Chapter 44
Simulation of Manufacturing Processes via Virtual Reality

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ABSTRACT

In a world in continuous evolution, the different industrial actors need to be reactive to remain competitive and to conquer new market trends. To achieve this, they are constrained to improve their way of industrial management, both at the strategic level, to adapt to technological advances and follow market trends. In this chapter, we introduce a new simulation method that makes it easy to understand the results of a given simulation. This is of crucial importance because the design stage of a manufacturing system usually implies not specialist actors. The objective of the chapter is to present the main advantages of using the virtual reality (VR) to the manufacturing processes simulation. To this end, a state of the art will compose the first part of the chapter. In the second part, we address the issue of the contribution of the VR to the industrial simulation.

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1. INTRODUCTION

To remain competitive in the increasingly unstable markets, the industrial actors often have to seek innovative solutions to improve their production, assist in the decision, update and adapt their means of production management, etc. This requires software tools to allow controlling and simulating various flows of production system. There are several tools to design and simulate various industrial processes and even the decision aid. We are particularly interested in the discrete event simulator of flow. These tools are generally used by industrial engineers specialized in management and production engineering process simulation. This prevents the simple industrial actors to understand the simulation's results which present complex and specific data.

The objective of the reactivity in production is to regularly update production systems. Since the 1990s the increasing diversity and complexity of products has gradually led manufacturers to use computer software in various stages of production, so that the industry can control management systems, as well as to simulate different processes of production systems. With the extensive development of computer technology, these software packages are now available in all stages of an industrial system life cycle. This revolution opens the door to new technologies and to their integration into the creation process and in the simulation of industrial methods. Today, several researchers are working on projects for the integration of VR into design tools and simulation of industrial systems. VR is a technology that combines software tools and other equipment to set up an immersive interactive experience that simulates a real-world scenario in virtual mode, this technology is used in various fields such as: medical, nuclear, mechanical simulation, and computer industry etc.

The simulation field is a very large one, in fact, it is applicable to all industrial flows and even services, at all levels and in all phases of the life cycle of a production system (Berchet, 2000). Often, the software packages are used for modeling of industrial systems, improving workshops to control stocks capacity, simulating the different processes of production, validating the operational rules, etc. Flow simulation can also be used at the operating stage, in addition to planning tools to estimate or schedule delays for example. It also allows determining the optimal configuration of logistics system production values (Fontanili, 1999). In this chapter, we will focus mainly on the simulation of flow of production in manufacturing-type systems using a discrete event flow simulator in which the state variables change only at events such as the start or the end of a transaction, release of a workstation, the occurrence of a failure, the standby in a queue of parts, etc… (Bel & Kieffer, 2002). The simulation allows us to project ourselves into the future to quickly measure the consequences of an event coming from appearing. It also allows the decision support by simulating several correction scenarios in a rapid way, to limit the consequences of a critical event. The modeling and the flow simulation of industrial systems is a specialty of industrial engineering, it must therefore have sufficient knowledge to be able to establish a flow simulation for a production system. Therefore, modeling and simulation is not accessible to the public industrial users, this problem represents a disability for many industrial actors.

2. APPROACH COMPARISON

The typical problem with the representation of a simulation of a manufacturing system is to understand the simulation results. These results are generally understood only by experts. Although there are tools to represent them with 2D data visualization, to understand these results remains a lot of works of industry