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The methods of knowledge acquisition in the Product Lifecycle for a Generative Model's creation process

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Abstract

The process of automation becomes popular at different stages of the Product Lifecycle. By applying advanced CAx systems and advanced modelling techniques such as a Generative Modelling, it is possible to design, manufacture and release products onto the market in an easy and fast way. During the Product Lifecycle, a lot of knowledge about the product is generated, however, in the standard process, this knowledge is lost. By using the Knowledge-Based Engineering technique, it is possible to capture, formalise and reuse the knowledge about projects in the future. This approach has a lot of advantages, which are described in this paper.

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1. Introduction

In modern times, every action in a project is supported by knowledge and experience; that is why designers try to define and collect the knowledge in a form which can be reused in future projects. The activities related to Knowledge Engineering are time-consuming, difficult and often expensive. Additionally, an established knowledge base can be used after some time, which makes the process of knowledge acquisition rare, and only a few enterprises invest in the Knowledge-Based Engineering (KBE). The aim of the study presented in this paper is to show how the KBE techniques can increase speed and quality of the product development process during the Product Lifecycle. The main focus was put on knowledge acquisition and the Knowledge Model's preparation, which can be useful in the Generative Model creation process.

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1.1. Knowledge-Based Engineering

During the Product Lifecycle, a huge amount of information related to a specific context is generated. That information is very useful in the design, manufacturing or exploitation processes. Such type of information is called knowledge[1][2][3]. In general, knowledge can be divided in the way presented in Fig. 1.

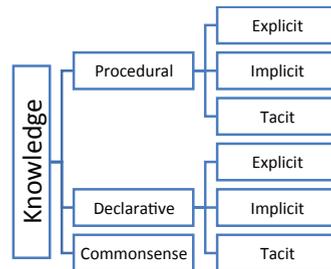


Fig. 1 Schematic of a knowledge division

No matter what kind of knowledge is collected, the process of knowledge acquisition can be divided into two basic ways: acquisition of knowledge in an automatic way and in a manual way [1][4][5][6]. A manual way is based on direct collaboration between a knowledge engineer and an expert in a specific field. In the case of the automatic way, a knowledge engineer also works with experts' knowledge, but in a form of elaborations like as notes, previous projects or standards[1][4][5][6]. In Fig. 2 is presented a chart of knowledge acquisition and the formalisation process where the final product is a Knowledge Base [2][3][7][8][9].

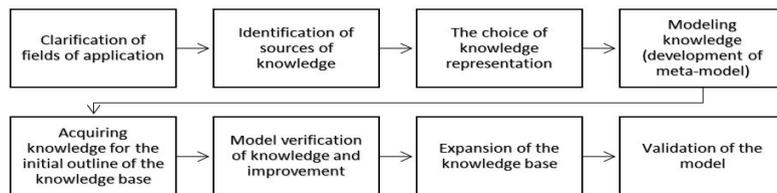


Fig. 2 The chart of the process of knowledge acquisition and formalisation

Because of an existence of many types of knowledge and many sources of knowledge, knowledge engineers developed many different techniques to make the process of knowledge acquisition easier. Among these many techniques of knowledge acquisition, the most popular are[1][4][5][6][10]:

- Acquisition of Knowledge Through Interviews
- The Diagram Technique of Knowledge Acquisition
- The Technique of Process and Concept Maps
- The Backpropagation Learning Technique
- The Matrix Method
- The 20-Question Technique

In Fig. 3 is presented a comparison of the most popular techniques of knowledge acquisition in relation to different types of knowledge. In reference to the comparison, during the knowledge acquisition process it is impossible to use only one method. Depending on the type of collected knowledge, the engineer must make a benchmark of available methods and decides which method will be the best.

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