

CONCEPT OF DFA PRODUCT ANALYSIS AND EVALUATION .

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Abstract. *The paper deals with the design of a product from the point of view of its assembly. The application, created on the basis of the known approaches to design for assembly is assigned to the product analysis and evaluation. For this purpose, the decision analysis, which combines the objective and subjective aspects, is chosen as the main method. The proposed method is processed as an access application tool and is verified at some products.*

Key words: *Assembly, Design for Assembly, Evaluation*

1. INTRODUCTION

The first step in the assembly system design is an assembled product analysis. The important aspect of this procedure is design for assembly analysis. The assembly has special requirements for manipulation and joining of the parts into higher units. The effective assembly assumes a product that responds to the requirements of manipulation and joining of separate parts into subassemblies and final products. In order to take in the consideration all aspects the designers need to understand the assembly processes themselves and respective procedures. The development of the complex products is a teamwork. The basic problem, which we must take into consideration, is to get to know the ways in which the parts behave during the transport, manipulation, joining and testing. In this context different properties of the parts and components are foreground with respect to evaluation of their function.

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2. ASSEMBLY SUITABLE PRODUCT DESIGN

To ensure the required product function it is possible to design the product by various concepts often by using of entirely different concepts and design principles. While comparing two products that ensure the same function in the same range and in a comparable quality (so that they have a comparable utility value) it is possible to observe great differences. They spring from either different design principles or other materials, forms and dimensions of the parts and components. The products often have other relative position of the parts and components, other tolerance limits and etc. Regarding the design quality, it is then possible to produce and assemble the product in a relatively simple way without serious technical problems and at relatively low costs or in the limit case is the production and also the assembly complicated or unacceptable from the point of view costs. A lot depends also on the production batch size. The design of a product with a great batch size should be different from the design of the same product to the piece or robotized assembly.

The significance of the product design and their influence to production and assembly can be confirmed also by the following data. Independently of the product kind are in the design process specified more than 70% manufacturing costs including costs of the assembly. 70-80% of the possible savings are depended on the product design, 10 –20 % are depended on the changes of technology, production means, fixtures and tools. 5-10% are connected with changes of the organization.

3. CONCEPT OF PRODUCT DESIGN ANALYSIS

For DFA analysis several methods and tools exist. In relation to this we can also mention the work of Boothroyd and Dewhurst [2], research of the IPA institute [4] or the approaches of Lotter [5].

For the product design analysis from the assembly point of view we propose a method issuing from the decision analysis. The basis of this approach is a set of rules and recommendations for the assembly and the collection of questions. The analysis and evaluation are divided into four steps: product, parts, joints and assemblies. The method assumes to answer to five main questions in all four steps. The "answer" is a point evaluation and our own creative proposal is inspired by the existing stored proposal for similar products, parts, joints or assemblies as by the set of rules and recommendations (see Fig.1).

The developed access tool is dedicated to analysis of medium complex mechanical products and is tested on several products.

Main functions:

- Refill and modify the contained rules and recommendations.
- The evaluating questions/criteria selection and definition.
- Definition of the point values for decision analysis.
- Product/products analysis.
- Analysis of the parts, joint and subassemblies.

The conception enables us also to modify the material, part symmetry, kind of the joint and other parameters assortment. The whole system is opened for further modification for instance as comparison of two or more variants of the products, evaluation from the point of view disassembly etc. For better information the system can include also drawings, 3D models or photographs of the products, parts, joints and subassemblies.

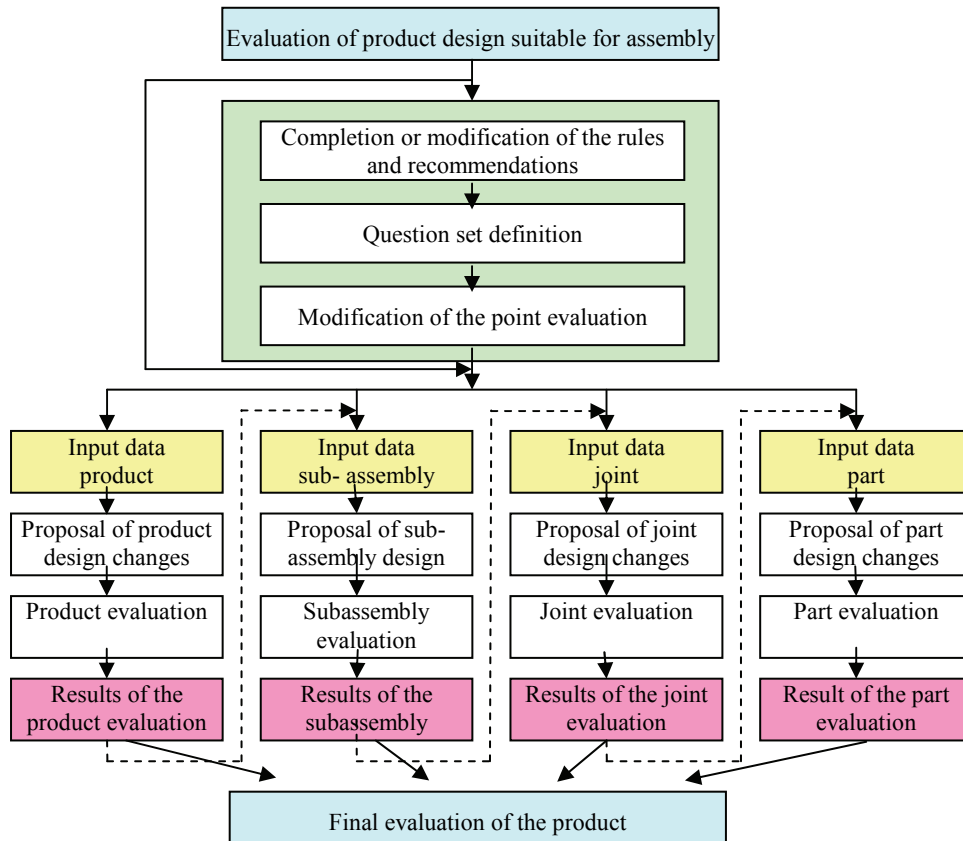


Fig. 1. Concept of the DFA analysis

The basic of this approach is a list of rules and recommendation for product design from the assembly point of view. The system is so created that when it gets into actual use, its rules, recommendation and examples can be continuously refilled. Fig. 2 shows the screen with the list of rules and appropriate examples.

