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ON DESIGN METHODOLOGY

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Abstract: It is absolutely not an easy job even for those researchers who are very good at design methodology to find their way in that polemics that rules this field of research. Present paper tries to clear up the difference between the concept and the embodiment, the conceptual design process and the embodiment design.

Keywords: *design methodology, design ability, conceptual design, embodiment design*

1. Introduction

It is hard to explain the difference between concept and embodiment, as in this field of research there are researchers all over the World, so references are written almost all languages of the World. In many cases it is difficult to find the proper word for notions during translating them to our own language. The situation is easier in case of those research fields that have a history of more hundred years and we can order specific figures to certain notions (e.g.: analysis or theoretical research of gears, planetary gears etc.). Design methodology slightly has 60 years behind [1] and as it can be regarded in many ways as design psychology [2], [3] it is rather theoretical science. This leads to different notions should be cleared up once in a while.

2. The whole design process

"Design involves a continuous interplay between what we want to achieve and how we want to achieve it." Suh [10]

The general process of the traditional design is shown in Figure 1, after VDI. The process according to the figure shows maybe the most comprehensively the general picture of the whole design process. Huge disadvantage of the introduced process (and those ones that were determined by the researchers of the classical design methodology) is that it does not make a sharp difference between conceptual and embodiment design. In this figure these two phrases cannot be even found! Significant German authors of classical design methodology – Hansen [4], Rodenacker [8], Koller [6], Roth [9] – regarded working out a method for embodiment design as their primary task, so to help the not-so-experienced designers during their work. As computer era has been started in the 70's their secondary aim was to get their methods to be suitable for a computer algorithm. They did pioneer work in the field so there was no need to find passageways between processes they suggested. Pahl and Beitz [7] defines conceptual design as the part of the whole design process where the designer engineer determines the basic solution routes after the identification and abstraction of the task, defining function-structure, finding and combining the proper solution principles and the elaboration of solution ideas.

Conceptual design and embodiment design have quite different steps. Conceptual design can be characterised by collecting, organising and reorganising ideas with a result of a product idea that is suitable for further embodiment design. During conceptual design neither materials nor sizes are ordered to the concept, this will be important during the embodiment design. The task of the engineering designer during embodiment design is to order the proper sizes, materials and masses to each subassembly and to the whole product embodiment.

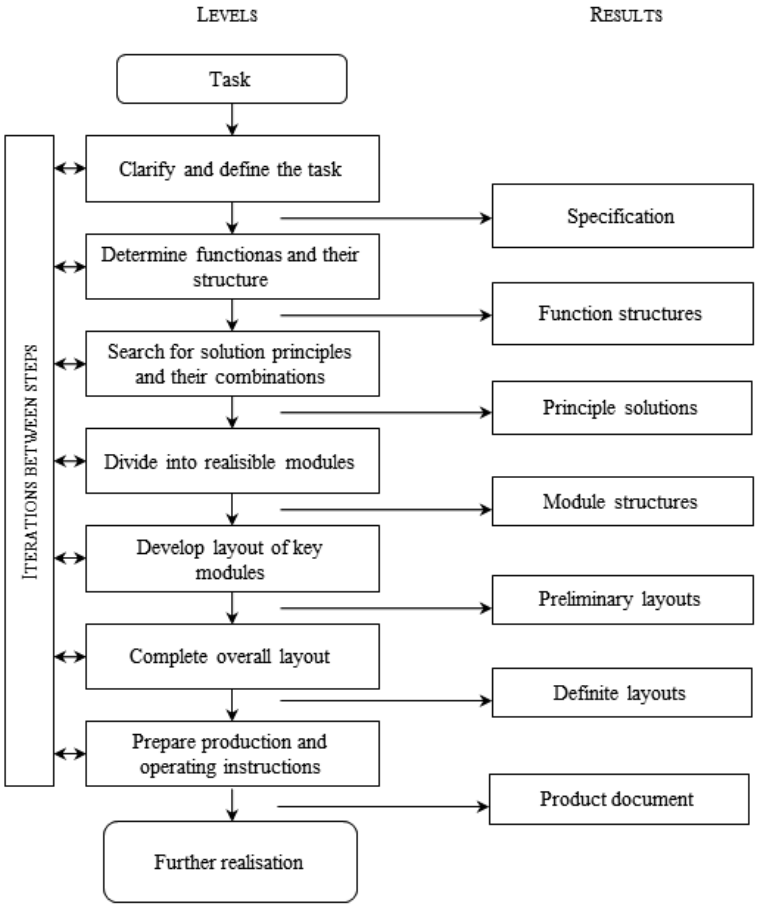


Figure 1. General design process [7], [13]

At the same time Figure 1 very well illustrates that during the whole design process every step has the effect on the other (even earlier, or later). So it should be laid down that without knowing the steps of the whole design process preliminary and getting acquainted with the interference of the steps products, machines, equipment that are optimal solutions of any design issues according to every aspects (economical, environmental, producing, maintenance etc.) cannot be designed.

