Assembly systems planning with use of databases and simulation

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Abstract. The work deals with the assembly workplaces and systems planning. The aim is to create a literary overview and describe problems in this topic of assembly workplaces and systems. Another aim is to design a proposal for solving the assembly systems planning problems. The focus of this work is therefore to propose a methodology for the design of assembly systems and thus to create an integrated methodological procedure and tools. In the introductory chapter, the paper is devoted to the current state of assembly systems and their planning. Based on the theoretical knowledge, the analysis of the assembly systems and workplaces will be carried out according to the pre-selected criteria. Given the need to develop the classification of assembly systems and workplaces in terms of product or assembled subjects. Next chapters of the paper is devoted to the creation of databases for the needs of designing assembly systems. Created database need proper algorithm to design correct assembly system. Proposal for solution in this paper is describe in last chapters.

1. Introduction to assembly systems planning
In the area of designing assembly workplaces and systems, it is necessary to address a whole range of problems, respectively tasks that arise from the specifics of designing and assembly processes [1].

As part of the project design of assembly plants, there is an attempt to create methodological procedures for individual assembly processes, but most of the framework procedures developed to support the design of assembly workplaces and systems are designed for specific cases or do not address this issue as a whole.

Making a broader methodology for designing assembly workplaces or systems is a purposeful task for shortening design times and trying to create a form of general practice is evident on the basis of already published concepts. Comprehensive methodology can be a required solution to the problem at planning stages where it would save substantial time pools.

At present, the term project is differently defined and generally applicable definition has not been met. Madauss [2] defines the project as "a goal with a defined beginning and end, characterized by time constraints, uniqueness, complexity and novelty. Similarly, it defines the Frese project [3], but, unlike the previous characteristic, it speaks of relative novelty, and the definition is complemented by the statement that "each project is characterized by a significant risk for a unique character." These characteristics are also found in the Haberfellner definition [4], which complements them by stating that each project must have a defined goal.

Several authors apply the definition according to DIN 69 901, which describes the project as "an intention that is in its overall essence characterized by the uniqueness of the conditions, such as the
given objective, time, financial, personnel or other constraints, boundaries in terms of other intentions and project specific organization”.

2. Simulation in assembly system planning
At present, designing deals with specialized companies that provide customers with a complex design of manufacturing systems. Such a team is made up of experts in engineering, industrial engineering, electrical engineering and computer science who are engaged in the development of innovative solutions using the latest technologies. They are more specific than the individual tasks, as well as the whole complexes, from the design of the concept to the production of the first series of products, from designing workstations and production lines to balancing, verifying and optimizing based on simulation as well as planning and production management. Development is conditional on the maximum use of digital technologies. Digitization helps shorten delivery times for projects and allows flexible responses to customer requirements.

Simulation is an experimental method in which we are replacing a real system with a computer model. On this model, it is possible to perform a number of experiments, evaluate them or modify them and apply the results to the real system. There is no other method or theory that would allow experimentation with a complex system before it was put into operation. There is no other algorithm that would allow for a few minutes to play complicated processes on the computer that actually last for weeks or months. It is the ideal tool to support decision making at various levels in the company [5].

According to collective [6], simulation is: Simulation of systems is a specific form of cognitive process.

3. Proposed solution based on databases
By defining the categories, the necessary first format of the database will be obtained, which will be assigned to the individual categories. Each entry must have its own attributes or properties, the properties on which the algorithm will work. Assignment of data properties is based on practice or after discreet simulation.

![Figure 1. Model representations of systems.](image-url)
3.1. Creation of database

Mounting workplaces and systems can be designed in two ways:
- from down to top,
- from top to down.

In case of down to top and top to down design, the same database should be used for designing. This can be ensured by assigning such features to data that will focus on component requirements as well as requirements for the assembly system / workplace.

3.2. Approach to database handling

The algorithmic solution has the task of correctly identifying data based on the selected properties. After selecting the correct data, it is necessary to perform and evaluate the capacities. This step should be simplified by designing an interactive capacitive calculator that can work on the basis of the algorithm of the selected data.
If the simulation model does not confirm the assumptions, it is necessary to return to the design and change the simulation model and thus the assembly system or workstation.

If the simulation model proves to be appropriate and confirms the design assumptions of the assembly system or workplace, we can talk about a design that meets the requirements. Such a model is suitable for future planning of plant or system modifications where it saves time and can also serve as a test model for planning changes in production. In the case of incorporation of the developed methodology into the software solution, we can talk about computer support of design in the field of assembly workplaces and systems.

4. Conclusion
The article shows the ideological design of the assembly system design methodology. The aim of the work was to clarify and to create a proposal of solutions and partial solutions, which will enable and help the design of the assembly system design methodology.

Paper defines access to designing databases that can be used for product-based access or assembly system requirements. Consequently, use the databases in the field of assembly systems to reduce design times.

Creating the design methodology of the assembly systems allows for shortening the initial stages in the projects. Database based on the categories that will include simulation verified data as well as associated with the correct properties, in cooperation with the appropriate algorithmic solution to create a useful tool.

Use of this approach for the drafting and subsequent simulation model allows not only shorten the projection times but also to creating the first simulation model that could be used for further planning and verification of changes. After verifying the functionality of the design idea, it is planned to create a software solution. Incorporating the entire proposed solution into the software can have a positive benefit for practice, especially in terms of simplicity and usability for the user.
Acknowledgement
This paper was created thanks to the national grant: KEGA 021STU-4/2018 - Development of a laboratory for the design and maintenance of production systems supported by the use of Virtual Reality

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