The questions can also be modified or changed. Fig. 3 shows a scheme of the creation of the relation between questions and defined rules. The changes in this field must be clearly made so that the obtained results can depend on the given questions. This must be considered in the case of comparison of the results obtained by using different questions.

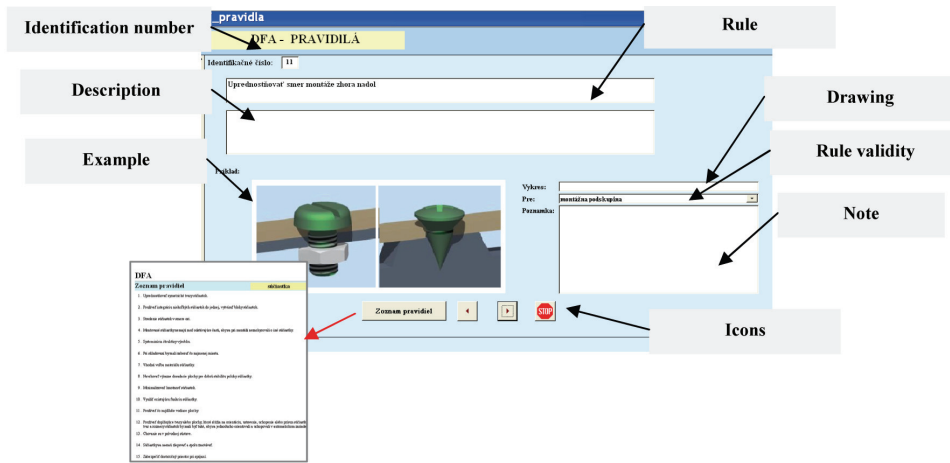


Fig. 2. DFA rules and examples

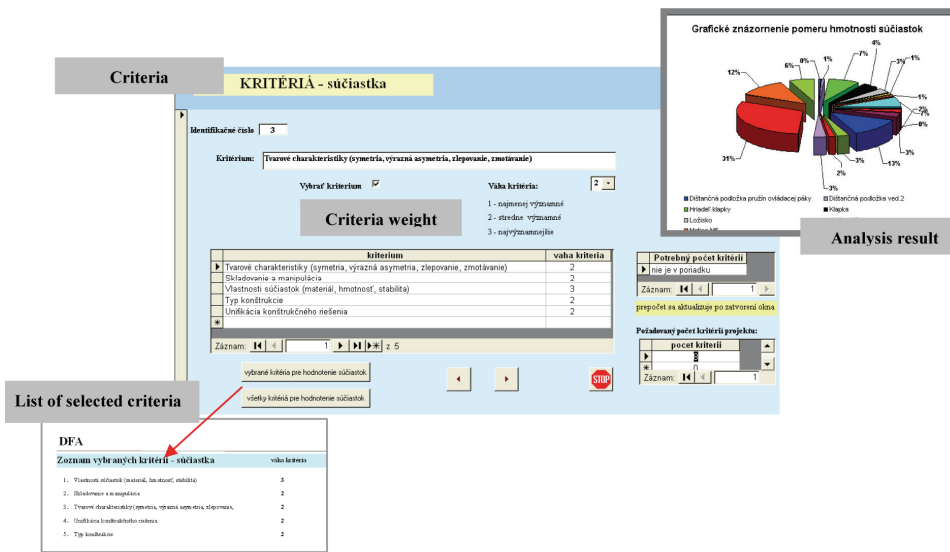


Fig. 3. DFA criteria selection and analysis results

3. RESULTS AND DISCUSSION

In this phase of the development an augmented verification in several directions is performed. The verification is firstly focused on the tools used for analyzing various assembled products. The target is to verify the scope of the tool from the point of view of the product variety. The second examined aspect is the possibility of the integration into the general procedure of the assembly process and system design and planning. The next considered characteristic is the support of the product design change. The main goal is to use impulses and experiences from the industry. Of importance is also the integration into the education. On the basis of the obtained answers to the above questions, we can take into consideration tool modification, selection of the program tool or Internet publishing.

4. CONCLUSION

Experiences with creation and application of the developed tool to product design analysis from the assembly point of view show, that it is one of the possible directions in the design for assembly supporting. The tool can be easy used, modified and refilled. It is also of importance to store and manage, besides the given tool, any previously proposed solution of part, joint assemblies or product changes.

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KONCEPT DFA ANALIZE I EVALUACIJE PROIZVODA**Katarína Senderská, Albert Mareš**

Rad se bavi dizajnom proizvoda iz aspekta montaža. Aplikacija, napravljena na temelju poznatih pristupa dizajna za montažu je privržena za analizu i evaluaciju proizvoda. Za ovu namjenu - kao glavna metoda je odabrana odlučna analiza, koja spaja objektivne i subjektivne aspekte. Predložena metoda bila obrađena kao aplikacioni alat i bila verifikovana na više proizvoda.

Ključne reči: *montaža, dizajn za montažu, evaluacija*