Chapter 3
Design Flowchart for Operational System Safety

Tahiri Omar
Sidi Mohamed Ben Abdellah University, Morocco

Sekkat Souhail
ENSAM, Moulay Ismail University, Morocco

Herrou Brahim
Sidi Mohamed Ben Abdellah University, Morocco

Khadiri Hassan
ENSAM, Moulay Ismail University, Morocco

ABSTRACT

Design is a predominant phase in the life cycle of any product. Referring to a number of reviews, this chapter cites design support tools, focusing in particular on security system and operational safety. It tried to define these two notions (safety, security) as well as the difference between them. It proposed a design aid model that can be adopted by designers in the design phases of new systems, or during their life cycle, based on the "Teorija Reshenija Izobretateliskih Zadatch" (TRIZ) and Failure Modes Vulnerabilities and Effect Analysis (FMVEA) methods. In the first instance, the authors' model enables newly-designed products to give impetus to production systems, for which they use the resolution matrix for technical contradictions. Secondly, it enables these systems to be improved, for which they suggested adopting the FMVEA method tables.

INTRODUCTION

In the life cycle of any process, a design phase is essential. That said, as in the case of production systems, the design study, or feasibility study of the latter, has taken on greater importance in intelligent industry. There are two aspects to it: the first is the material part of the company that produces goods, it's all about products and materials; the second is the system as a whole; the hardware system, human resources and organizational structure.

With the multitude of design methods to be found in the literature (Hampson, 2015; Choulier, n.d.; Herrou & Elghorba, 2005; Beauvallet & Houy, 2009), the choice of one among them is more difficult than it appears. The aim of this section is to propose a design aid method which will give priority to operational safety in the production process, and in particular to the security of goods and people in the production system to be designed.

DOI: 10.4018/979-8-3693-0497-6.ch003

The aim of this study is to find a model that we would like to develop further, by introducing algorithms with iterations that will enable us to continuously improve the system under study.

In the first part of this chapter, we attempt to define design according to the literature, focusing on maintenance and innovation. This is followed by a non-exhaustive presentation of design support methods, with a comparative table of the methods presented.

The second part is devoted to defining safety and security by reference. We then refer to the model proposed by Robin (Cressent et al., 2009) called MéDISIS; a method for integrating safety analysis into systems engineering; (in French: Méthode D'Intégration des analyses de Sdf à l'Ingénierie Système) based on the SysML method. Then we presented the tools used for the design model presented by Nabdi and Herrou (2017). The result of this analysis was to propose a model integrating the two previous approaches, in an attempt to improve the design of production systems. Finally, we have outlined the problems that our model may encounter, and the prospects for this work.

1) Design of Production Systems

a) Design, Definition

Design Review

Deneux (2002) considered that design is a process made up of three essential phases:

- Understanding and identifying the problem to be solved;
- The search for a solution;
- Choice, in order to satisfy the design intent, which translates into a finalized design project.

According to Sénéchal et al. (2003), the product design process consists in transforming the flow of information (in the form of the Functional Specification FS) in a way that accurately represents the evolution of the product. The author has summarized the design activity in the actigram shown in Figure 1.

The same author identified the following non-exhaustive elements: corporate strategy, market constraints, design and production resources, as elements that influence the design process. And here, we can cite the impact of the COVID-19 pandemic, which affected customers' purchasing power, as well as the price of raw materials, which exceeded all limits.

Figure 1. Design activity
Source: Sénéchal et al. (2003)