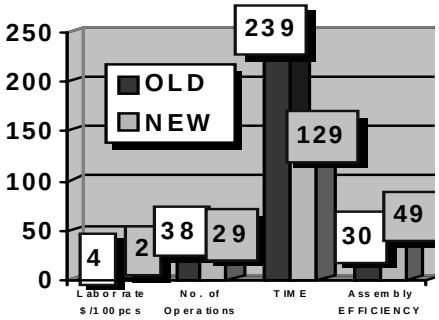

Fig. 7. Comparison of the final results

The common use of Pro-Engineer and DFA software were useful for developing the big taps manufactured by ARMATURA Zalau Company (Fig. 8).

The initial number of assembly components was 21, the number of assembly operations was 50 and the computer processing total time of the assembly was 386s.

The parameters of redesigned product are presented in Table 2.

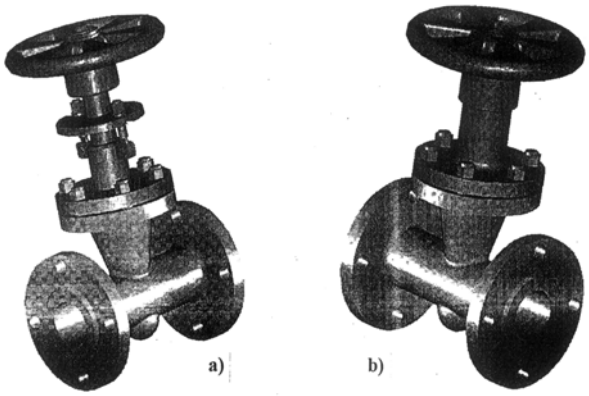

Fig. 8. The old and the new model of the tap:

a) the initial variant; b) the redesigned variant

Table 2

Our significant results

Analyzed products	Number of pieces		Assembly efficiency (%)	
	Last	New	Last	New
Sewing machine	120	95	15	20,6
Ice-cream machine	49	44	32	42
Garden sprinkler	17	8	14	38
External car mirror	22	19	39	41
Hydraulic Distributor	61	46	27	36
Back-flow Preventer	25	19	22	30
Straight-way Cock	47	34	12	16
Garden shears	13	9	16	26
House holding balance	39	30	14	18
Hydraulic automatic valve	50	18	5	29
Closing cock	12	7	33	34

4. CONCLUSIONS

The new requests of the quality and competitiveness of the products needs new organizing and manufacturing management methods, in order to develop more competent and flexible products, with a higher rate of success.

The adequate method for obtaining these results is the Concurrent Simultaneous Engineering method, which today represents the unique method that can used by the companies that are proposing to be maintained or to break through the new markets.

After more than 15 years of activities and experience our conclusions is that in Romanian market conditions only with a competitive product development methodology we can succeed to create an economical and industrial development.

The accumulated results determined us to continue this work and keep on teaching students, researchers and specialists from industry.

For the future work we propose the following activities:

- To develop and enlarge the competitive product development teaching methodology and to enlarge the industrial applications of this methods;
- To continue the research in the field of DFMA – Rapid prototyping – 3D modeling methods and to apply the results in industrial applications;
- To increase the efficiency of the project diploma, PhD, and young researchers works by using and developing these methodologies;
- To continue and develop our connections with other partner universities from Europe.

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Rezultate practice privind metodele de dezvoltare a produselor competitive

Rezumat: In cadrul acestei lucrari sunt prezentate cateva rezultate practice obtinute datorita implementarii metodologiei de Inginerie Concurenta. In studiul de caz, din cadrul acestei lucrari, sunt prezentate rezultatele obtinute datorita modelarii si analizei produsului „regulator de presiune”.

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