3. Design process aided by computer

The development of the methodological design was necessary because of the designer who wanted to design the best product in spite of the rushing world and the less time he has got to develop a product. So the significant researchers of this field of science were suggested methods that help the work of the designer-engineer in the phase of conceptual design. Analysing other technologies integrated into CAD systems – so the CAxx technologies – in connection with the whole design process it can be defined that aiding of the design process by computer was developed counter direction to the advancement of it (Figure 2). Computer technologies appear first time in the documentation period of the design process that can be taken as the last phase of it, while the computer aid of conceptual design – that can be taken as the basis of the design – is not yet solved even today! Designers have to keep their eyes on the costumer's criteria as well, although these criteria can eliminate some originally new solutions. This way in this paper a method is suggested that combined with the tool system of the design methodology can be used with a great benefit in the period of conceptual design that is during the working out of the basis of the optimal product variant, and it also pays attention for the costumer's criteria.

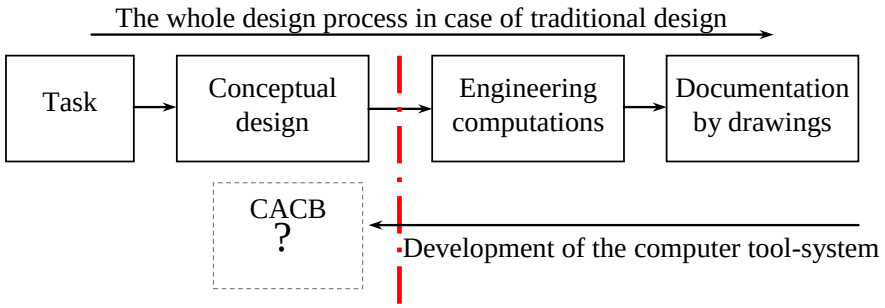


Figure 2. Challenges of the computer adaptation during the application in the design process

4. Conceptual Design process

Logical steps of conceptual design is shown in Figure 3. Before elaborating the design task it should be analysed. The tools for that are the market research and the analysis of patented solutions. In parallel with this customer's requirements should be found and defined. These requirements should be evaluated and ranked with the designer's eyes, because these requirements are the basis of the evaluation at the end of the concept building method. All the possible functional subassemblies should be defined during the market research and the analysis of patented solutions. Product structures or solution variants can be generated from these subassemblies. These variants should be evaluated by the designer. The optimal solution that is the result of the concept building is the one that fulfilled all the evaluation criteria.

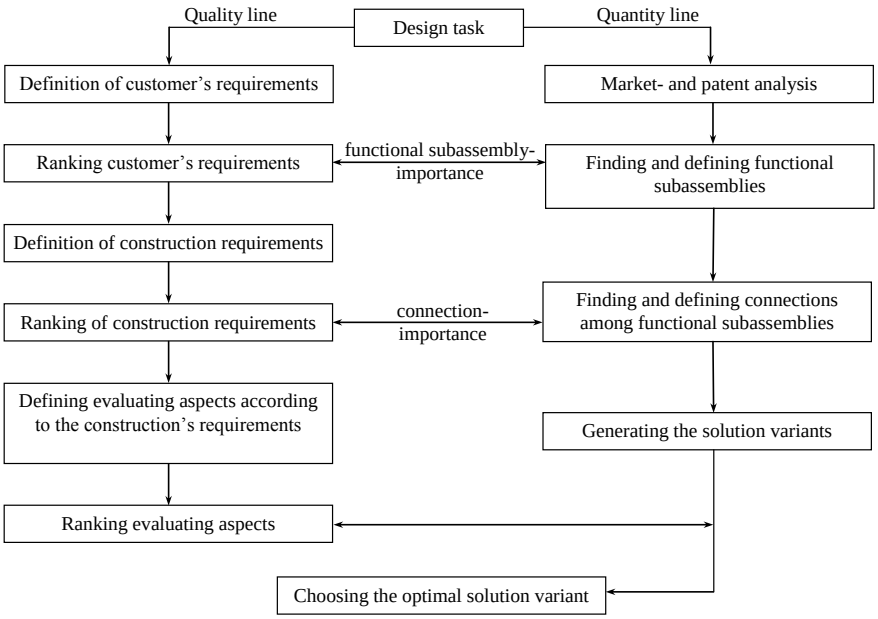


Figure 3. Logical steps of conceptual design suggested for computer [11]

5. Conclusion

Designer engineer prefers development and exploration than generating another example of an existing, similar solution. [5] Reaching this he intends the biggest amount of the time he has for the whole design task for knowing and finding previous solutions. This is the key of the conceptual design, the successful generation of the optimal concept. Nowadays the work of the designer engineer is aided by several, different software but the phase of the conceptual design aided by computer should be still developed. [12]

6. Acknowledgement

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