

# SYNTHESIS REGARDING THE PRODUCT CONCEPTUAL DESIGN METHODS AND TOOLS

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**Keywords:** product design, conceptual design, design methods and tools

**Abstract:** The presented researches refer to the product's conceptual design phase. The paper is part of a wider theme having as final aim the development of a platform for product conceptual design. This platform will include the main design methods and their software supports. To solve the proposed goals, we started with the analyses of the theoretical bases, which define the main concepts, some of the methods and their software supports. These software supports can follow different ways to finalize a study, according to AFNOR or APTE norms. Because we choose an APTE approach, we presented first APTE method and Functional Analysis based on APTE method, and then FMEA method. Finally, we presented the software that applies these methods: TDC Need, TDC Structure and TDC FMEA.

*Engineering design* is a creative activity which starting from expressed needs and existent knowledge has as aim to define a material or immaterial object, named also *artifact*, which satisfy these needs and which can be industrial realized. Engineering design is a key factor for the new product's development process.

*Product design* can be defined as an entirety of activities and processes which allow us to pass from the idea of a new product (or improving an existent one) to information (drawings, programs, etc) which allow the production launching and ensure the product's use and maintenance.

Among design models the most representative is the model of Pahl and Beitz, which is based on a design seen as a hierarchical, sequenced phases, the predominant logic being the convergence. At the origin of each new technical object, there is a specific problem to solve and a goal to focus on. The first phase of design consists in establishing the desired technical and economical specifications. The next phases consist of comprehending the design as a process of an increasingly defining process of adopted solution or like a bridge from a function (abstract form) to a solution (certain form). In the *conceptual design* phase, after a functional analysis and a study of possible technical alternatives available for each function and sub-function a concept for the design object is usually chosen. The goal in the *embodiment design* phase is to determine the shape and the dimensions of the artifact. During the *detail design* phase are mentioned the components of the product and are formalized the papers needed for preparing the supply and manufacturing the components.

The presented researches refer to the products conceptual design phase. The paper is part of a wider theme having as final aim the development of a common platform for product conceptual design. This platform will propose a conceptual design methodology based on the most usual methods and software tools: Functional Analysis – FA (TDC Need, TDC Structure), Value Analysis – VA (Valorise), Quality Function Deployment - QFD (QFD Designer), Structured Analyses and Design Technique – SADT (AIOWIN), Failure Modes and Effect Analysis – FMEA (TDC FMEA), Theory of Inventive Problem Solving –TIPS (TRIZ Explorer).

In the paper we deal with Functional Analysis (AF) method, used in software TDC Need to elaborate the Functional Specifications Conditions (FSC) and in TDC Structure so that we can functionally decompose the products. Taking into account that a FMEA can be made starting from a product's decomposition in functions that have to be achieved by the product itself or from the decomposition of systems in subsystems, components, functions, we continued with the FMEA method.

To solve the proposed goals, first, we started to analyze the theoretical bases that define the main concepts, some of the methods and their software supports. These software supports can follow different ways to finalize a study, according to AFNOR or APTE standards. Because we choose an APTE approach, first, we presented the APTE method and Functional Analysis based on APTE method, then FMEA method. Finally, we presented the software, which apply these methods: TDC Need, TDC Structure and TDC FMEA.